

CROSS-SECTOR

Institutional Network Regime: a new framework to better grasp the key role of infostructure

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The re-regulation processes of network industries transforms property rights arrangements and policy designs. This article presents the “institutional network regime” framework and underlines the key, but underestimated, role of infostructure.

Since the beginning of the 1990's, political scientists have studied the design and implementation of regulatory reforms in liberalized network industries. These studies have mainly focused, in Europe, on the comparison of regulatory regimes in multiple countries (Coen & Héritier, 2006; Eberlein & Grande, 2005; Thatcher, 1999; Vogel, 1996). The common point of these reforms consists in implementing at different degrees the new textbook model of regulation (Joskow, 2006), which could be described through four main lines of reforms:

- the unbundling of the incumbent firm thanks to the formal or at least functional separation between service operation and infrastructure ownership;
- the opening up of competition on the market thanks to the opening of third party access to the network;
- the creation of a new and independent regulatory authority in order to guarantee the enforcement of sector-specific rules, as well as of competition in a non-discriminatory way;
- the publication of public service obligations and security standards.

The pace and modes of development of this new regulatory model varies along both sectoral and national political traditions. The recurrent conflicts generated by the regulatory reforms explain why the political science literature has mainly concentrated on these following dimensions: conditions of unbundling, weight of the incumbent on new markets, formal or *de facto* independency of the regulatory agency, ownership of the network infrastruc-

ture, etc. This article goes one step further and is founded on two basic premises. First, network infrastructures constitute artificial man-made resources providing crucial goods and services to citizens and consumers, the supply of which directly depends on the way the network infrastructure is managed and its uses regulated. Second, the (political) regulation of these industry networks is usually the result of a combination of different *public policies* (policy design) and, from one or more *property rights* corpuses (property rights system). We define such a combination of institutional rules as an “institutional network regime”. Policy design and property rights system are relevant for analyzing the liberalization of network industries due to the fact that the unbundling and re-regulation processes create the need to reorganize property rights arrangements and to redesign policies. Thus, a new analytical framework that can combine these two central regulation modalities is required.

This article aims to briefly present the “institutional network regime” framework and to underline the key role of infostructure in the new regulatory model, a role that have been largely underestimated until now in the literature.

Theoretical framework: the institutional network regime (INR)

The INR framework considers network infrastructures as artificial resources used in more or less rival ways to provide various direct (e.g. transportation, urban services, energy) and indirect (e.g. capital investment, land use planning) services to more or less heterogeneous users groups.

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Thus, network infrastructures can be described from various perspectives: i.e. their morphological (i.e. physical and technical) characteristics or components, the level of their technical complexity, the different goods and services they provide, the intensity of the rivalries resulting from the different uses to which they are subjected and the impacts on their physical and human environment.

An institutional network regime (INR) is a specific type of regime related to the “institutional resource regimes” framework (Knoepfel, Nahrath, Varone 2007; Gerber et al. 2009), according to which all regimes are based on the same neo-institutionalist axiom: the uses made by individuals and groups of their natural and/or built (artificial) environment is the primary – but not necessarily exclusive – result of the incentives generated by the associated institutional arrangements, i.e. the systems of rules that these arrangements have progressively introduced to regulate the competing uses of natural and artificial “resources.”

The INR framework is the product of the combination of institutional economics (property rights theory) and policy analysis (policy design theories). By *policy design* we mean the aggregation of all use and protection policies that regulate the uses and rivalries, to which the natural, artificial or infrastructural resource is subjected. The *property rights system* can be defined as the aggregation of all property rights involving the resource and its uses. The basic postulate is that the regulation of rivalries between network users is influenced by a *combination of these two rules repertoires*.

Thus, by focusing the analysis on the complex interplay between policies and property rights, the INR concept makes it possible to explain all issues associated with the vast redistribution of property and use rights occurring during the liberalization and re-regulation process. In particular, it allows better analysing the risks of incoherencies, blockages or even the collapse due to the unbundling

of actors (from their tasks and rights) and to the growing heterogeneity of interests which both increase rivalries between users of the central infrastructural resource represented by the industry networks. Finally, it provides the analyst with specific hypotheses on the impacts of INR (change) on the *actor configuration* and the *eight regulation functions*.

The *Actor Configuration (after liberalization)* is composed of all of the public and private actors involved in the functioning of the network industry itself and in service delivery (e.g. owner and manager of the network, competing public and private operators, end beneficiaries of the network services and sector-specific regulator).

The *Regulatory Framework* encapsulates the various regulatory tasks or functions that must be fulfilled by the identified actors in a liberalized network industry. This framework could be describe through

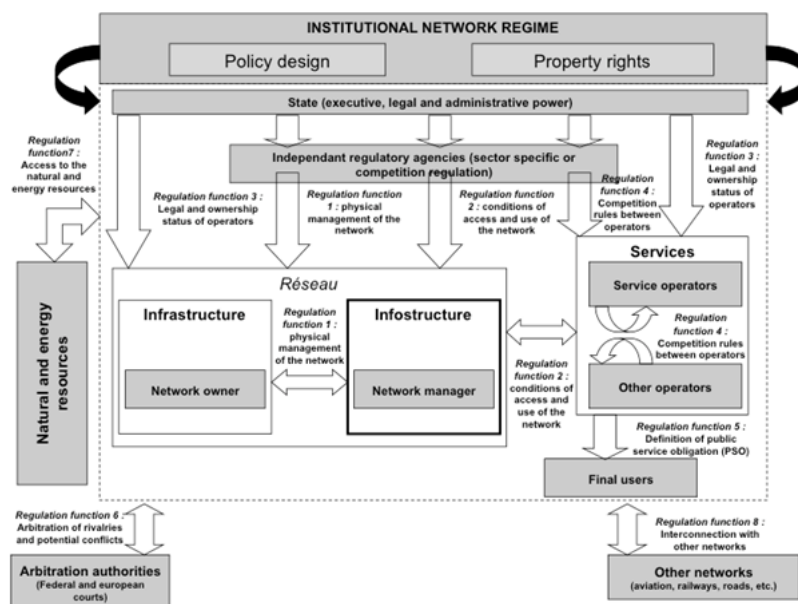


Figure 1 | Detailed regulatory framework

the analysis of eight main regulation functions the scope and the content of which are strongly dependent on the (change in the) INR:

1. the *physical management of the network* (e.g., construction, maintenance, technological innovation, security);
2. the conditions of *access* to and *use* of the network (e.g., operation and other competing uses);
3. the definition of the *legal and ownership status of the different operators* (e.g., privatization of the legal form and of the ownership) that have access and use rights to the network infrastructure at their disposal (e.g., concessions allocated to operators);
4. the definition of *competition rules* for private and/or public operators (e.g., speed of market opening, categories of eligible customers, fair competition);
5. the definition of the *public service obligations (PSO)* (e.g., quality, accessibility and affordability of specific goods and services) and standards relating to the other uses of the networks;

6. the *arbitration* of the rivalries and eventual conflicts between the different users of the network (e.g., between operators, between the operators and the network owners, between the consumers and the operators, between the network owners and the regulators);
7. the *conditions of access to the natural and energy resources* used to produce urban goods and services (attribution of appropriation and use rights) or guarantee of supply of the different natural and energy resources necessary for the production and/or the provision of the different goods and services; and last but not least,
8. the *interconnection* with other networks (either in the same sector, across national borders or between sectors as is the case, for example, for the electricity grid and the railway network).

The INR framework is based on the assumption that the future of network industries depends essentially on the technical, social, economic and ecological uses made of them and on the regulation of these uses by means of institutional rules (i.e. public policies and property rights arrangements) and actor arrangements. In this sense, the management of such networks is not only a question of technical management but also one of policy regulation, social and ecological norms and economic management. The selected approach posits that network industries constitute very important *infrastructural resources* for an entire series of actors. Thus the control of the network is a key issue in terms of the supply of public services obligations. It is therefore crucial to manage this infrastructural resource very carefully if the objective is to ensure its sustainable use. Any failure in the provision of these services would have serious economic, social, and ecological impacts for customers, i.e. private companies and individual passengers.

Infostructure as a missing link

The INR framework highlights the key role of a regulation function which often remains on the dark-side of the textbook model of regulatory reforms: the *management of infostructure* which consists in monitoring the conditions of access and use of the infrastructure network (the regulation function 2 described above). More precisely, one defines infostructure as the control and command services necessary to monitor the access to and to optimize the use of the infrastructure. It includes key and strategic services such as dispatching for the electricity sector, paths allocation and timetabling for railways and air traffic control and slots allocation for the aviation sector.

The genesis of the concept of infostructure is related to

computer science but also to the new network economy (Curien, 2000, 1990) which define a network as a sum of three closely interconnected layers:

- the first and deepest one is infrastructure composed of the nodes and the lines and by all the technical, material or immaterial equipments associated to the functioning of the network (radars for the air sector, electric pylons, railroads switches)
- the intermediary layer is infostructure which permits to access to the infrastructure for different service operators and to optimize the use of infrastructure ;
- the highest and most visible layer is composed by final services which are provided by operators to end users thanks to the access and the use of infrastructure.

Concretely, infostructure is composed by a set of intermediary services and technical facilities, which are auto-consumed by the network (Curien, 2005: 9). The perimeter of the three layers varies with networks industry sectors. For the aviation sector for instance, the infrastructure layer is both material and immaterial, composed by airports, radars and air lanes whereas infostructure is determining in terms of physical equipments of air traffic control, security facilities, airport services. In contrast, for the electricity sector the infrastructure of transport and distribution lines is much more capital intensive than the dispatching equipment of the infostructure layer, although the dispatching function is strategic for the well functioning of the whole system and the balance between supply and demand.

The infostructure layer has known a major technological development, which has often been key to liberalize. In the case of telecommunication services, one can cite the case of the ISDN development during the 1980's, which allows sharing the infrastructure between different uses and service operators. For the electricity, railway and aviation sectors, innovation in ICT helps to develop new services of communication, dispatching, control and coordination between different service operators and to facilitate access of new entrants.

Considering the distinction between infrastructure and services, infostructure is usually considered as part of the infrastructure / network management function, under the responsibility of the owner of the network. However, at the intersection of infrastructure management and service operation, the economic and institutional status of infostructure remains unclear in the design of liberalization reforms. *There is a sort of confusion between infrastructure ownership on one side and infostructure services management on the other.* We claim thus that the control over infostructure overcomes the simplistic role of network keeper (such as track maintenance, lines renewal) but is a strate-

gic position to control or at least influence third party access to the network. The capacity of the national railways companies to keep the control of the timetable production process as well as to orientate crucial decisions concerning technical aspects of network management constitutes a good example of the capacity of incumbents to control the access to the network and to reduce the level of competition within a liberalized industry sector. A number of other examples of competition reduction through the control of infostructure can be found in various sectors of network industry such as electricity, civil aviation, telecommunication, etc.

In a nutshell, the textbook model of regulatory reforms focuses on the unbundling of infrastructure and service layers and underestimates the role of the infostructure layer. The new regulatory model doesn't consider clearly how and by whom the management of infostructure is and should be taken in charge, both empirically and theoretically. Whereas, for instance, the model of the independent regulatory authority has spread as a 'best practice' in Europe, to guarantee a non-discriminatory access to the market and the infrastructure, the rules related to infostructure management are still unclear. Infostructure management responsibility could stay in the hand of the incumbent firm, or could be delegated to the infrastructure owner or to an independent public or private body. Infostructure management represents therefore a great room of manoeuvre for the incumbent firms, for the infrastructure owner or for national policy makers to influence the architecture and the functioning of the new market and its regulatory framework. What is sure is that the management of infostructure could limit the opening up to competition and at least influence the design of liberalization and re-regulation process by determining the conditions of access to the infrastructure and modifying the capacity of the infrastructure network. Infostructure

has therefore an impact on both infrastructure management and on the structure of liberalizing markets, but remains as the missing link of the new regulatory model of networked industries markets.

In sum, we suggest studying in more details which actor is responsible for managing infostructure and, how this role assignment influences the whole institutional network regime. We expect a major added-value of empirical studies currently lead on the aviation and railway in Switzerland within the framework of our SNF project, focusing on these analytical issues and practical challenges as well. ★

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