New Wine in an Old Wineskin? – How Technology Changes affect both How and Why we Regulate

LEANZ Presentation at KPMG Wellington

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Outline

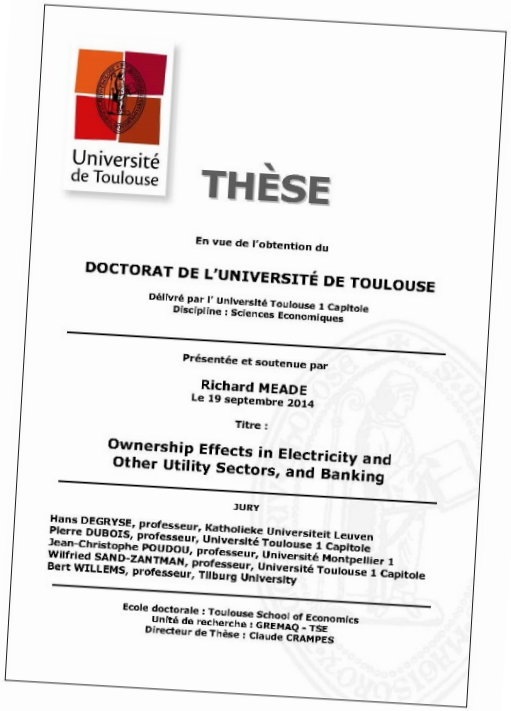
- Background.
- Some basics – the standard regulatory challenges.
- What's changed? – how new technologies are becoming increasingly disruptive.
- Some case studies:
  - Transport;
  - Electricity;
  - AI/Labour – "future of work".
- Implications for regulation.

Background

- "DNA" of presentation comes from three areas of interest:
  - Electricity reform;
  - Transport futures thinking – e.g. looking out 10-20 years;
  - Impact of alternative ownership forms on organisation and regulation of imperfectly competitive industries.

- *Bottom line – pace and nature of technology changes fundamentally change how and why we regulate, with possibly unexpected (and undesirable) consequences.*

Background (cont'd)


Université de Toulouse

THÈSE

En vue de l'obtention du

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Délivré par l' Université Toulouse 1 Capitole
Discipline : Sciences Economiques

Présentée et soutenue par

Richard MEADE
Le 19 septembre 2014

Titre :

Ownership Effects in Electricity and Other Utility Sectors, and Banking

JURY

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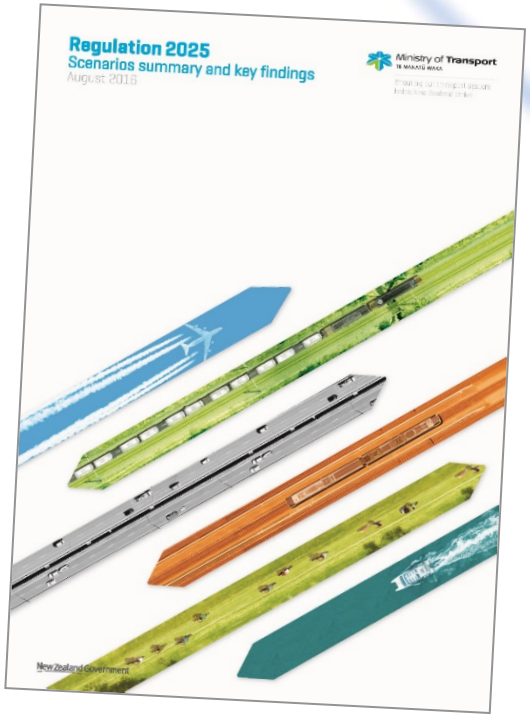


Basics – The Standard Regulatory Challenges

- Draws on Evans and Meade (2015), *Regulation 2025: Spectrum of Regulatory Responses*.
- Regulation conventionally justified due to "market failures":
  - I.e. features of private exchange that cause private choices to diverge from socially-desired ones;
  - Examples – pollution, vehicle safety, "public goods".
- In practice, this idealistic view tempered by reality:
  - Regulators fail too (information/incentive problems, capture by interest groups, poor regulatory tools, etc).
- *Question is: will regulating to remedy a market failure do sufficiently better (or worse) than not regulating?*

The Standard Regulatory Challenges (cont'd)

- Related question – what type of regulation might be useful?
  - Old school "command and control", or "market-based"?
  - Process-based (prescriptive), or performance-based?
  - Centralised, or decentralised (e.g. self-regulation, or risk-based regulation)?
  - By sector (e.g. road transport) or by activity (e.g. safety)?
- At any point in time, technologies determine the types of *problems* regulators confront:
  - Drones crashing into helicopters only a recent problem …
- Technologies also affect the *tools* regulators might use:
  - Drones for remote monitoring/enforcement …

The Standard Regulatory Challenges (cont'd)

- One dichotomy of particular relevance to innovation – process- vs performance-based regulation, e.g.:
  - Cars should have catalytic converters (process) vs cars should emit no more than *x* ppm of CO (performance).
- *Process* regulation relatively simple/cheap to specify, implement and monitor (for compliance):
  - But locks in a given technology – what if cheaper technologies emerge for removing CO?
- *Performance* regulation much harder to implement (how to monitor and judge performance of different technologies?):
  - But, better preserves/creates incentives to innovate …

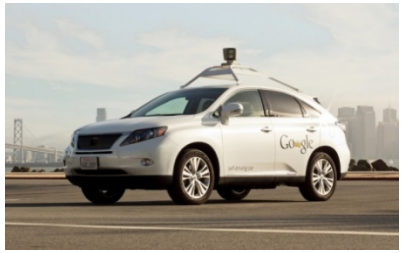
The Standard Regulatory Challenges (cont'd)

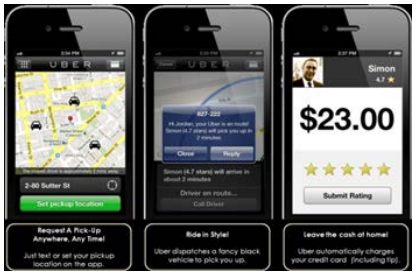
- Some bigger questions to address – what is it that regulation is even trying to achieve:
  - Whose preferences/interests are to be served?
  - How do we balance conflicting preferences/interests? – e.g. young vs old, incumbents vs entrants.
  - How do we preserve incentives to invest? Or to innovate?
  - How much innovation does society really want, and how much risk is it willing to bear with new technologies?
- *And in a world of increasingly globalised technology, how much can we influence that technology, and how much freedom do we have to choose our own course?*

Why are new technologies so disruptive?

ICT & Internet of Things/Everything

Transport





Electricity

Labour (etc)

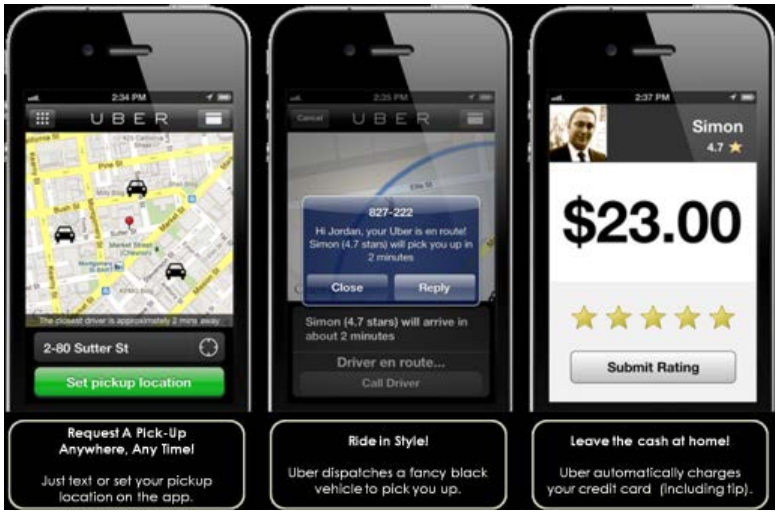
Why are new technologies so disruptive? (cont'd)

- The industrial revolution turned industry and society on its head – changing transport and manufacturing technologies redefined what we do, and where we live, work and play.
- What we are witnessing is a pace and type of innovation that is far more wide-reaching:
  - Underpinned by ubiquitous communication technologies that – due to interconnection – diffuse across countries, sectors and individuals;
  - Snowballing improvements in technologies, with feedback– the more you do here, the more you can do there (and vice versa); and
  - Human monopoly on ideas/thinking under challenge.

Why are new technologies so disruptive? (cont'd)

- New technologies underpin new business models which, at their heart, are just decentralised digital market-places:
  - Uber/Lyft, AirBnB, trading spare electricity, etc – price signals affecting choices in wider spheres of activity.
- They give rise to "prosumerism" and "sharing":
  - Traditional supply/demand boundaries become porous and dynamic – redefines effective supply, and hence "reliability";
  - Prosumers become the "frenemies" of traditional suppliers and users (cf taxis and passengers)

Why are new technologies so disruptive? (cont'd)



Sell and/or buy services – i.e. PROduce or conSUME those services

Mechanism for matching buyers and sellers, using prices to unlock "latent capacity" – i.e. a "market".

Disruptive technologies – Transport

- Autonomous vehicles (AVs) – people and freight – reduce:
  - Travel time costs – travel more, and farther;
  - "Last mile" costs – move more freight, faster, with just-in-time mobile manufacturing, and on-the-fly pan-modal logistics, …;
  - Less possibility of (real-time) human error – travel faster …
- Real-time tracking technologies enable real-time pricing and greater private infrastructure provision, delivery on-the-fly, …
- On-demand passenger services disrupt "public transport".
- VR teleconferencing/tourism – change why we move (or not).

Disruptive technologies – Electricity

- Traditionally dominated by large generators (economies of scale), with energy transported to demand by long-distance by grid and local distribution (both monopolies):
  - Customers just the end of the supply chain.
- Small-scale photovoltaic panels (PVs) and battery storage (including electric vehicles, EVs) becoming economic:
  - Customers can become prosumers – competing with rest of supply chain, or complementing it (dynamically, and actively);
  - Trading to become more decentralised (vs through organised centralised markets) and algorithmic – disintermediation, financialisation …

Disruptive technologies – Electricity (cont'd)

Falling PV costs …

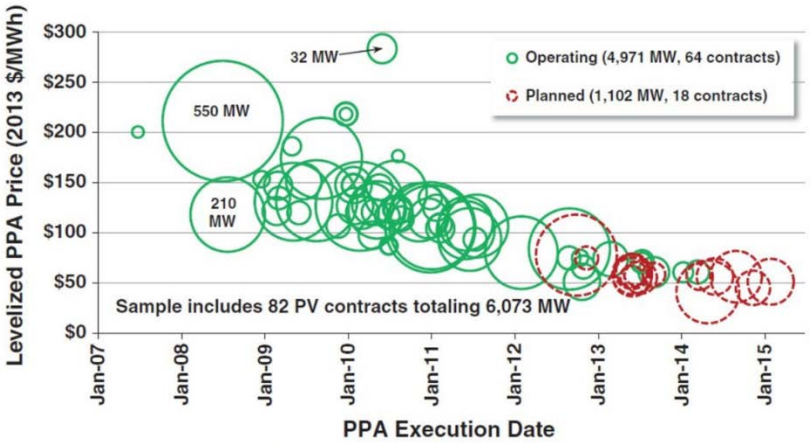


Figure 1. Levelized US utility-scale photovoltaic power purchase agreement (PPA) prices by operational status and PPA execution date.

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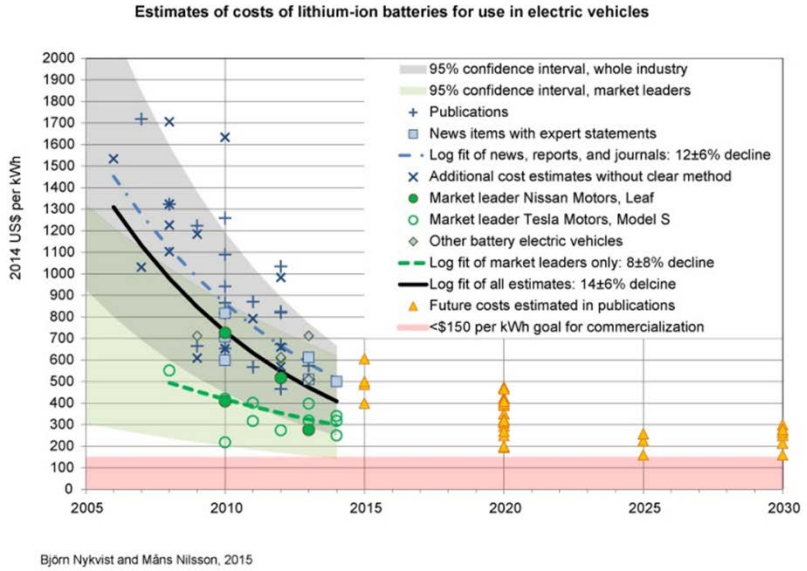
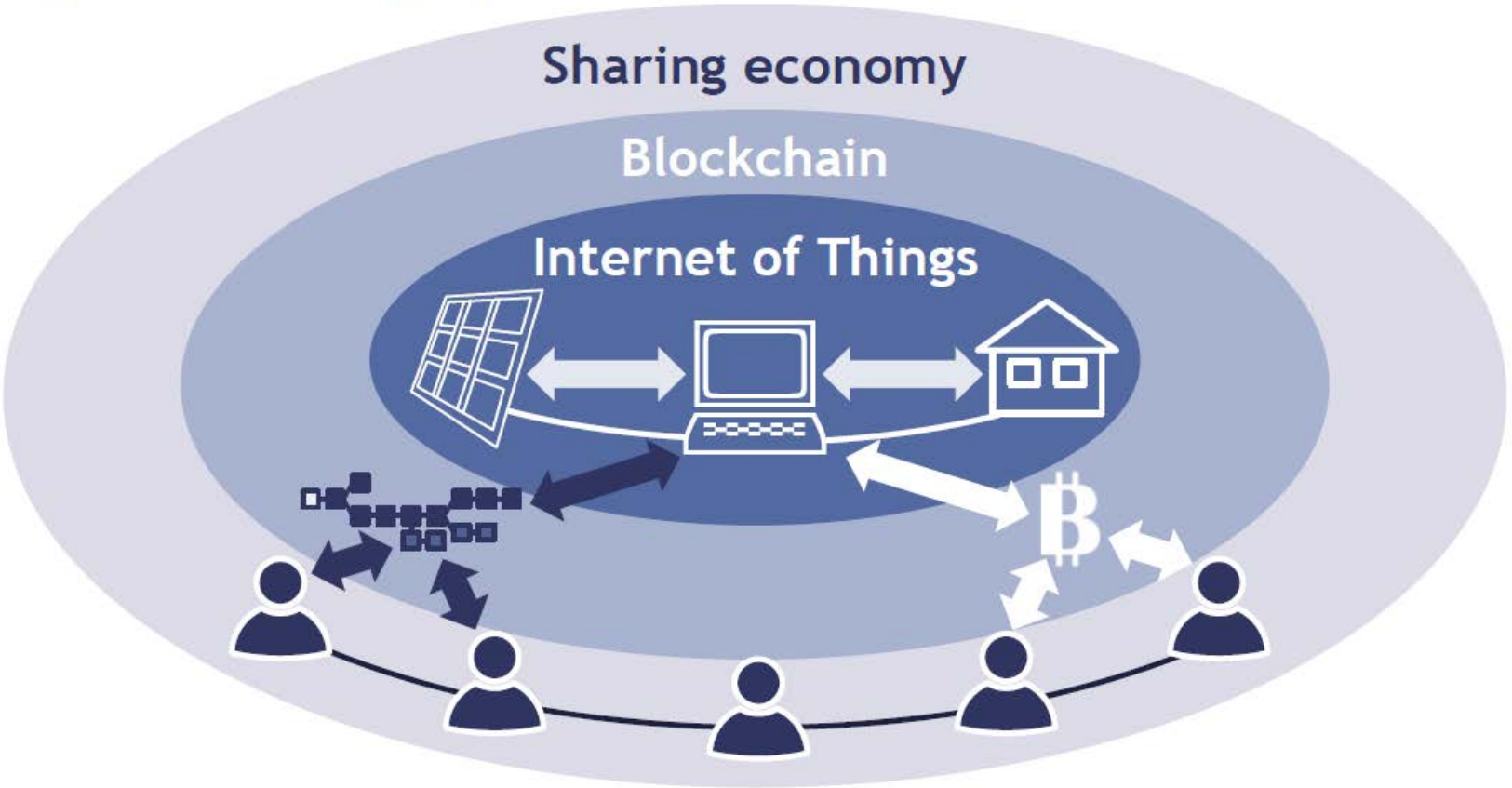
… and falling battery/EV costs (complementary technologies)



Disruptive technologies – Electricity (cont'd)

Figure 8: The "Big Beyond"



Source: Burger et al. (2015), The "Big Beyond", ESMT.

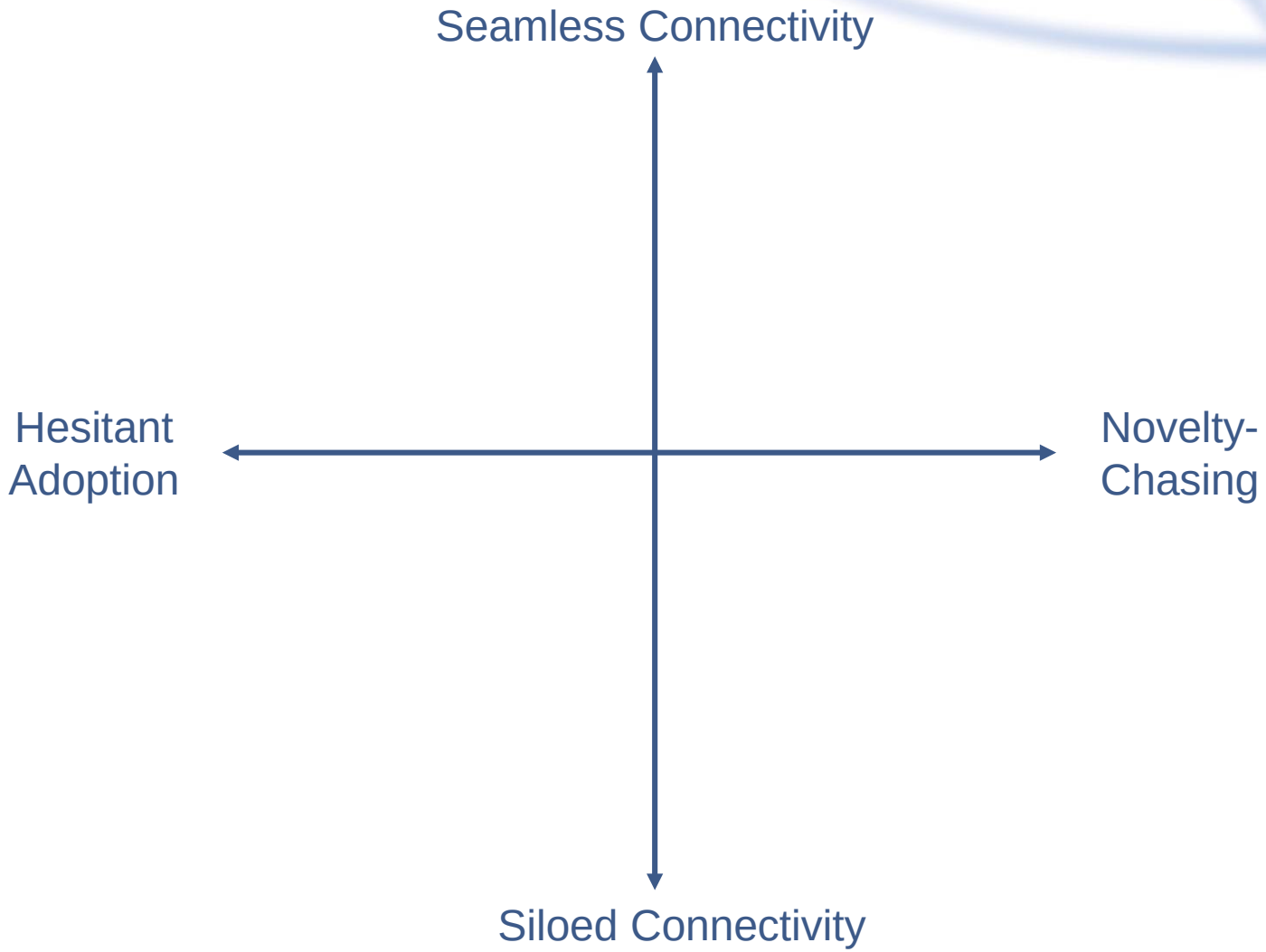
Disruptive technologies – Labour markets

- "AI"/machine learning technologies already:
  - "Learning" from what people do;
  - Replacing some human functions.
- Depending on who controls or benefits, can (24/7) either:
  - *Substitute* for people – e.g. low-cost back-office functions, high-risk/undesirable jobs, skilled jobs requiring more costly human resources;
  - *Complement* people – e.g. making even unskilled people "super-skilled".
- Immense potential for distributional/political problems, but ludditism less tenable in a globalised world.

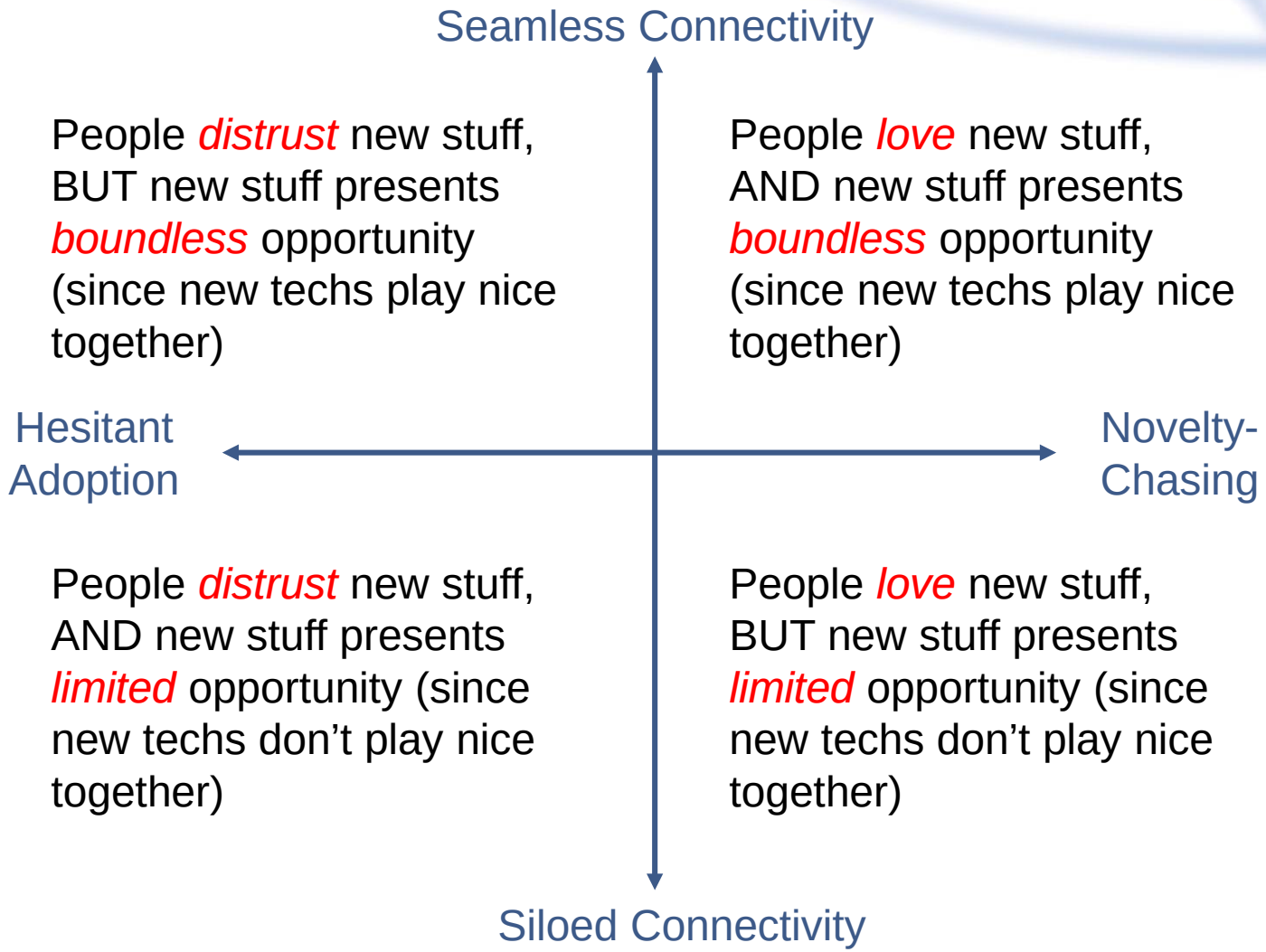
Regulatory implications – Transport

- Drawing on Ministry of Transport (2016), *Regulation 2025: Scenarios Summary and Key Findings*.
- Project involved four futures scenarios to help think about suitable regulatory responses to new technologies.
- Usefully interacted *technology* possibilities with *social attitudes* possibilities:
  - Technologies can be seamlessly connected OR siloed;
  - People can be hesitant about new technologies OR embracing of them.
- Leads to four possibilities …

Regulatory implications – Transport (cont'd)



Regulatory implications – Transport (cont'd)



Regulatory implications – Transport (cont'd)

Seamless Connectivity

Consider the "high-tech" scenario (note: not forecast!) …

- AVs quickly predominate:
  - Road toll "crashes";
  - Drink and "drive" as much as you like.
- 24/7 "transport on demand" takes over from part-time, owner-operated vehicles:
  - Passenger trips up, but fleet smaller;
  - Less parking required;
  - Risk of "zombie" fleets.

Novelty-Chasing

Regulatory implications – Transport (cont'd)

Seamless Connectivity

- AVs quickly predominate:
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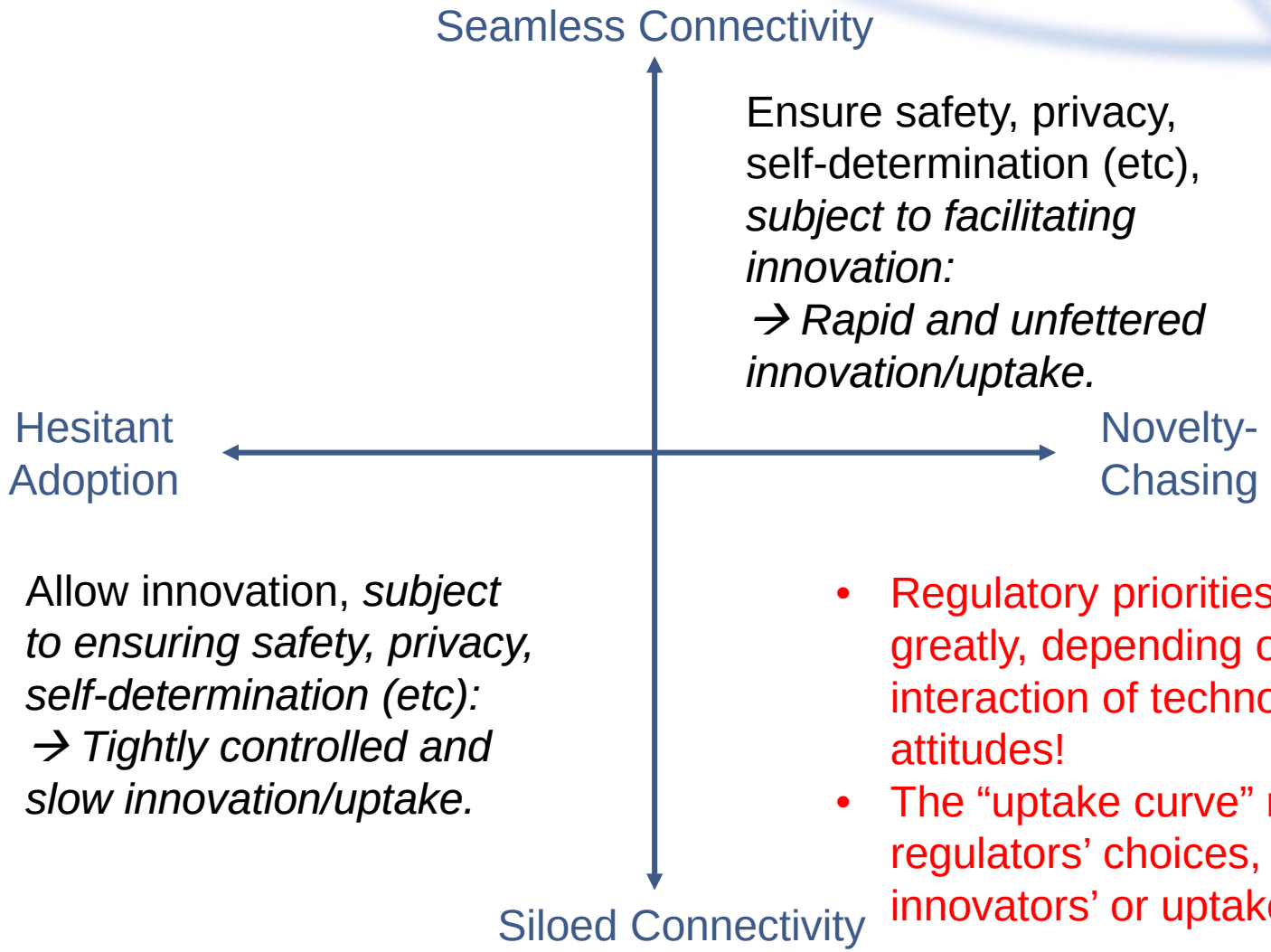
- 24/7 "transport on demand" takes over from part-time, owner-operated vehicles:
  - Passenger trips up, but fleet smaller;
  - Less parking required;
  - Risk of "zombie" fleets.

- Vehicle/driver safety compliance now automatic:
  - No WoFs, licences, …
- Technology-based monitoring enables pan-modal, performance-based regulation:
  - "3 laws"* apply across all transport modes;
  - No speed limits, lanes.
- New priorities include:
  - Standards, hacking/ mods, system security, spoofing, congestion pricing …

Novelty-Chasing

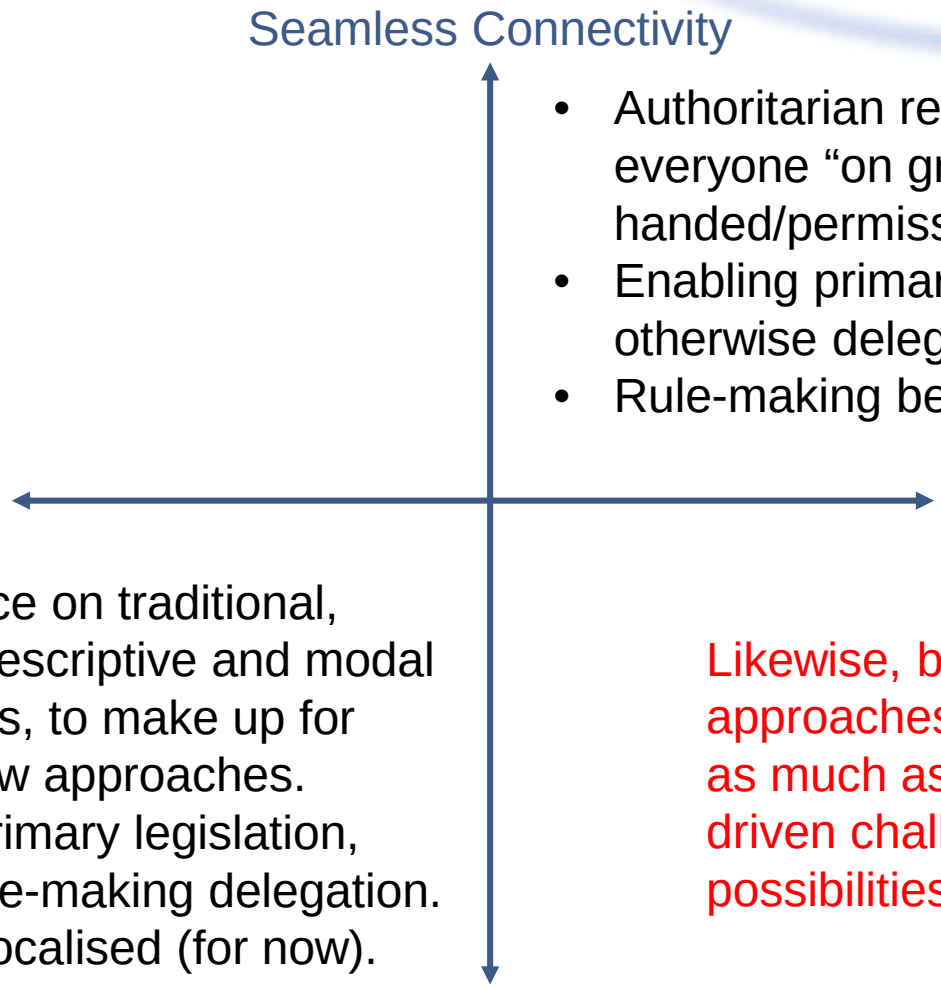
* 1. Don't bump into other things. 2. Don't go where you are not meant to be. 3. Don't move in an unfit state.

Regulatory implications – Transport (cont'd)



- Regulatory priorities differ greatly, depending on precise interaction of technology and attitudes!
- The "uptake curve" reflects regulators' choices, not just innovators' or uptakers'!

Regulatory implications – Transport (cont'd)



- Authoritarian regulation to ensure everyone "on grid", otherwise light-handed/permissive/responsive.
- Enabling primary legislation, otherwise delegated rule-making.
- Rule-making becoming globalised.

- Greater reliance on traditional, "hands-on", prescriptive and modal regulatory tools, to make up for rejection of new approaches.
- Reliance on primary legislation, with limited rule-making delegation.
- Rule-making localised (for now).

Likewise, best regulatory approaches reflect attitudes as much as technology-driven challenges and possibilities.

Regulatory implications – Electricity

- PVs and batteries are decentralised and intermittent:
  - Cuts across centralised "least-cost" dispatch:
    - Compulsory centralised wholesale market becomes a side show? → move to UK-style self-dispatch?
  - System reliability challenges – how to ensure parties creating reliability problems bear the costs of remedying them (e.g. network reinforcement, standby generation)?
- Depending on price, households et al. could be competing with former "natural monopoly" distributors one minute, and beholden to them the next:
  - Time to revisit lines regulation? How to define markets that change so dynamically? Who should own the kit?

Regulatory implications – Electricity

- With technologies rapidly changing, and uptake potentially sudden, what does "long-term" mean for regulatory asset bases?
- Ironic twist – status quo regulation represents a choice about the speed of new technologies' uptake:
  - Variable lines charges to recover fixed network costs likely to become spread over a decreasing (and poorer) customer base, as richer customers adopt self-generation;
  - Incentivises richer customers to uptake sooner (because they can), and poorer ones too (because they eventually can't afford not to).

Regulatory implications – Labour

- Likewise, health and safety rules might hasten AI-based labour substitution in industries with low-income and dangerous occupations.
- Alternatively, AI might simply push humans into roles that machines remain incapable of filling – e.g. high-risk manual ones – potentially exacerbating safety risks.
- AI has potential to reduce human-related problems – e.g. fraud/dishonesty – but what if:
  - Machine-learning simply replicates human foibles, without ability to sanction misbehaving machines?
  - Genuine AI means machines have agency, and potentially make bad choices … what rights/duties/sanctions?

Regulatory implications – Pan/Cross-sectoral

- The economics of PVs improves greatly with batteries.
- Some uptakers likely to be deterred by the overall cost of PV + batteries.
- But what if those uptakers were about to replace their car, and EVs are a decent substitute for fossil-fuel cars?
  - Bundling the new vehicle decision with the PV investment could make PVs more viable.
- Conversely, having PVs means charging an EV becomes cheaper, making EVs more viable if you already have PVs.
- Clearly there will be increasing complementarities across traditionally distinct sectors – e.g. electricity and transport.

Pan/Cross-sectoral implications (cont'd)

- This means regulation in one sector will affect new technology uptake in the other, e.g.:
  - If variable lines charges accelerate PV uptake, then this could accelerate EV uptake (again, initially by the rich, ultimately by even the poor);
  - If fuel excise duties to pay for roads fall more and more on (poorer) non-EV uptakers, then this accelerates EV uptake (by all), which in turn accelerates PV uptake. (Or we move to RUCs).
- Hence the reverse is also true:
  - PV uptake will affect transport regulation;
  - EV uptake will affect electricity regulation.
- What about algorithmic/disintermediated trading in electricity? – implications for financial market regulation (or vice versa)? …

Conclusions

- Disruptive new technologies are emerging as a joint consequence of choices made by innovators, uptakers and regulators – potentially changing traditional roles/relationships.
- Technology affects the problems we might (de)regulate, but also the tools available to regulators – either enhancing or reducing the case for regulation.
- Status quo regulation represents a choice about the speed of new technology uptake:
  - Valid to ask whether it is the best choice, recognising the importance of social attitudes towards uptake, not just technological possibilities.
- Technology complementarities mean regulation may need to be increasingly activity-based rather than sectoral:
  - While innovation means regulation itself becomes more responsive/permissive, globalised, and performance-based.