

NGI101x - Introducing module 2

In the previous weeks, you have learned to define infrastructure systems as complex socio-technical systems – and you have seen how today's large scale infrastructure networks evolved over decades and even centuries, driven by emerging needs and technologies. Conceptually we can separate the physical network and the multi-actor network, but in practice they are inseparable. Like two sides of a coin, they are both part of one and the same infra-system.

Now, if we diagnose a problem in one of our infrastructures, it is clearly impossible, or very impractical, to include the entire system in our problem definition. We have to come up with a meaningful system delineation for the problem at hand. That is quite a challenge as infra-systems are characterized by fuzzy borders, as you will see in this weeks course modules.

A meaningful system delineation for a given problem entails that you focus on the relevant geographical scale level, that you focus on the relevant time constant, on the relevant actors and on the relevant institutions. For instance: Are you dealing with a problem that requires intervention by a supranational authority – or is it something that can be solved at the local level? Are you dealing with a problem in infrastructure operation, or is it concerned with securing future infrastructure performance over a longer time scale of several decades? And are you dealing with a problem that originates within the same infra-system – or is its root cause originating from another infra-system?

It may be disconcerting to realize how interdependent our infrastructure systems are: without electricity, mobile telecommunications will break down. Without telecommunications, the electricity infrastructure itself will stop functioning properly. The interdependencies and interactions between different infrastructures explain why it is so difficult to restore basic services after natural disasters, such as hurricanes, floods and earthquakes. We are, in fact, dealing with a system-of-systems in which a local fault, if it cannot be contained, may propagate across national borders and across different infrastructure sectors.

This week we will see why interconnected infrastructure systems were brought into being. Once you understand the mechanisms and driving forces, you may be able to judge for yourself whether or not the benefits of network expansion and interconnection outweigh the risks and vulnerabilities of interconnection. You will also see that the borders between different infra-systems are becoming only fuzzier, as infra-systems are acquiring new functionalities. You can now access the internet through your tv cable, through your mobile phone, through your laptop and through your PC, with a choice of fixed and wireless networks to hook on to. This is only possible because the operators of all these different multi-functional communication networks agreed on interoperability standards. Also within mono-functional infrastructure systems, such as railway systems and electricity infrastructure, interconnectivity and interoperability standards are key to ensuring the smooth functioning of interconnected multi-national infrastructure systems.

In other words, this week's course material will show you how we manage the increasing complexity of infrastructure systems, caused by expansion and interconnection of infrastructure systems, across national borders and across the borders between infrastructure sectors.