

The consumer appeal of low-carbon innovation

Charlie Wilson

SPRU, University of Sussex, January 2018

Tyndall°Centre[®]
for Climate Change Research



European
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Starting Grant #678799



Social Influence and *disruptive* Low Carbon Innovations

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Historical energy transitions are characterised by **new** &/or improved **energy services**



lighting



mobility

Historical energy transitions have been 'pulled' by the appeal of **novel attributes** for consumers

novel attributes

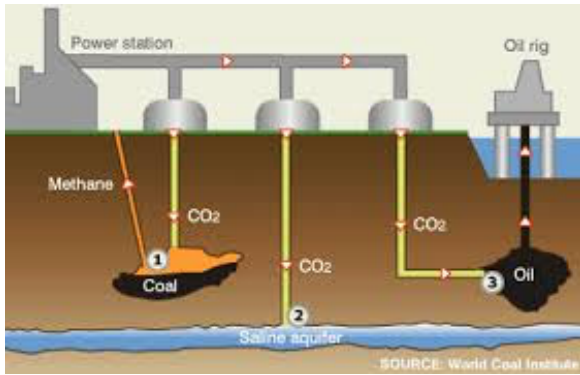
- functionality, versatility, multiple uses
- convenience, ease of use, reliability
- cleanliness (at point of use)

+ more efficient & lower cost energy service



mobility

Most **low C** innovations in 1.5 - 2°C scenarios offer cleaner, more efficient **substitutes**



Most **low C** innovations compete on **attributes already valued** in mainstream markets

novel attributes

- functionality, versatility, multiple uses
- convenience, ease of use, reliability
- cleanliness (at point of use)

+ more efficient & lower cost energy service

+ lower CO₂ emissions [reliant on policy]



mobility

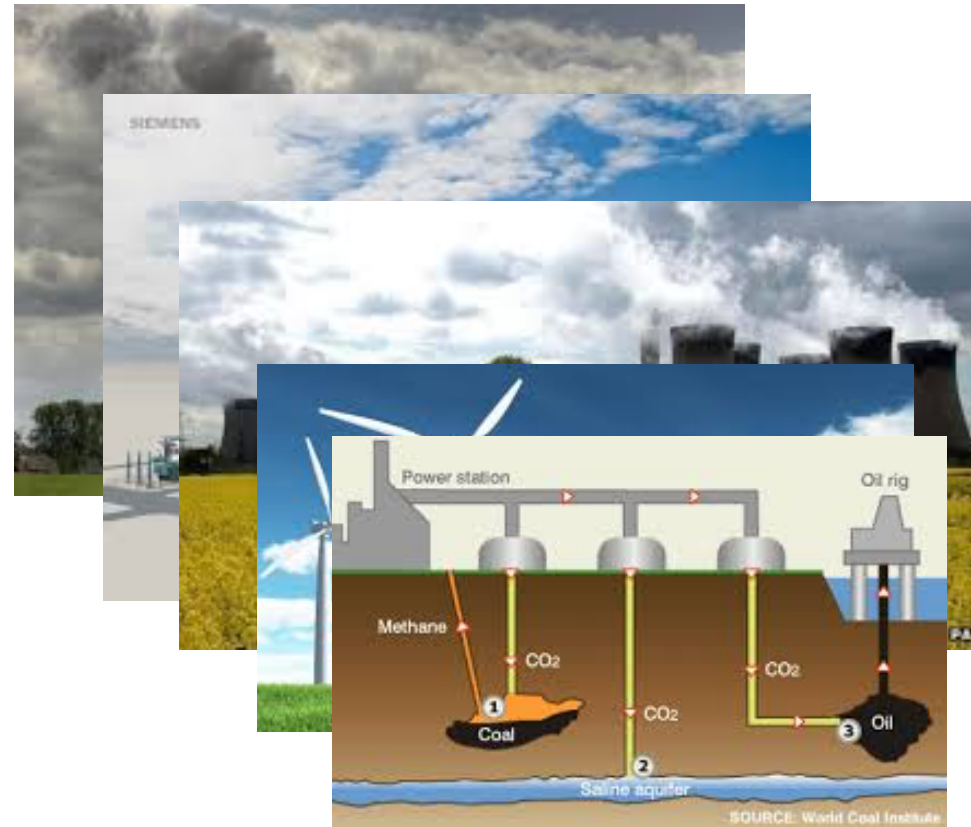
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energy production

Can **consumer-facing innovations**
offering **novel attributes**
help stimulate **demand**
for a low-carbon future?



**Can consumer-facing innovations
offering novel attributes
help stimulate demand
for a low-carbon future?**

what are the
innovations
& attributes?

who are the
consumers?

how do the
innovations
spread?

how big is the
impact on
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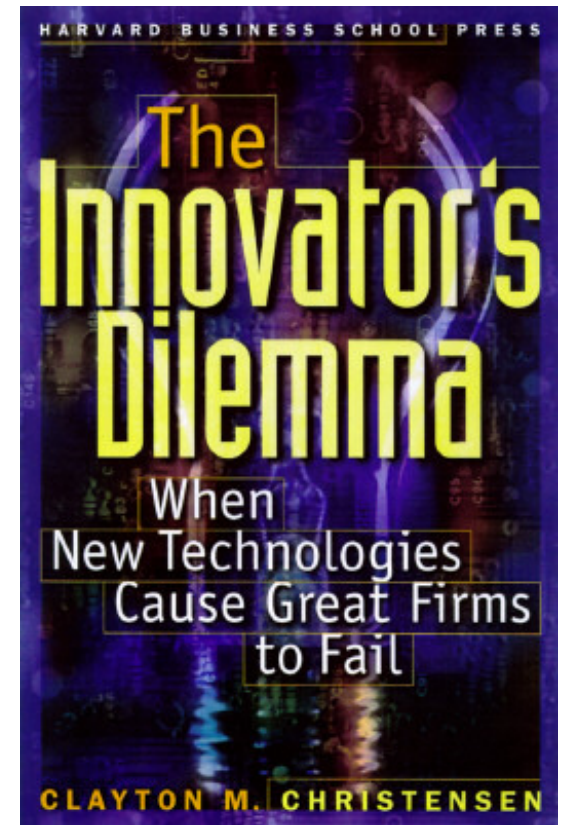
Disruptive innovations offer **novel attributes** to users ... and can **rapidly change** markets

Sustaining innovations -> improve currently valued attributes

- power -
- speed -
- storage -
- low cost per MB -



- portability -
- versatility -
- codeability -
- low cost per unit -



Disruptive innovations -> offer novel attributes, create new value

Examples of *potentially* disruptive innovations to **mobility**: alternatives to **car ownership**

Sustaining innovations -> improve currently valued attributes

based on ownership
upfront cost -
in-car 'features' -
status signalling -

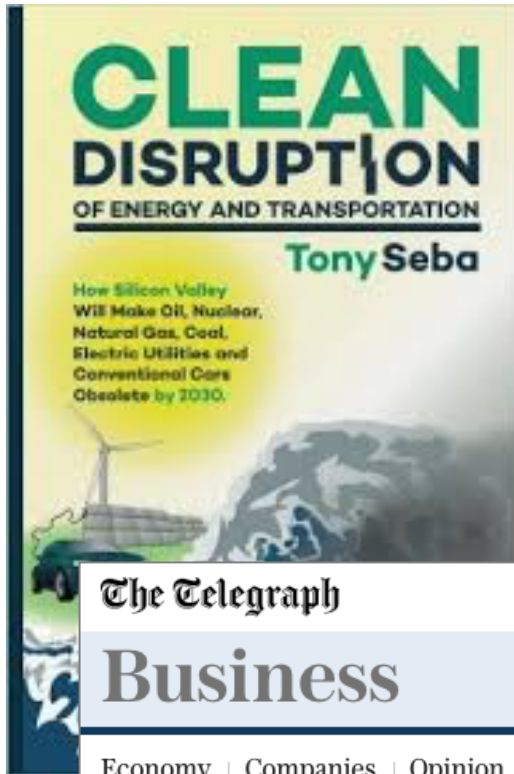


based on 'usership'
care-free -
relational -
choice variety -

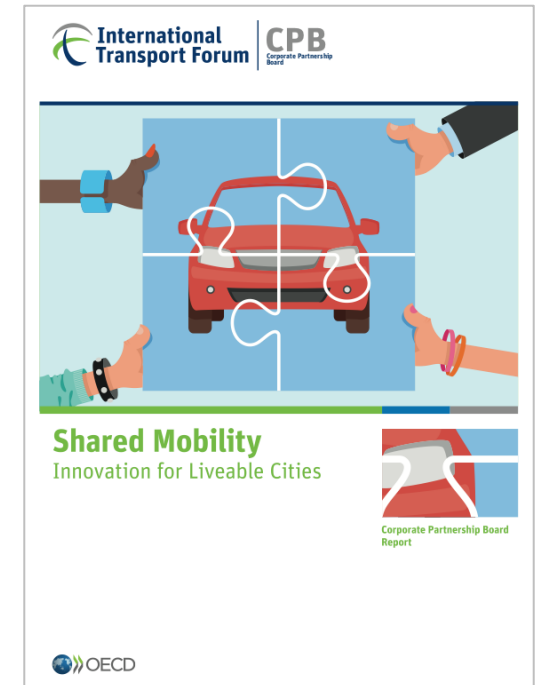


Disruptive innovations -> offer novel attributes, create new value

Convergence of **digital + energy** creates new value propositions: *mobility-as-a-service (MaaS)*



“Mobility-as-a-service will reduce energy demand by 80% and emissions by over 90%”



The Telegraph

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Report by 2017 by Seba

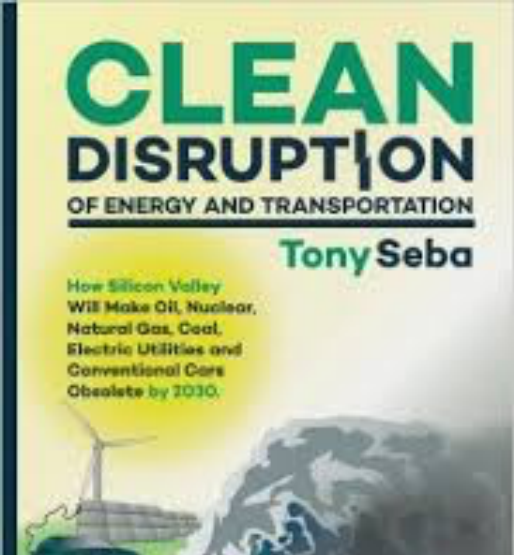
PREMIUM

Business

The end of petrol and diesel cars? All vehicles will be electric by 2025, says expert

Arbib & Seba (2017). *Rethinking Transportation 2020-2030*. [RethinkX](#).

Convergence of digital + energy creates new value propositions: *vehicle-to-grid (V2G)*



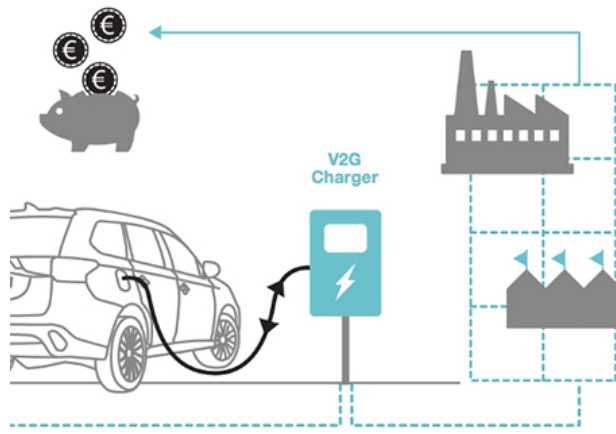
Economy | Companies | Opinion | Markets | Brexit | A-Z | Alex | Telegraph

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vehicle-to-grid (V2G)

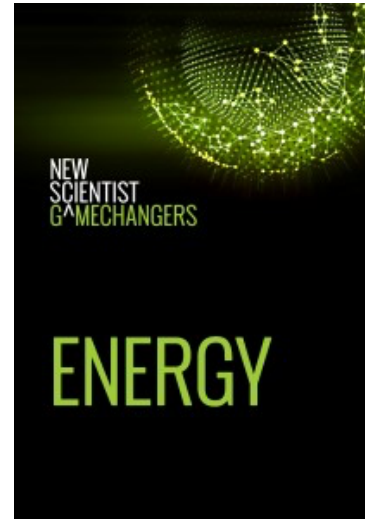


wholly new consumer role

Market surveys & consumer behaviour reports identify *potentially disruptive low C* innovations

Innovations & novel attributes

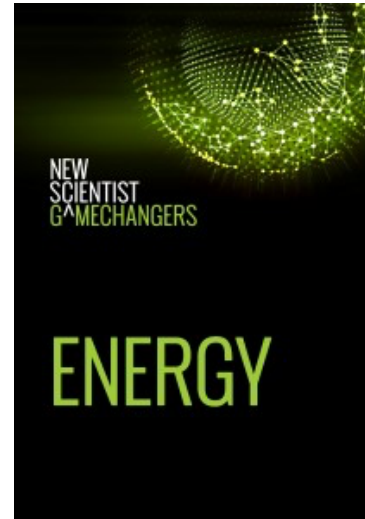
- mobility
- food
- buildings & cities
- energy supply & distribution



Workshop with **diverse innovation actors** to identify *potentially disruptive* **low C** innovations

Innovations & novel attributes

- mobility
- food
- buildings & cities
- energy supply & distribution



innovator workshop

'Most disruptive' and 'lowest C' innovations for mobility = EVs, MaaS, car-sharing

mobility

electric vehicles



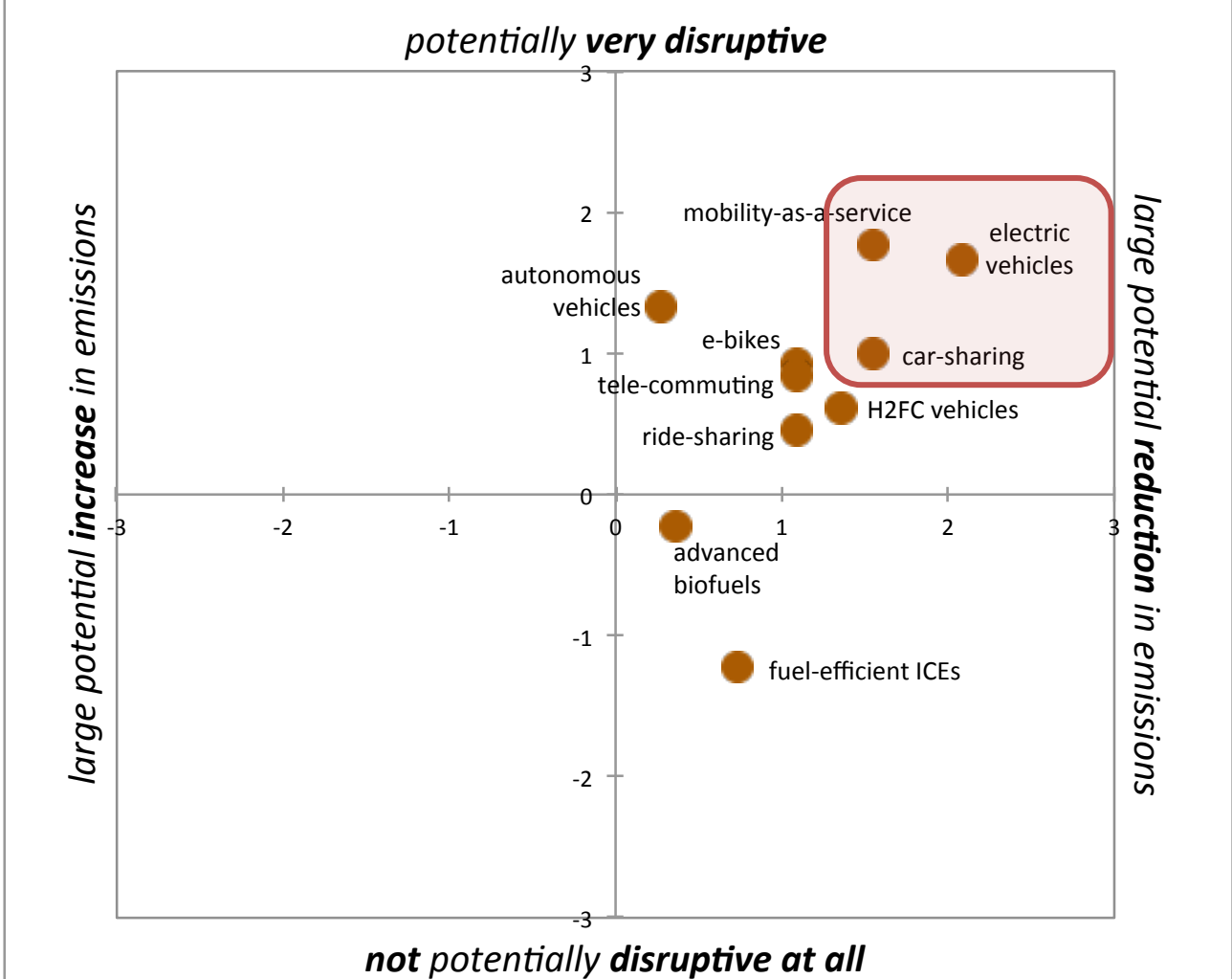
mobility-as-a-service



car-sharing



10 Mobility Innovations



'Most disruptive' and 'lowest C' innovations across four different domains

mobility

electric vehicles



mobility-as-a-service

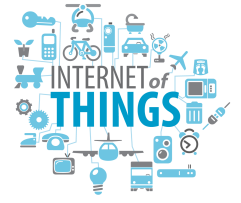


car-sharing

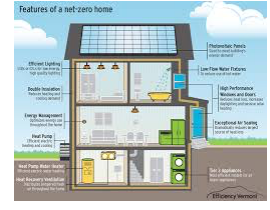


buildings & cities

internet-of-things



net zero-energy building design



hard! tend to be **infrastructural**

food & agriculture

urban (vertical) farming



reduced meat diet



hard! tend to be **behavioural**

energy supply & distribution

solar PV + storage + peer-to-peer trading



smart grids + demand response (+ V2G)



hard! tend to be **upstream**

'Most disruptive' and 'lowest C' innovations for mobility: novel attributes valued by users?

mobility

novel attributes valued by actual early adopters
[excluding already valued attributes e.g., cost, efficiency]

electric vehicles



multiple uses

active involvement
+ clean at point of use

mobility-as-a-service



pay per use, service-based

ease of use, control

car-sharing



pay per use, service-based

choice variety

relational

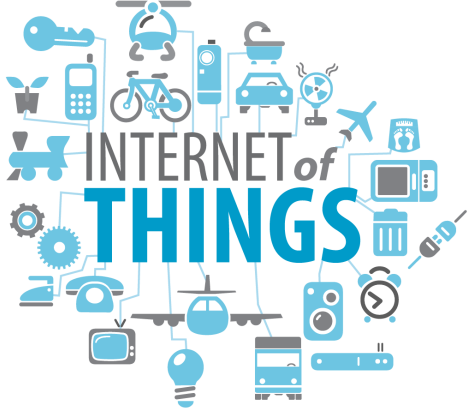
active involvement

Different disruptive low carbon innovations offer **common attributes** of appeal to end users

<i>novel attributes -> (relative to displaced incumbent)</i>	pay per use	service-based	multiple uses	choice variety	relational	active involvement	ease of use	control	autonomy	clean at point of use
electric vehicles (EVs)			light green	light pink		light green	red		light green	dark green
mobility-as-a-service car clubs, car sharing	light green	dark green	white	dark green			light green			
	dark green	light green	dark green		light green			grey		

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internet of things			■		■	■	■	■	■	



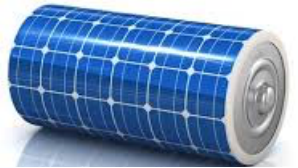
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internet of things			█	█	█	█	█	█	█	
urban (vertical) farms			█	█	█	█	█	█	█	
PV + storage + peer-to-peer trading		█	█		█	█	█	█	█	



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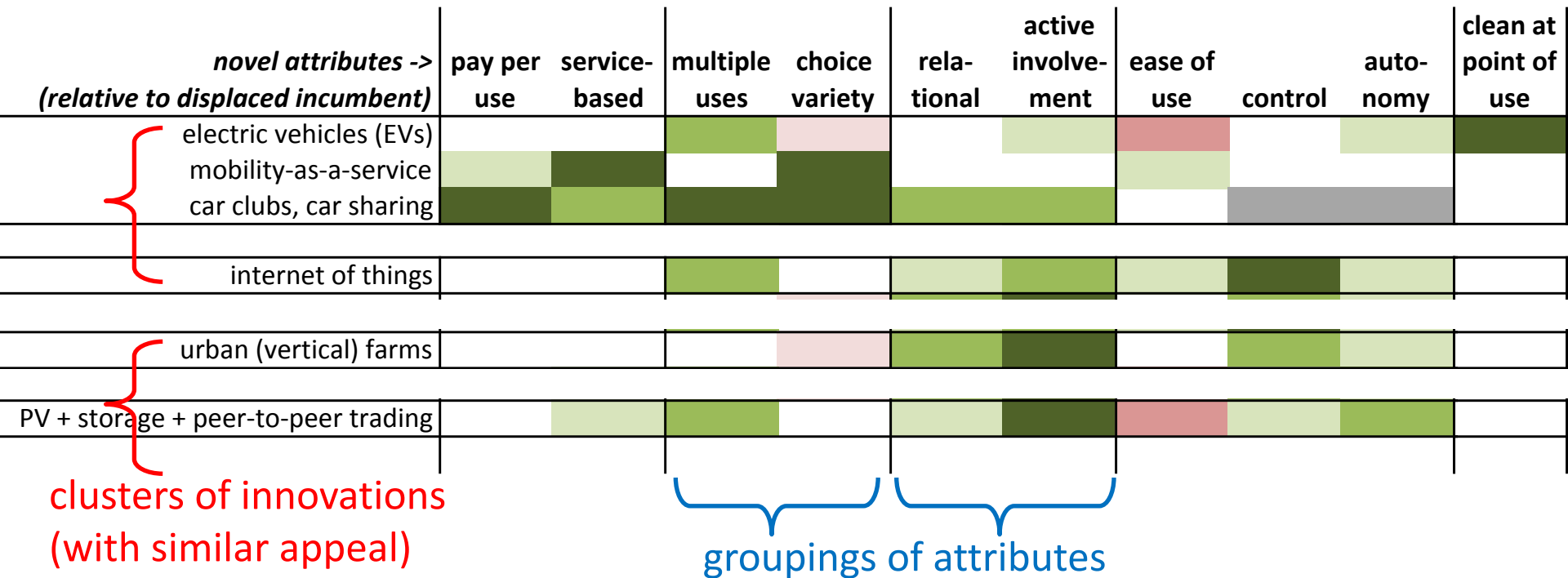


emphasis of business models for disruptive low C innovations

atypical early adopters ?

broadly consistent with historical transitions ...
except ease of use

Next steps: factor analysis (to reduce attributes) then cluster analysis (to group innovations)



then ...

do these groupings and clusters make sense? are early adopters similarly clustered?

- spring 2018 structured elicitation of how attributes are perceived
- summer 2018 large-scale survey questionnaire (*adopters & non-adopters*)

Can **consumer-facing innovations**
offering **novel attributes**
help stimulate **demand**
for a low-carbon future?

what are the
innovations
& attributes?

**who are the
consumers?**

**how do the
innovations
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how big is the
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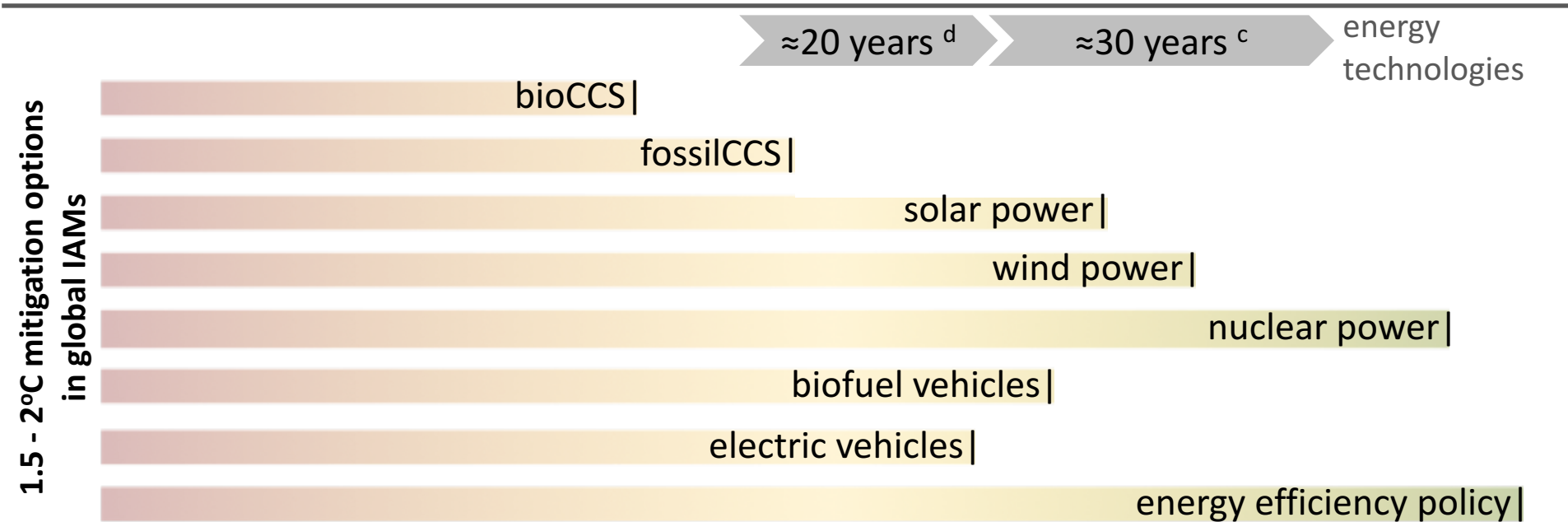
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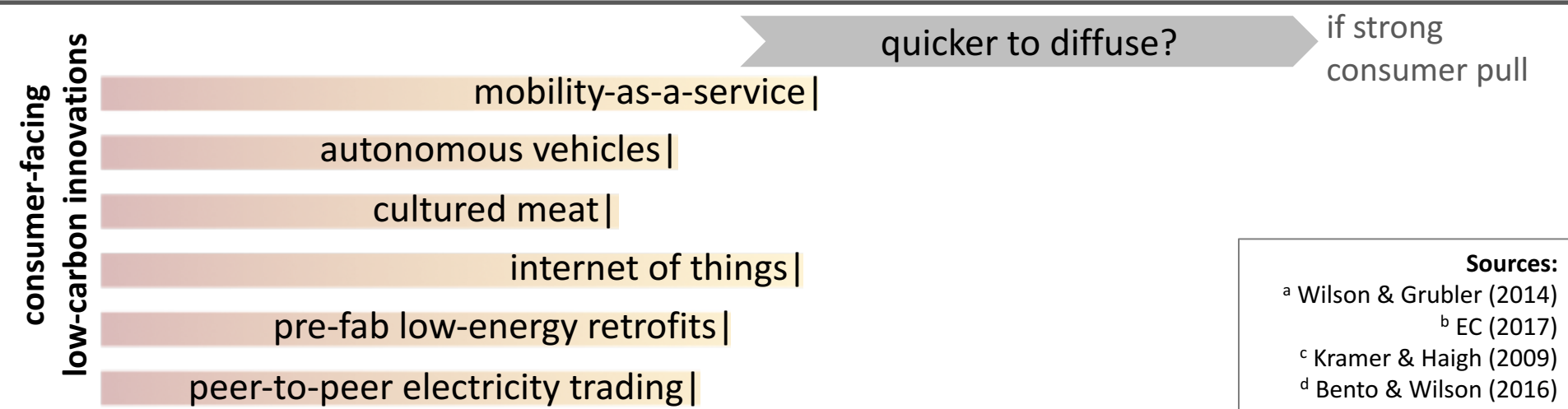
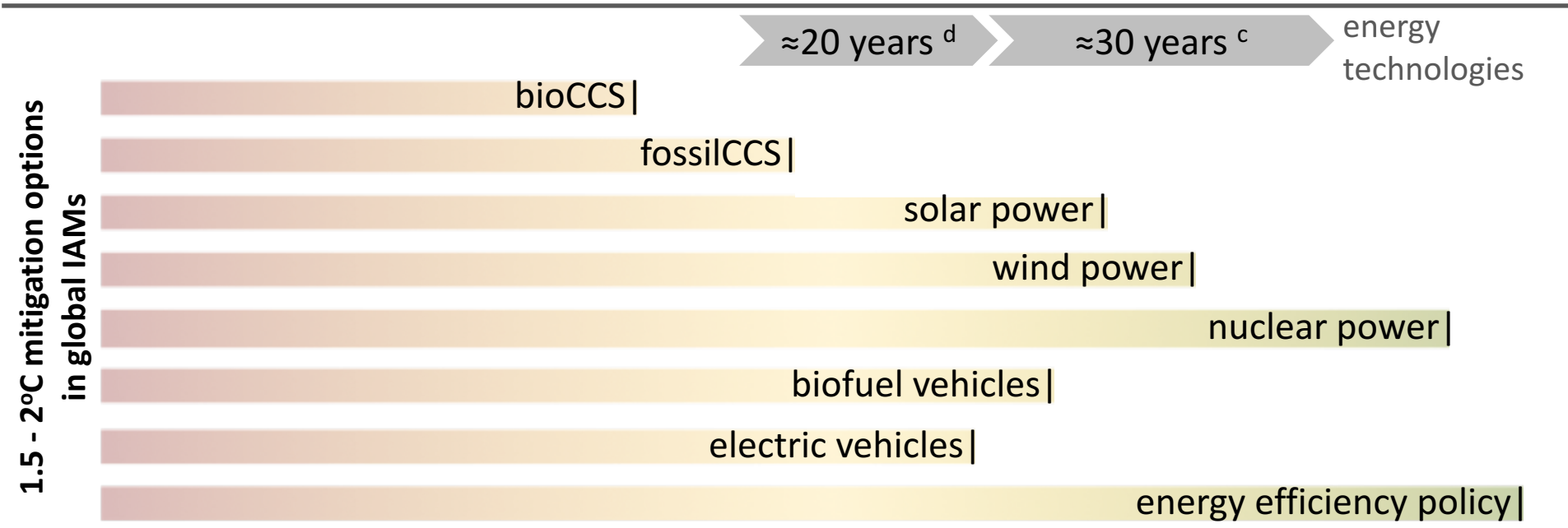
**how big is the
impact on
emissions?**

		technology lifecycle ^a										
		Basic Research		Applied Development			Demonstration		Market Formation		Rapid Diffusion	Maturity
TRL ^b		1	2	3	4	5	6	7	8	9	exponential ^c	materiality ^c



Sources:
^a Wilson & Grubler (2014)
^b EC (2017)
^c Kramer & Haigh (2009)
^d Bento & Wilson (2016)

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are these even meaningful and/or useful questions to ask?!?

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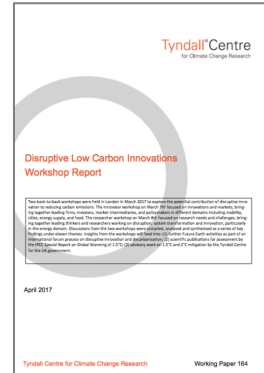
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There is no consensus on the meaning or relevance of *disruptive* low-carbon innovation



innovator workshop



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disruptive innovation
= innovation

Harvard
Business
Review

DISRUPTIVE INNOVATION

Tesla's Not as Disruptive as You Might Think

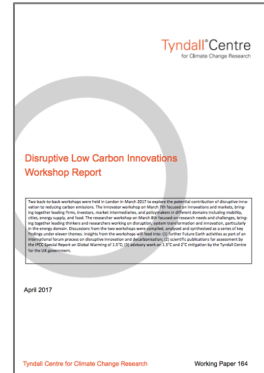
FROM THE MAY 2015 ISSUE

There is no consensus on the meaning or relevance of *disruptive* low-carbon innovation



innovator workshop

disruptive innovation
= innovation



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researcher workshop

system not discrete innovations
= necessary unit of analysis

system processes not consumers
= determinant of diffusion

continuity not disruption
= desirable narrative

Harvard
Business
Review

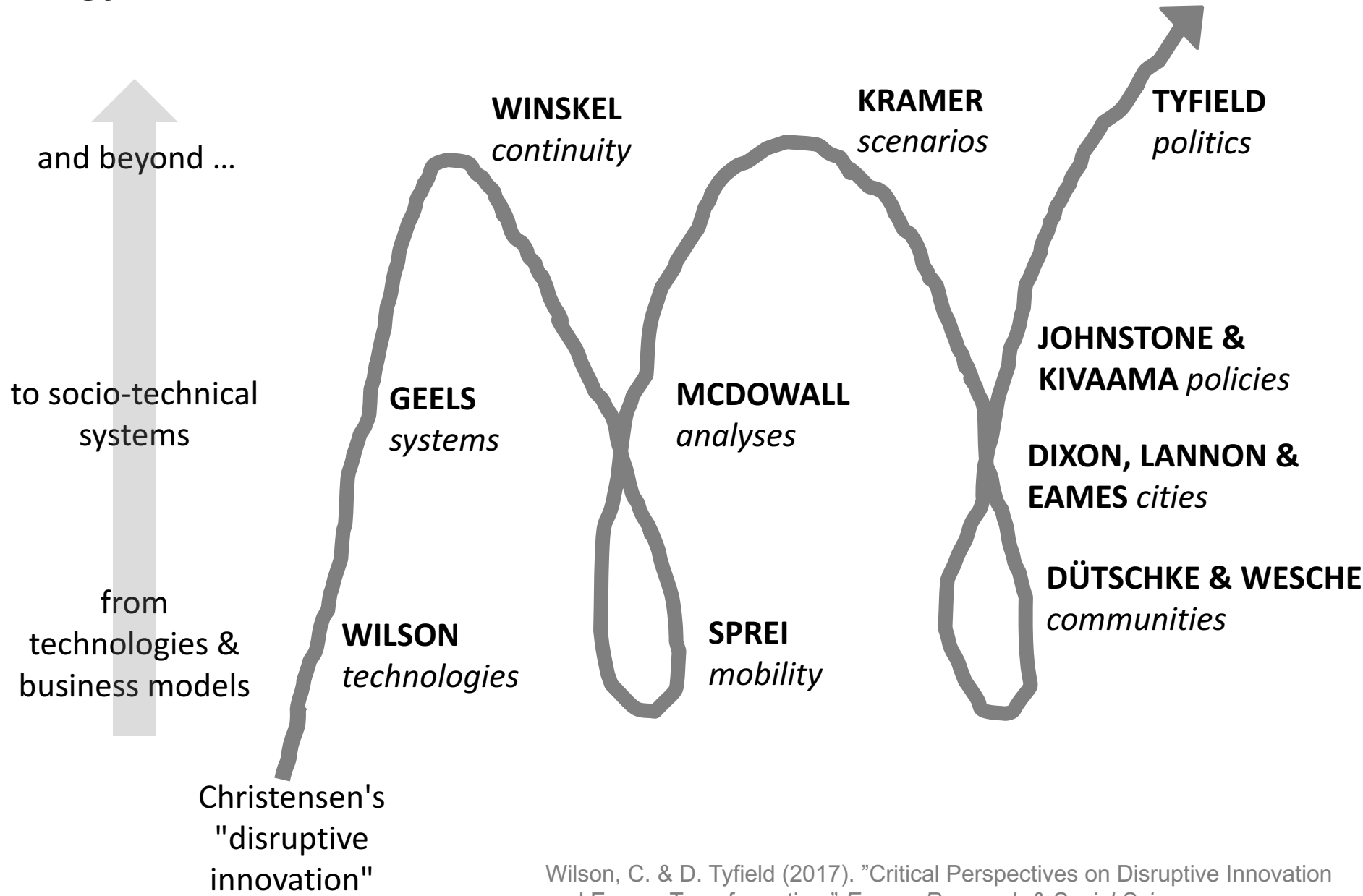
DISRUPTIVE INNOVATION

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FROM THE MAY 2015 ISSUE

Special Section on 'Disruptive Innovation and Energy Transformation'

Energy Research & Social Science



Wilson, C. & D. Tyfield (2017). "Critical Perspectives on Disruptive Innovation and Energy Transformation." *Energy Research & Social Science*.

Innovation-centric explanations of adoption and diffusion have a very **robust evidence** base

Diffusion = communication over time about an innovation *among members of a social system*



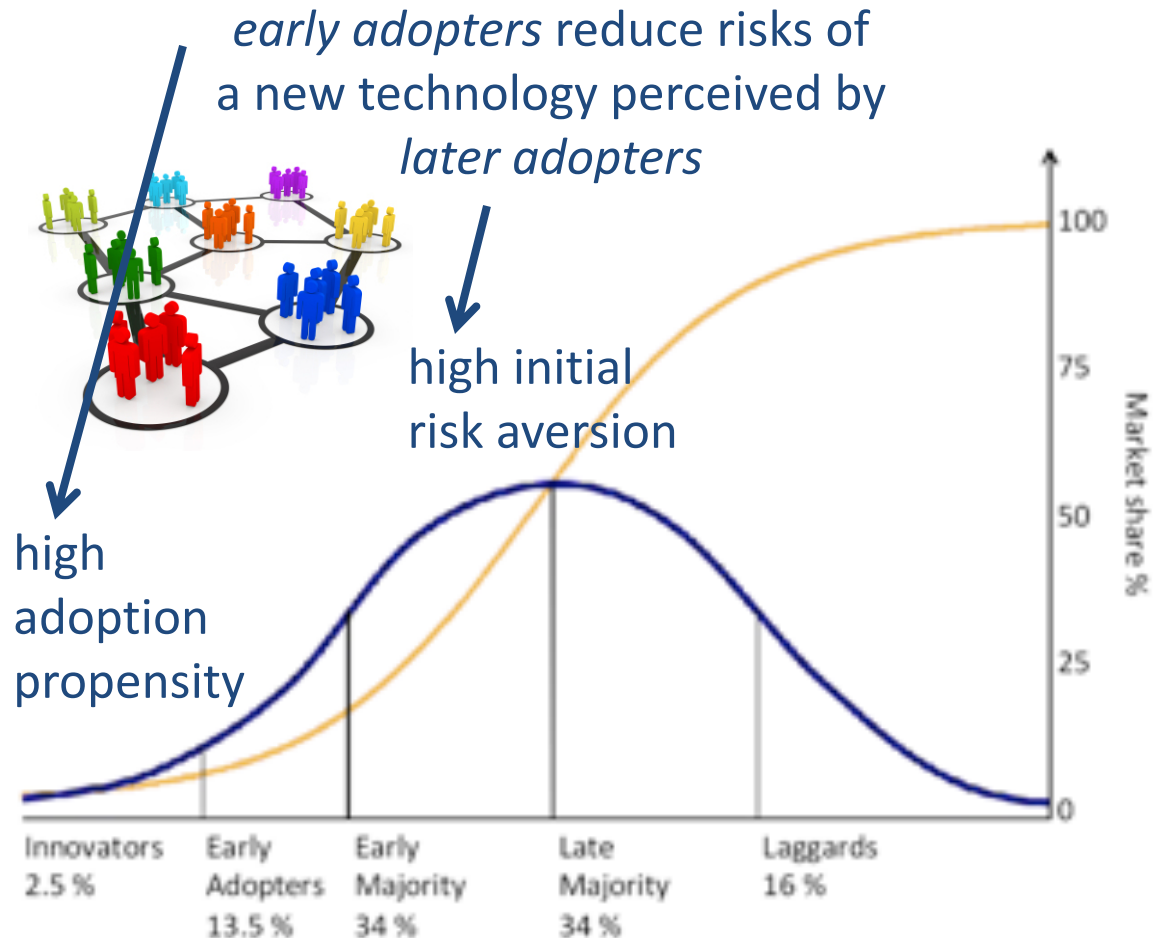
Everett Rogers
1931-2004



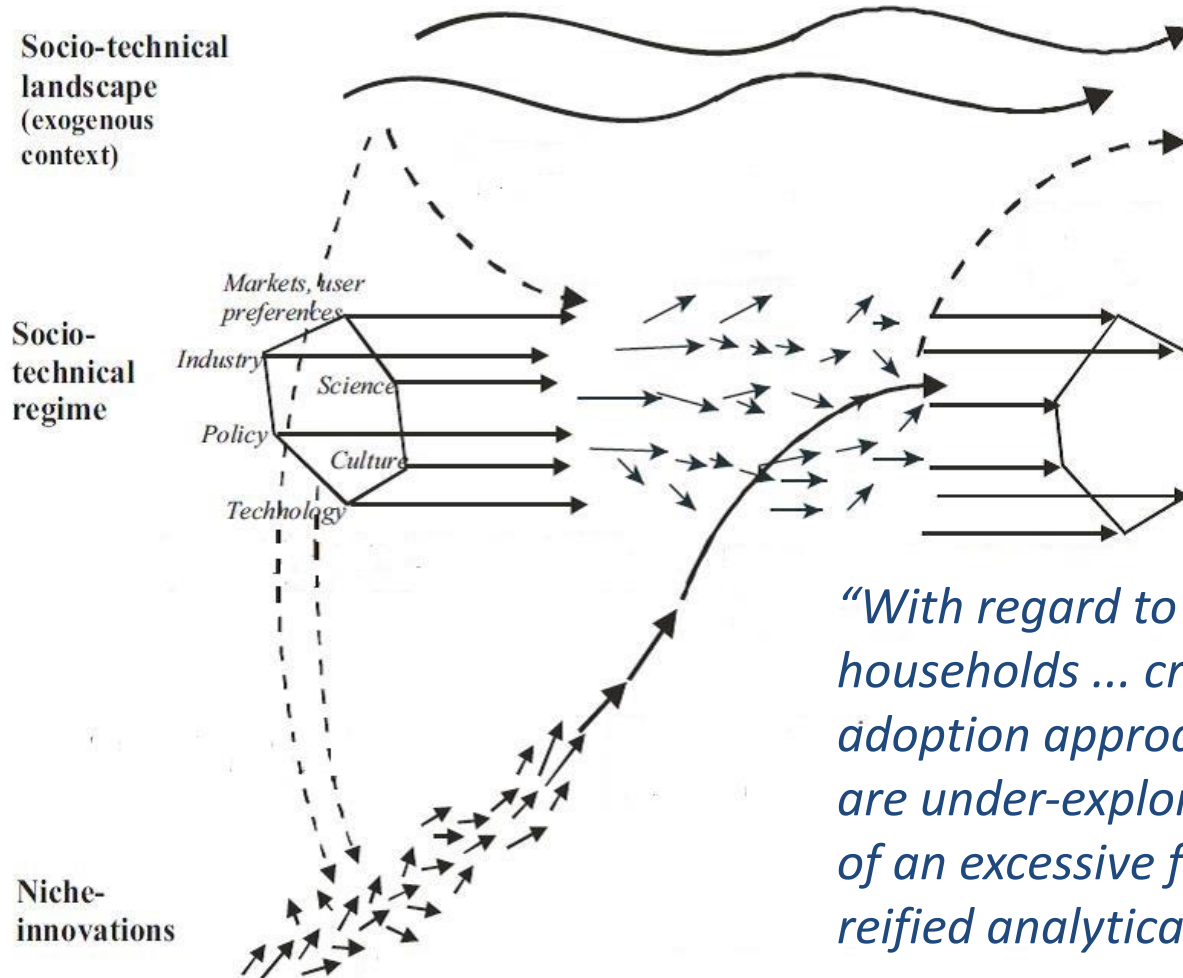
Five **attributes** of innovations determine adoption rates:

- (1) relative advantage**
- (2) compatibility**

(3) ...

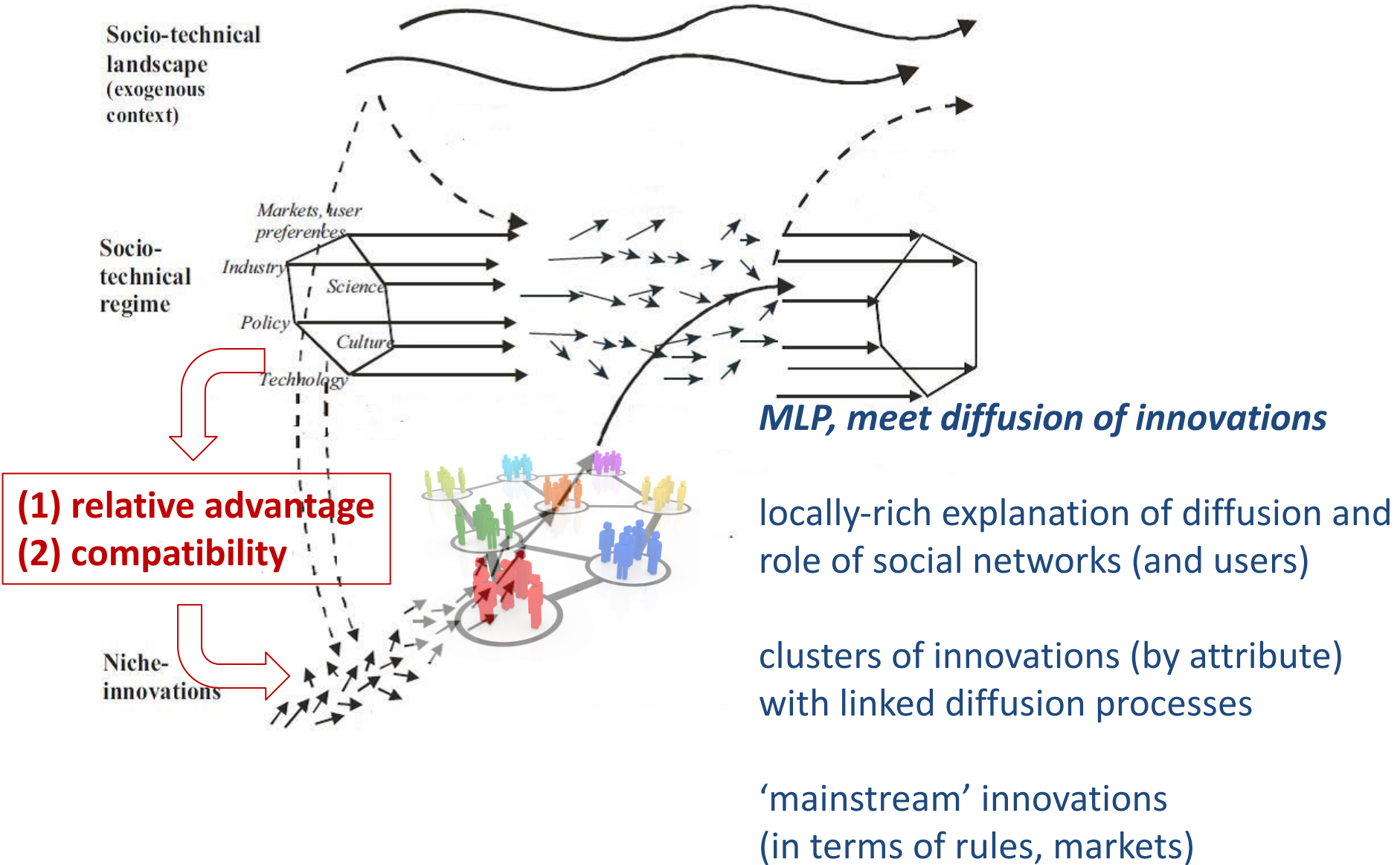


Multi-level perspective provides a compelling account of **system change** (and stability)



"With regard to consumers and households ... crossovers to traditional adoption approaches (Rogers, 1996) ... are under-explored, perhaps because of an excessive fear of using reified analytical categories."

Usefulness to MLP of diffusion of innovations' explanatory power seems worth exploring



Conclusions: disruptive low C innovations can engage (or even potentially excite) consumers

Disruptive innovations offer **novel attributes** valued by consumers
(a missing constituency of low C transformation)

Disruptive innovations are primarily about **business models and users**
(not radical technological breakthroughs)

Novel attributes of potentially disruptive low C innovations in different domains include:

pay-per-use (*rather than* ownership)

multiple uses & functionality (*rather than* single purpose)

relational & active involvement (*rather than* isolation & passivity)

control & autonomy (*rather than* dependence on systems)

Digitalisation of daily life enables many of these novel attributes

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