4 waves of Regulation’s... challenges & tools...

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To stay young… for ever!
Regulation: a Lego to play...

• Two Big Classics of Public Regulation

1st Layer: To submit (Natural Monopolies) to Social Welfare

2nd Layer: To implement Political Economy of (Universal Service)

Two Revolutions of Public Regulation: Industry Structure, Technology, Market Arrangements

3rd Layer: To coordinate (Unbundled Grids) & (Market Design)

4th Layer: To innovate with (Decentralization) + (Digitalization)
Regulation: a Lego to play...

• **1\textsuperscript{st} Layer:** To submit (Natural Monopolies) to Social Welfare

• -- -- -- -- 1880’ & 1900’ (Railways) -- -- -- -- 1930’&40’ (Electricity)

• **2\textsuperscript{nd} Layer:** To implement Political Economy of (Universal Service)

• -- -- -- -- Two Revolutions of Public Regulation: Industry Structure, Technology, Market Arrangements -- -- -- --

• -- -- -- -- 1980’ & 1990’

• **3\textsuperscript{nd} Layer:** To coordinate (Unbundled Grids) & (Market Design)

• -- -- -- -- 2010’

• **4\textsuperscript{th} Layer:** To innovate with (Decentralization) + (Digitalization)
Regulation: a Lego to play...

• 1st Layer: Social Welfare with natural monopolies

1- Monopoly of essential facility: as a bridge on a river.
2- Utility for society is usage, then pricing. Monopoly price not good for society.
3- Society will price better: fair price for owner & fair price for users. Average Price? Marginal Price? Recovery of Fixed costs? >>

Regulated cost of service.

France Railways: discrimination pricing. 1 price for flowers; 1 price for coal. 1 price for 3d Class, for 2nd Class, for 1st Class
Regulation: a Lego to play...

- **2nd Layer: Political Economy of Universal Service**
  1- Investments: where to put bridges & rails?   > *Universal Service*
  2- Price discrimination: why to discriminate?   > *Postal Stamp*
  3- Postal stamp is average pricing   > *Social tariffs*
  4- Quality of service: why to discriminate?   > *Universal Quality*
  5- *Further Technology choice & innovation*   > *How compatible with Universal Service & Postal Stamp?*
Regulation: a Lego to play...

- **3rd Layer**: Coordinating (Unbundled Grids) & (Market Design)
  1. To do Unbundling “*Infrastructure facility*” from “*Final services*”
     - Unbundled grids (~ / ~) > Independent Market
  2. To do Unbundling “*Regulation*” from “*Political economy*”
     - Independent regulators (~ / ~)
  3. Then one can go to “*Incentive Regulation*”
     - and faced its “seams”: the **coordination issue**.
What’s coordination issue?

“Essential facility / Final service”

My hotel room in Australia: Access is not only pricing > Transaction Costs

Lovely 😊 Aussie 😊 plugs… seen by a continental EU visitor
What’s coordination issue? “Essential facility / Final service”

My hotel room in Washington: Access is not only pricing > Transaction Costs

Lovely 😊 NorteAmericana 😊 plugs... seen by a continental EU visitor
What’s coordination issue?
“Essential facility / Final service”

My hotel room in New Delhi:
Access is not only pricing >
Transaction Costs

Lovely 😊 NorteAmericana 😊 plugs... seen by a continental EU visitor
Regulation: a Lego to play...

• 3rd Layer: Coordinating (Unbundled Grids) & (Market Design)

3- We did go to “Incentive Regulation”, and faced its “seams”

4- Rules for Infrastructures interact with “Market for final services” via “System Operation” → Grid Codes (Capacity calc. & allocation, Congestion man., Balancing)

5- “System operation neutrality” is “market design” sensitive: “Zonal” vs “Nodal

6- Revenge of Ronald Coase & Oliver Williamson: Markets need “infrastructures for transaction” - Market Transaction <calls for> Industry Coordination

7- Regulation still needed BUT very far from ‘Natural Monopoly Pricing’ + ‘Universal Service’ > another type of rules needed

> Need regulation to make market work on the basis of “system operation”.

In the EU >> EU Market Design is implemented via Network Codes
Regulation: a Lego to play...

• 4th Layer: Innovating with two Big Bangs (Decentralization) + (Digitalization)

1- Decentralizing “Big Bang”.

New Generation technology shift: (1st: French nuclear plant 1,700MW - Coal Plant 500/1,000MW - CCGT 300MW) ~/~ (2nd: Wind mills by MW - PV Panels by KW)
This can be pushed by decarbonisation (new public policy) > (new kind of Regulation): EU, Maryland, California. Or not: State of Texas, Chile, Mexico. Etc.

“Utility Wind & Solar” becoming very cheap, can beat coal: India; or gas: US
(And more to come: V. Sivaram -2018- Taming the Sun. Innovations to Harness Solar Energy & Power the Planet)

Consumption technology shift: Aggregation. Multiple small consumption units are gathered, & become new offer which enters wholesale market as “virtual units”

Storage revolution (in between) started, growing, challenging system operation

2- Digitalization is parallel “Big Bang”.

1st wave digitalization (“mainframes”, smart meters) supported wholesale market

2nd wave digitalization (+ new smart grids) supports new decentralization shift
(S. Vadari -2018- Smart Grid Redefined. Transformation of the Electric Utility)
Why Decentralization & Digitalization are twins...

1/ Decentralization changes size & scope of assets; then their operation, & the decision making

*New Ownership structure* <-> New Operation rules for assets <-> New Governance structure for industry

2/ Digitalization changes information, control, & decision making; then operation of assets, services they deliver -> new decision making:

1/ Decentralization brings two children
*End of *single centralized Utilities*; substituting multiple players

**End of *single centralized System Operation*; substituting multiple levels of control & optimization

2/ Digitalization brings two children
*Setting *rules outside traditional Electricity Sector* regulation (as Aggregators playing with “Behind the Meter”)

**Coordination of new ‘digitalized’ tasks within Electricity Delivery Loop
>Remember 1st wave: Coordinating Transmission & Wholesale
>2nd wave > Amazon “Delivery Loop”
= the “Distribution Grid Platform”
which is where prosumers + prosumagers + all other Behind the Meter enter the El.system
1/ Decentralization has two focal points
* Ending *centralized Utilities*
** Ending *centralized System Operation*

2/ Digitalization has two focal points
* Setting *rules outside El. Sector* regulation
** Coordinating digital tasks with *El. Delivery loop* (Amazon “Delivery Loop” = Distribution Grid Platform)
Interactions between twins: Decentralization - Digitalization
Decentralization opens two streams of changes

1* Distributed Generation expands, with new “Utility Scale Renewables”, down to distributed Prosumers (PV or Wind PPAs), Prosumagers (Storage), & other “Behind the Meter” (electric Cars; smart buildings)

2* Aggregators & Platforms (2-sided markets) offer new ways of coordinating decentralized units (Down to “Sharing Economy” Platforms = Peer2Peer)
Decentralization supports two streams of changes

1* Distributed Generation expands to distributed Prosumers (PV or Wind PPAs), Prosumagers (Storage), & more “Behind the Meter” (electric Cars; smart buildings)

2* Platforms & Integrators offer new ways of coordinating the decentralized units, down to “Sharing Economy” Platforms (P2P)
Digitalization favors two streams of changes

1/ Playing from outside Traditional Sector: 
Fleets of “Behind the Meter devices” can be gathered & controlled to be managed as system smart assets 
(think electric car fleets; or “zero net consumption” buildings)

2/ New ways of coordinating decentralized units, thanks to Aggregators & Platforms P2P; 
down to Blockchain networks (a Blockchain network is P2P with NO intermediary, with NO UBER between Peer-2-Peer).

3/ BUT WITHIN “Amazon Delivery Loop” constraint 
It is the needed / desired “Distribution Grid Platform” – 
the Ignacio Perez-Arriaga “Utility of the Future” when perfectly set up (MIT Report 2016); or New York “Distribution Platform” project (Sioshansi Fereidoon 2017; 2019)
**Digitalization** favours two streams of changes

*Out of Sector* gathering the “Behind the Meter devices” to manage them as smart assets (think electric car fleets)

**Aggregators & Platforms** offer new ways of coordinating the decentralized, Down to Blockchain networks (NO intermediary, NO UBER between Peer2Peer)

***But “Amazon Delivery Loop” constraint (Distribution Grid Platform)***
Decentralization & Digitalization strongly interact

1/ Because they have similar streams of changes
>* “Behind the Meter” targets of “smart assets”
>>**Aggregators & Platforms P2P offering entry to the “El. Amazon Loop” delivery constraint

2/ Both 2Ds (Decentralization & Digitalization) touch upon tasks, assets, operation, apps, integrators, platforms
>> > Up to Governance
with new types of players, as
* Communities of Peers
** Clubs of Partners
*** Smart Local Authorities
Decentralization & Digitalization strongly interact

Because they have two similar streams of changes
*The “Behind the Meter” targets of smart assets
**Platforms & Integrators facing the “El. Amazon Loop” delivery constraint

They touch upon tasks, assets, operation, apps, integrators, platforms

> Up to Governance:
*Communities of Peers
**Clubs of Partners
***Smart Local Authorities
3/ Conclusions: a lot of challenges for industry, industry regulation, and regulators

<> New Coordination Tasks
   Beyond “Utility regulation”
+ “Behind the Meter” activities

<> New Incentive Regulation:
   needed to favour structural business innovations
   Innovation Business Models <through> Regulatory Frames
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