

EPFL

- One example
- Framework
- Case study
- A few final points

Transformative Innovation Policy (TIP)



TIP is a policy to support system's transformation
The public sector plays a central role not only as funder but also as coordinator

Mobility on demand in California to shift the mobility model from the individual use of private cars to a model including collective transportation, multimodal networks and sustainable mobility

Many actions: public infrastructure, last mile solution, car pooling incentives, app to integrate all suppliers, employers involvement, mobility and social practices



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Mobility on demand



Five components

FTA
 Cities of Palo Alto...
 Sponsors

Reduce single-occupant vehicle use through commuter trip reduction software

Pilot design and refocus (sandbox)

The experiment is labour intensive, institutionally intensive, requires a lot of staff..and people championing the project in various administrations and firms

Goal – to reduce single-occupant vehicle commute share through a range of complementary services, technologies and incentives

Smartphone mobility platform incl multimodal trip planning app.

Pilot implementation – August 2019

Financial incentives – feebate and cashout – to push carpooling, Caltrain, e-bike & e-scooter, paying employees to give up parking space

Pilot end – December 2019

Objectives should not be too ambitious given the timeframe of the demonstration

Gap filling – first mile/last mile – e-bikes, etc. can involve subsidizing Uber rides to and from public transport stop

Evaluation according to project goals
 Survey data

Financial incentives need to be strong enough

Systemic obstacles – equity + accessibility

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Insights from the case

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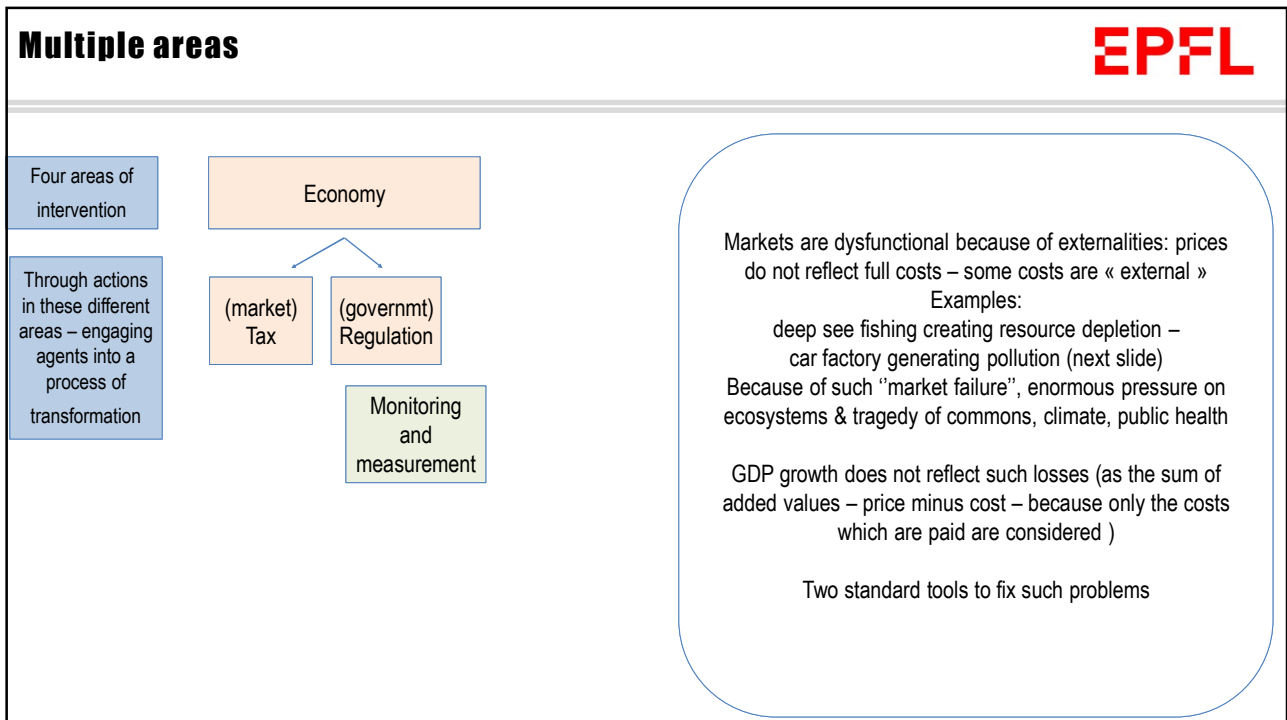
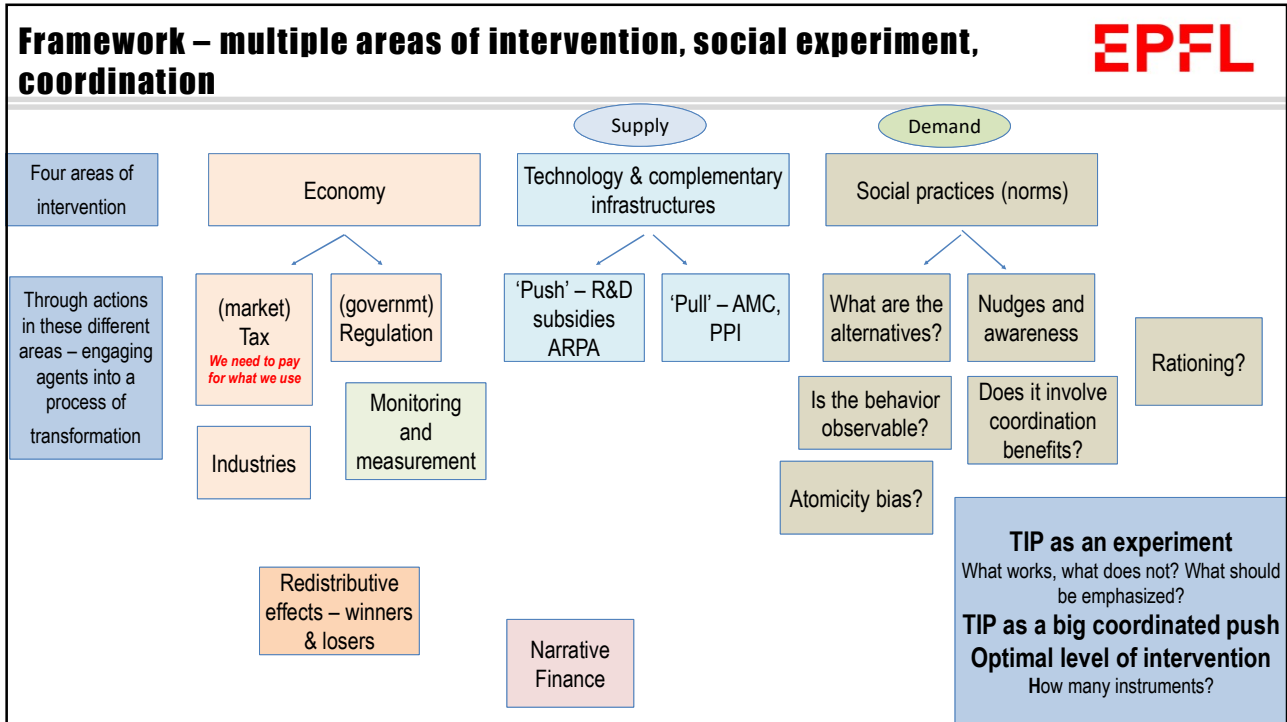
- TIP is not a discrete policy instrument but a policy approach to promote a system's transformation through various types of interventions
- TIP = R&D and innovation + the provision of public services and infrastructures + regulatory framework + actions to influence large scale behavioural tipping...
- It involves interventions in 4 main policy areas + 2...
 - Market instruments (tax), regulations, industrial policy
 - Technologies (invention and adoption) & infrastructures
 - Social norms (incl education, awareness)
 - Equity, justice (winners and losers)
 - Transformations are facilitated if a robust **narrative** exists as well as **funding mechanisms**
- Policy design challenges : social experiment, coordination, optimal level of intervention, role of public sector, accountability

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- Many actions of agents have harmful side-effects to others who have not been part of the production or consumption decision
- These effects are not paid neither compensated
- Side-effects without compensation are called negative externalities (some costs are not *internalized*)
- Side-effects with a compensation are NOT a negative externality

Negative effects with compensation (firm pays a tax, pollution cost is **internalized**)

Negative effects without compensation (the pollution cost remains **external**)

Short run	Pollution	Pollution
Long run	Problem fixed innovation	Pollution

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- Negative externalities means: a fraction of the cost is not internalized by the firm or the individuals– only perfect internalization generates the right incentives – ‘*perfect*’ is an important qualification!
- In presence of negative externalities – incentives are distorted :
 - Who generates negative externalities ignores the harm the action imposes to others (he will not consider the full costs) and will not invest to minimize the negative effect
- If the firm has to pay to compensate the side effects – there is no longer an externality and therefore the side effect is expected to decrease in the long run because incentives go the right direction
 - It becomes costly to pollute – so the firm will reduce activity or **invest in clean tech**
 - The firm will make a trade off between compliance cost (pay the tax) and abatement cost (decrease pollution through **green innovation**)
 - This is why we say: « first condition for **stimulating transformation** is that all prices are right – they reflect the full cost of the activity »

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A negative effect which is not paid by the one generating it and not compensated for those who are suffering from it: the effect remains "external"
Why perfect internalisation does not happen spontaneously?

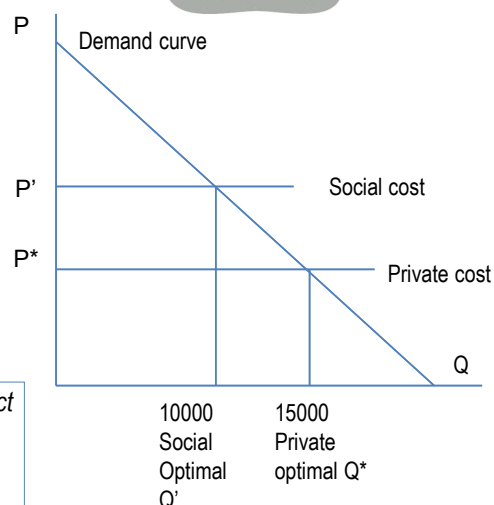
- **A car factory generates toxic discharges** - All resources used to produce cars (steel, labour, machineries) have a price as they are traded on a market – the factory has the correct incentives to economize on them.
 - It can economize on people (automation), on steel (process innovation), on energy (process efficiency & optimization)
- One resource 'used' has no price; hence there is no incentives to economize it: **clean air**
- The factory destroys the resource – clean air – but does not pay for it
- This means that the factory will not consider the full cost of its activity – one cost is external (it is transferred to society)
- Hence the firm will not try to correct the problem through innovation and will prefer the status quo : a situation where its private cost is lower (the cost of clean air destruction is not included) than the full social cost it generates

- The market for cars in presence of a negative effect (car's factory produces toxic discharges)
- The **social cost** of producing a car is **higher than the private cost**
- **If all costs are internalized**, the price should be $> P^*$ and the quantity $< Q^*$
- The socially optimal quantity is 10000 cars not 15000 cars (which is the privately optimal quantity when some costs are not internalized)
- Unless corrections are done (for example taxing the pollution), the market fails to provide the optimal quantity: **overprovision**

The equilibrium price P^* doesn't reflect social marginal cost and thus send a wrong signal about some resources destructions



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- Negative externalities are everywhere
- Almost any human activity generates negative externalities – many of them are insignificant (we don't care) – some are affecting massively welfare – some others need not to be fixed (or can be fixed through social relations)
 - Firms generate pollution, emission, toxic byproducts
 - (Bad) food companies (and of course tobacco industry) have negative effects on public health
 - Companies exploiting natural resources destroy ecosystems (e.g. overfishing, tragedy of commons)
 - Overfishing is an externality not just fishing – 'eg fishing at quantity which put regeneration rate at risk)
 - Companies in chemical or nuclear industry increase the level of risk in the local neighbourhood
 - Individual drivers contribute to traffic congestion
 - Pesticides, antibiotics overuse, dirty energy, AI applications,
 - Double externality: polluting activity has an externality on climate which has an externality on tropical diseases

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*Why perfect
internalisation does not
happen
spontaneously?*

Missing markets

- Many resources cannot be subdivided into individual property rights – clean air, safe environment, ecosystems, quiet night: **it is technically impossible to differentiate people according to their decisions of selling or not selling their « right »** to clean air (pollution), to a quiet night (noisy car) or to a safe place (nuclear) – hence no market for trading the externality
- **Markets don't exist because the relevant interactions take place over large distances** (the effects of deforestation in Latin America on climate in Africa)
- **Markets don't exist because relevant interactions are separated by large temporal distance** (the effects of pesticides on pollination and later on the survival of critical ecosystems or of emissions on the disappearance of glaciers)
- For all these reasons: no price on the externality which remains external
- Two main corrections

Multiple areas

Four areas of intervention

Through actions in these different areas – engaging agents into a process of transformation

Economy

(market)
Tax

(government)
Regulation

Monitoring and measurement

Quotas
Thresholds
Protected areas
Ban
It is an administrative instrument: there is no choice

The external cost is priced

Reduce quantity
Accelerate substitutes
Generate revenues to manage transition
It is a market instrument because agents have a choice

Price

Quantity

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Multiple areas

Four areas of intervention

Through actions in these different areas – engaging agents into a process of transformation

Technology

'Push' – R&D
subsidies
ARPA

'Pull' – AMC,
prizes, PPI

Technologies – essential part of transformation and solutions
Requires significant amount of resources as well as a relevant mechanisms to « allocate » the resources (push – pull)
Big question: is it possible to accelerate tech development?
But the production of knowledge is not deterministic

Mr. and Mrs. Gates Save the World

How to spend the money?

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Multiple areas **EPFL**

Four areas of intervention

Through actions in these different areas – engaging agents into a process of transformation

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graph TD
    Tech[Technology] --> Push['Push' – R&D subsidies]
    Tech --> Pull['Pull' – AMC, prizes, PPI]
    Push --- PushBox[Push more R&D resources in targeted fields  
Risk is on the public agency because it pays for inputs and there is no certainty that a valuable output will be generated (knowledge or invention)]
    Pull --- PullBox[Reward achievement ex post  
Risk is on the innovator  
Creates focus  
Advanced market commitment is an ex ante binding commitment (from a Government) to buy a solution at a guaranteed price when and only when the solution is invented. It sends a market signal where there is not yet a market : acceleration!]
    
```

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How to spend the money?

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Michael Kremer, an influential Harvard economist, first suggested the idea in 2000

An extensive consultation process was organized by an American think tank (2004-2005)


The report of the think tank was followed by work from the World Bank and the Italian government

G8 leaders agrees to launch a pilot AMC in July 2006 at the St Petersburg Summit

In February 2007 the pilot AMC (on pneumococcal vaccine) was launched <http://www.vaccineamc.org/>

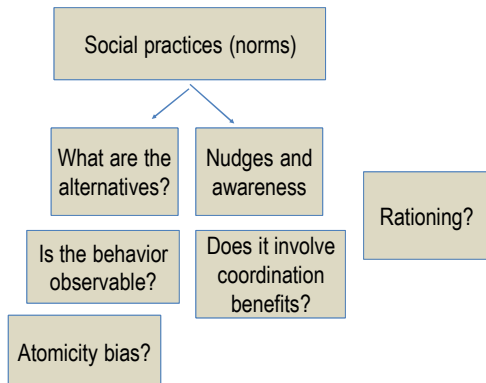
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Multiple areas



Four areas of intervention

A predominant behavioral pattern within a group, supported by a shared understanding of acceptable actions and sustained through social interactions within that group
Diet variation across countries (societies) reflect social norms
How to eat, how to get dressed, how to move or to spend vacations?




```

graph TD
    A[Social practices (norms)] --> B[What are the alternatives?]
    A --> C[Nudges and awareness]
    B --> D[Is the behavior observable?]
    C --> E[Does it involve coordination benefits?]
    D --> F[Atomicity bias?]
    E --> G[Rationing?]
            
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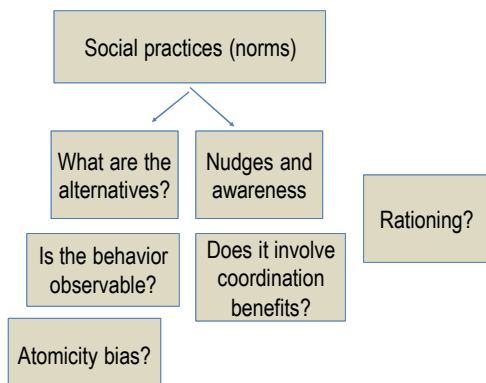
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Multiple areas



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***Alternative (and better) behaviors need to be supported by massive public investments** to provide reasons for people to change their expectations

***Some deviations from social norms are easily observable** and sanctionnable (smoking)

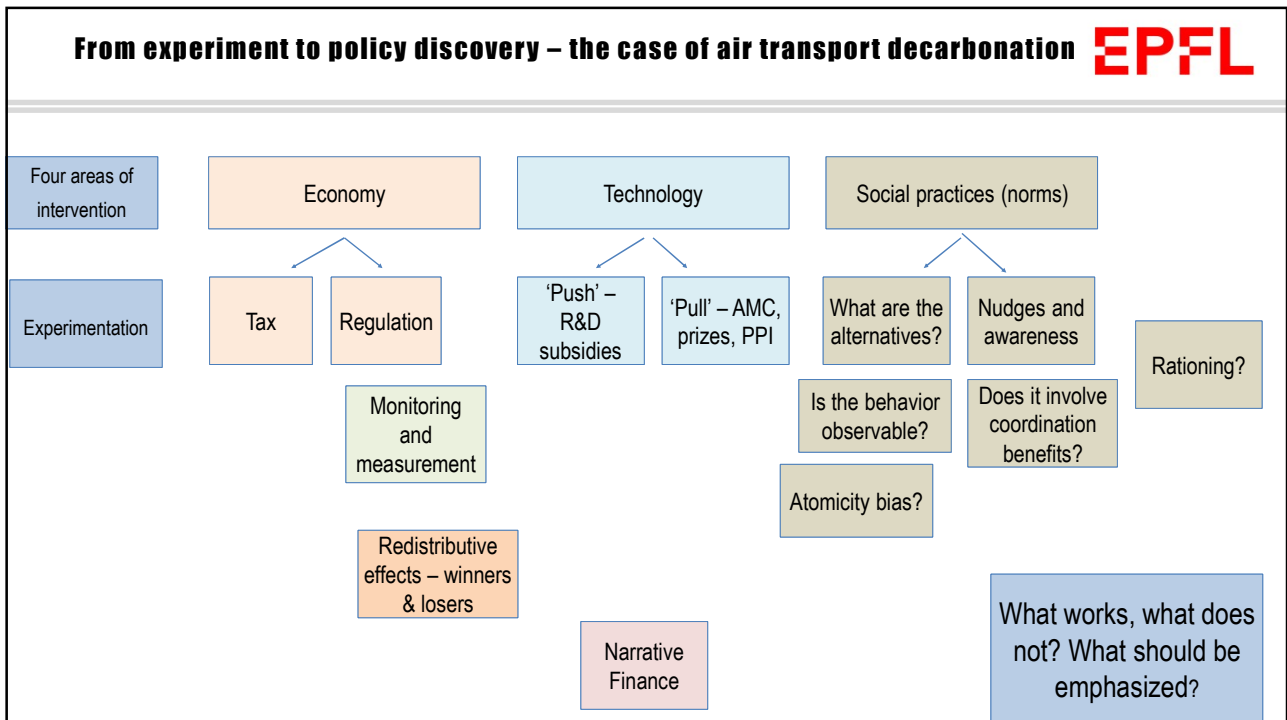
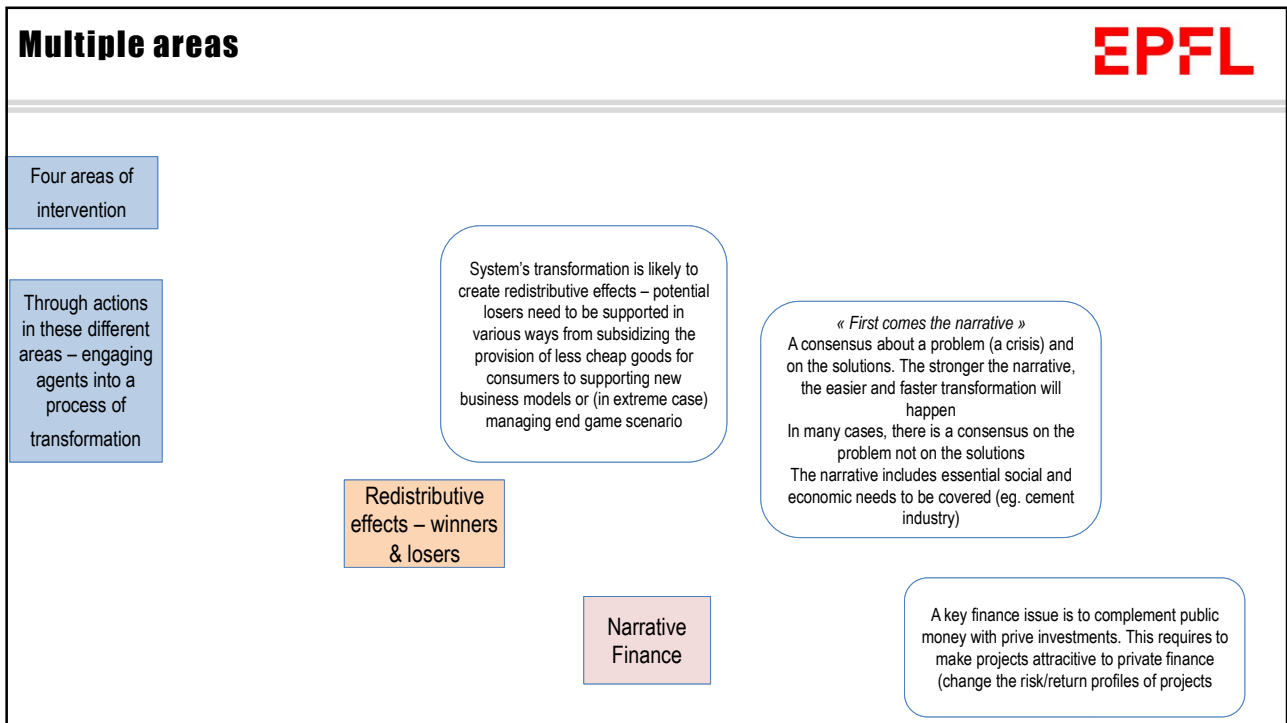
***Coordination benefits** arise from following the norm – reinforcing the status quo (it pays off to follow the norm)

***Nudge** - alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives"

***Atomicity bias – whatever I do!**

***Rationing** – when all policies fail and no large scale behavioural tipping does happen

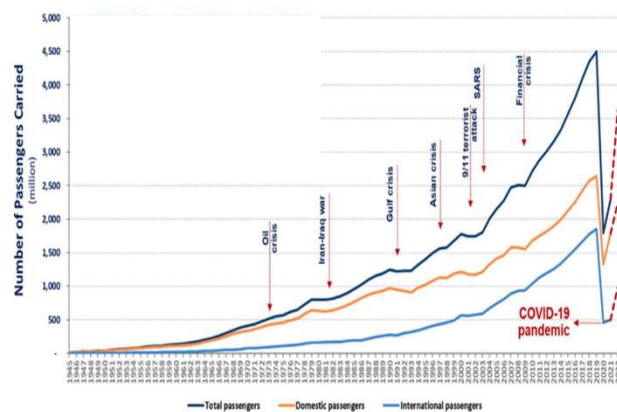
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Decarbonation of air transportation

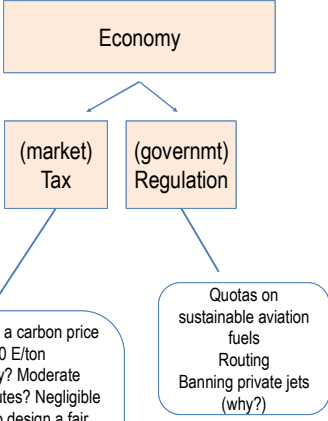
- Air traffic will increase by a factor 2.5 by 2050
- It is responsible of 3.1% of world wide emissions and 12% of transportation emissions
- The narrative is fragile - many losers; flying is one of the most permanent human dream..
- Suppliers (Airbus, ..) have full order books for the next decade
- In many (large and low income) countries, domestic flight is the only solution to visit family or make business travels
- Middle-class population in developing countries (e.g. millions of people) can/will afford flying for intercontinental travels
- Coordination benefits which arise from "flying"
 - Myriad of new airports and better infrastructures
 - Still a lot of tourism infrastructures are planned given flight opportunities
 - Many social and economic activities organized because we can fly

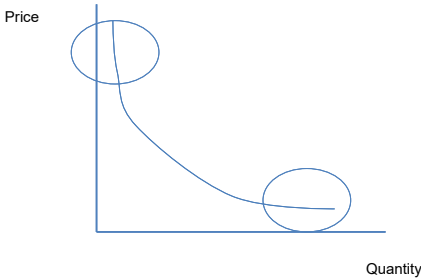


Decarbonation of aviation – what works?



Four areas of intervention






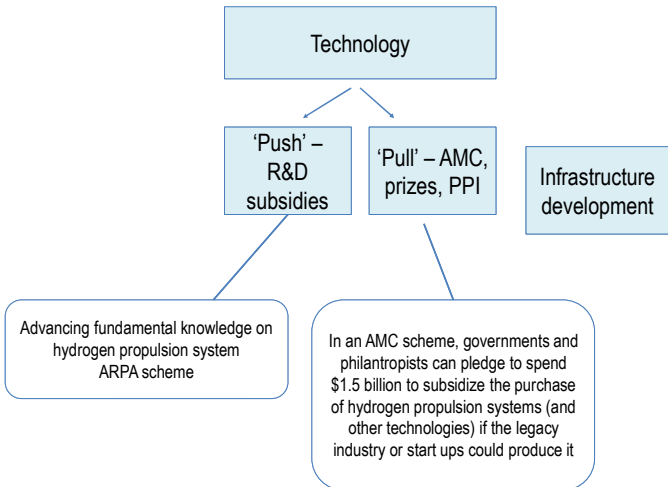
Through actions in these different areas – engaging agents into a process of transformation

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Decarbonation of aviation – what works? 2



Four areas of intervention



Infrastructure development

Through actions in these different areas – engaging agents into a process of transformation

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Decarbonation of aviation – what works? 3

Four areas of intervention

Through actions in these different areas – engaging agents into a process of transformation

Alternative (and better) behaviors need to be supported by massive public investments to provide reasons for people to change their expectations – high speed trains, night trains

Having non responsible behavior is NOT easily observable and sanctionnable – on the opposite, it is rewarded (frequent flyer program)

Coordination benefits still arise from following the bad norm – reinforcing the status quo: better access to airport; attractive far destinations , frequent flyer rewarding

Nudge - does not seem to work well here
Strong atomicity bias

Rationing – based on social score which takes into account individual characteristics

Social practices (norms)

↓

What are the alternatives?

Nudges and awareness

↓

Is the behavior observable?

Does it involve coordination benefits?

↓

Atomicity bias?

Rationing?

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Decarbonation of aviation – What works? 4

Four areas of intervention

Through actions in these different areas – engaging agents into a process of transformation

Weak narrative

Many groups as losers: companies, consumers, industries and locations

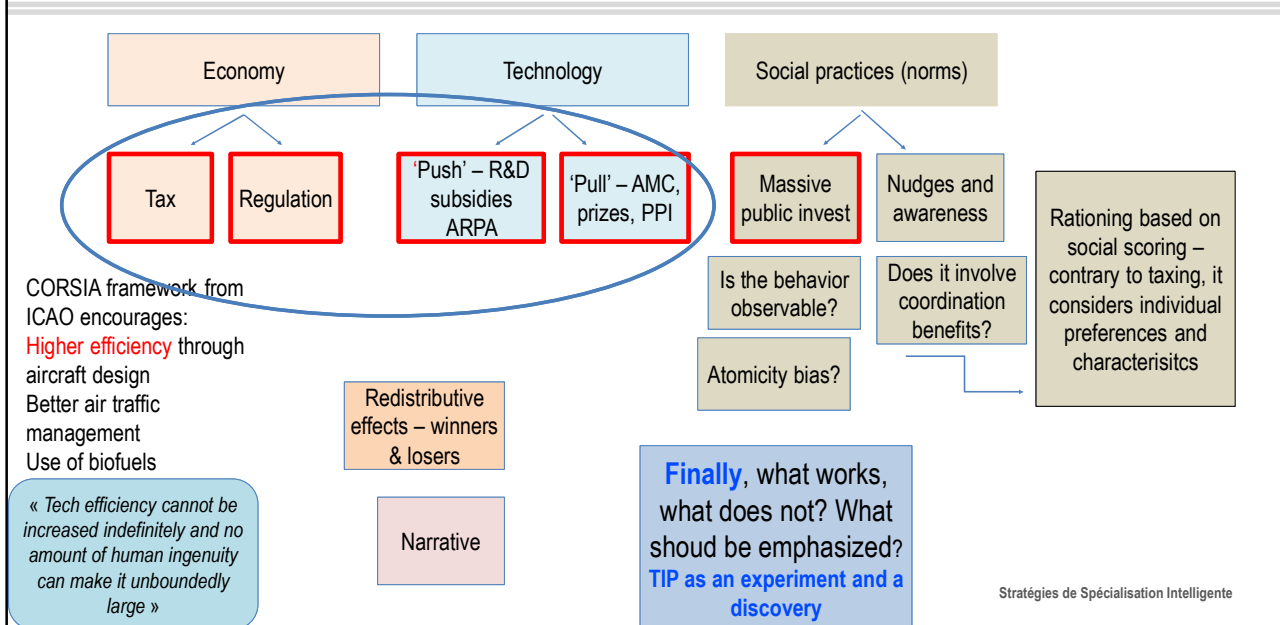
Some losses can be managed, some others not really!

Redistributive effects – winners & losers

Narrative

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From experiment to policy discovery – the case of air transport decarbonation



Cleaning the ocean



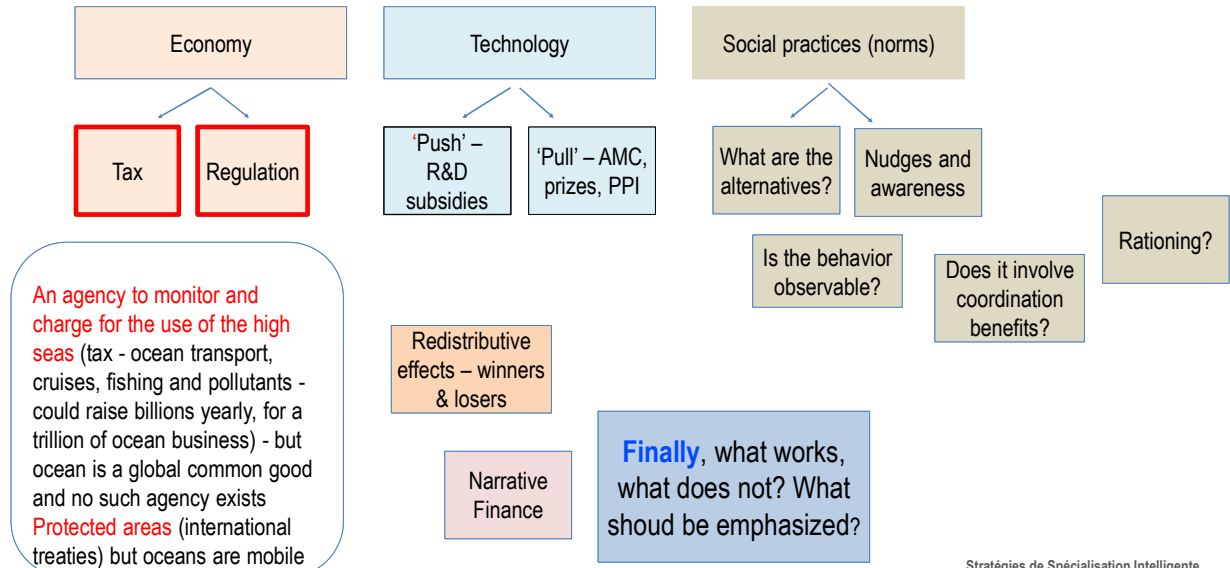
- Ocean is a global commons or open-access resources (the seas beyond exclusive economic zones)
- Huge activities – ocean transportation – deep see fishing, cruises, pollutants emanating from land – by companies and communities which don't pay for what they use – **negative externalities: massive**
- Even worse, deep sea and industrial fishing are heavily subsidized by governments (1.2 Billions/year in the EU) – That amounts to negative price for the ocean
- Because **we don't pay for what we use and we subsidize harmful activities**, we overshoot the resilience capacities of the ocean ecosystem



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From experiment to policy discovery – the case of cleaning the ocean

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TIP as social experiments and discovery process

- The model of TIP is one of strategic collaboration between specific sectors (or areas of activities) and the government with the aim of learning where the most significant bottlenecks are and to discover the private sector and consumers *willingness to change* as these bottlenecks and problems are progressively removed.
- The right way of thinking about policy is as a **process of discovery**, learning where the constraints and opportunities lie and responding appropriately.
- A sectoral focus is key here because each sector is different and has specific issues. The issue of growth or de-growth needs to be addressed at sectoral level
- The meta question is whether **a government** at any level of governance can put in place the appropriate processes and institutions to engage in such strategic interactions with the various private sectors and civil society.
- In some cases there is just no government (ocean) or we have potentially a powerful one such as the EC (aviation)

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TIP as a discovery process

- Perhaps, we will discover that :
 - The development of adequate technologies is the main solution in this case (cement)
 - Large scale behavioural tipping is feasible and is the solution in another case (diet)
 - There is no other hope than a radically new regulatory framework in another case (ocean)
 - The key is a coordinated push of various interventions in another case (aviation)
- « The development of adequate technologies is the solution »
- This is not always techno-solutionism
- Techno-solutionism is when « technology is the solution in any case »
- Under a TIP experimental logic, we discover that for this problem it is the solution but for another problem it is not
- Technology solutions should not generate perverse incentives; e.g. provide reasons not to change behaviors and business models – e.g. technology policy needs to be associated with long term commitment of governments to maintain and reinforce other policies (such as taxing or regulating)
- « *Technological fixes do not offer a path to moral absolution, but to technical resolution* ».

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TIP as promoting a coordinated push



Establishing a circular economy in industry X

Most business models (repair, recycle, modular design, infrastructures, services) make sense only when other, complementary models are already in place – the success of one depends on the success of the other

Individually each BM has only a limited pay-off

If all projects were developed simultaneously, they would form a self-sustaining system with potentially enormous profit potential: this will create a potential for system transformation

But can the market succeed in capturing these complementarities?

TIP happens at system level to capture all complementarities, solve coordination problems and align incentives, technologies and social practices towards some desired societal goals



TIP and the optimal level of interventions?



- Are we doing enough, too much? Too many instruments?
- Tinbergen rule as first-order guidance : use just as many instruments you have problems (market failures, externalities, missing technologies, social norms inertia)
- Examples: air traffic decarbonation
 - Environmental externalities (tax, regulations)
 - Promoting technologies (AMC, subsidies)
 - But two is not enough
 - Social norms (awareness, public investments)
 - Redistributive effects - equity

Centrality of public sector



- There is a need for an orchestrator to experiment and coordinate actions and investments
- A solution could be a large company with large capacities to capture all complementarities and internalize coordination positive externalities
 - IBM: a smart city
 - Syngenta : resilient agriculture in the South
 - Unilever: sustainable living plan
- But drawbacks
 - Monopolisation
 - Bias towards what the company does at best
 - If Airbus or ICAO is in charge of air transport decarbonization, it will focus on technologies and avoid any actions about better railway infrastructure or taxes aiming at reducing air travel quantity

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Centrality of public sector? *cont.*



- But this is not public sector only!
- The targeted transformation involves social practices and norms – citizens and communities need to be included to trigger large scale behavioural tipping
- There are high potential benefits to involve private innovators – determining a win-win deal
 - Private innovators get support and signal reputation
 - Public sector improves the cost-effectiveness of the policy
 - Example: NASA and SpaceX

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