

# Responsible innovation in food and agriculture (social and cultural dimensions): early lessons from gene editing, late lessons from GM foods

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F&A Next: Investors meet Food and Agri Startups



# F&A NEXT 2019

- F&A Next is an initiative ... collectively believing that innovation will be key to sustainably feed future generations. Disruptive innovation in itself is not enough; it also needs to be implemented and transformed into tangible applications....
- Edition 2019 will cover what technologies and policies are needed to create sustainable food systems embraced by the full value chain and the public.

# The challenge of responsibility

How to align innovation with and for society in pursuit of sustainability

A cautionary tale

# The controversy over GM crops and foods

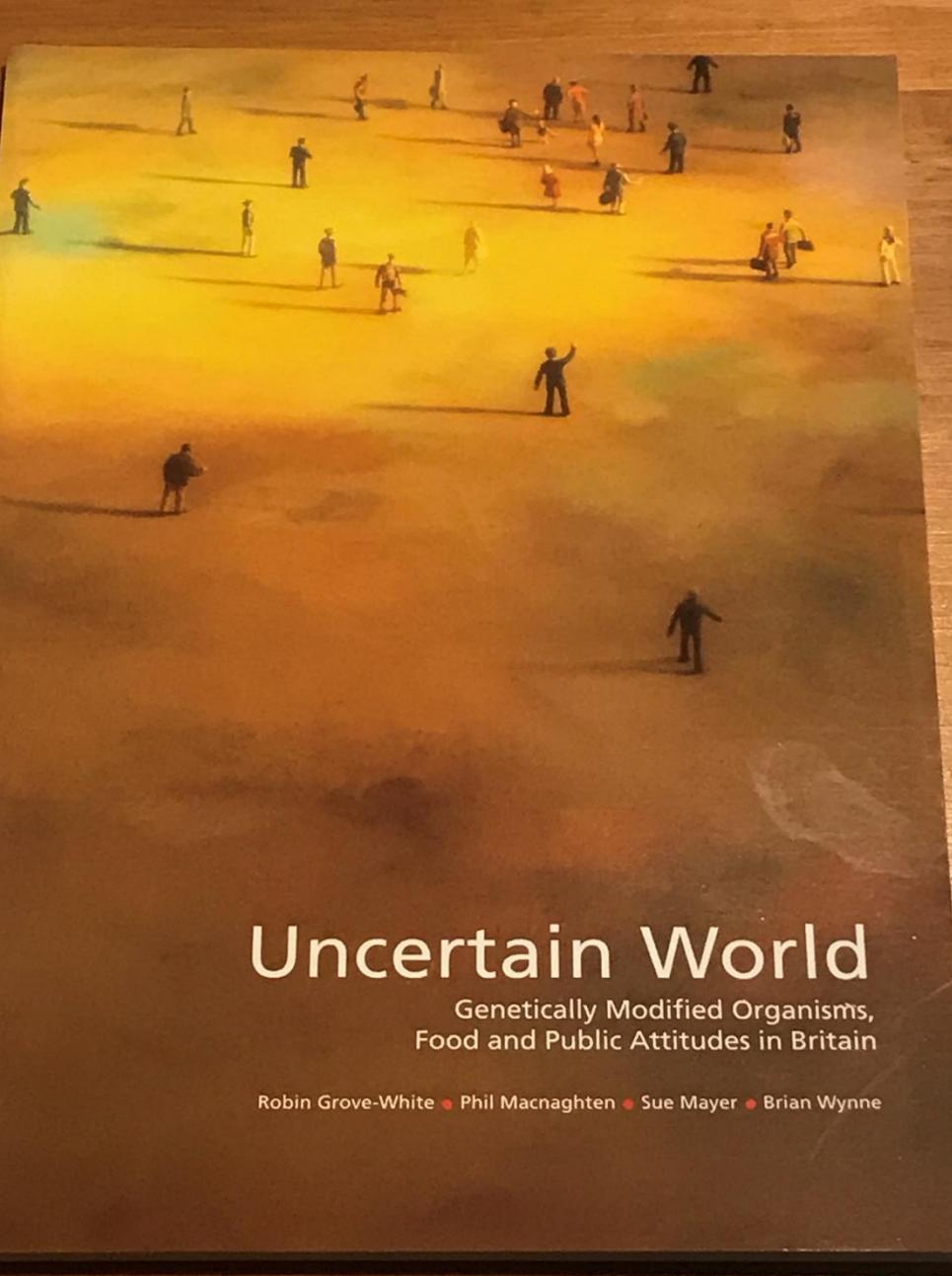






# Research questions

- What are present feelings about GMOs in the UK, both generally and in relation to actual and proposed food products?
- What are possible future public reactions and responses?
- What are potential approaches to improved institutional handling of the implications?



# 1996–97: Uncertain World research

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- A dialogue methodology
- How to elicit clues about factors shaping public attitudes and likely responses in a field where few people have ‘settled’ views?
- Qualitative focus group discussion methods (Nine 2-hour groups across a spectrum of demographics)
  - Focus on changes in food as key context
  - Located within people’s broader sense of biotechnology as a whole and different classes of product
  - Scenarios of risk dynamic
  - Questions of responsibility and trust

# Uncertain World: Findings

1996/ 1997: Latent concern, heightened with familiarity

Reasons:

- Scepticism over 'scientific' reassurances
- Sense of inevitability and fatalism
- BSE as heuristic: dispelling 'innocence'; public unease about limits of expert knowledge
- Boundary issues: meddling with nature
- Gap between regulatory framework of 'what is at stake' and broader character of public concern

# Research conclusions (1997)

1. When interpreted (culturally and sociologically) public responses seen as reasonable
  - a. Reflective of wider issues of trust in regulatory institutions
  - b. Reflective of wider unease of life in the risk society
2. Urgent need for changes to the UK's existing risk assessment culture and practices

Successful  
anticipation?

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Anticipated the dynamics underpinning the  
1998/99 political controversy

*'I now have had a chance to read "Uncertain World", which I wish I had indeed read earlier. It is in many ways a remarkably prescient document.'*

(UK Chief Scientific Officer Sir Robert May, March 1999)



**BACK** ←  
*TO THE* **PRESENT**

CRISPR



# Responsible research and innovation: A methodology to align innovation with and for society

*“Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)”*

(von Schomberg, 2011)

*“taking care of the future through collective stewardship of science and innovation in the present”*

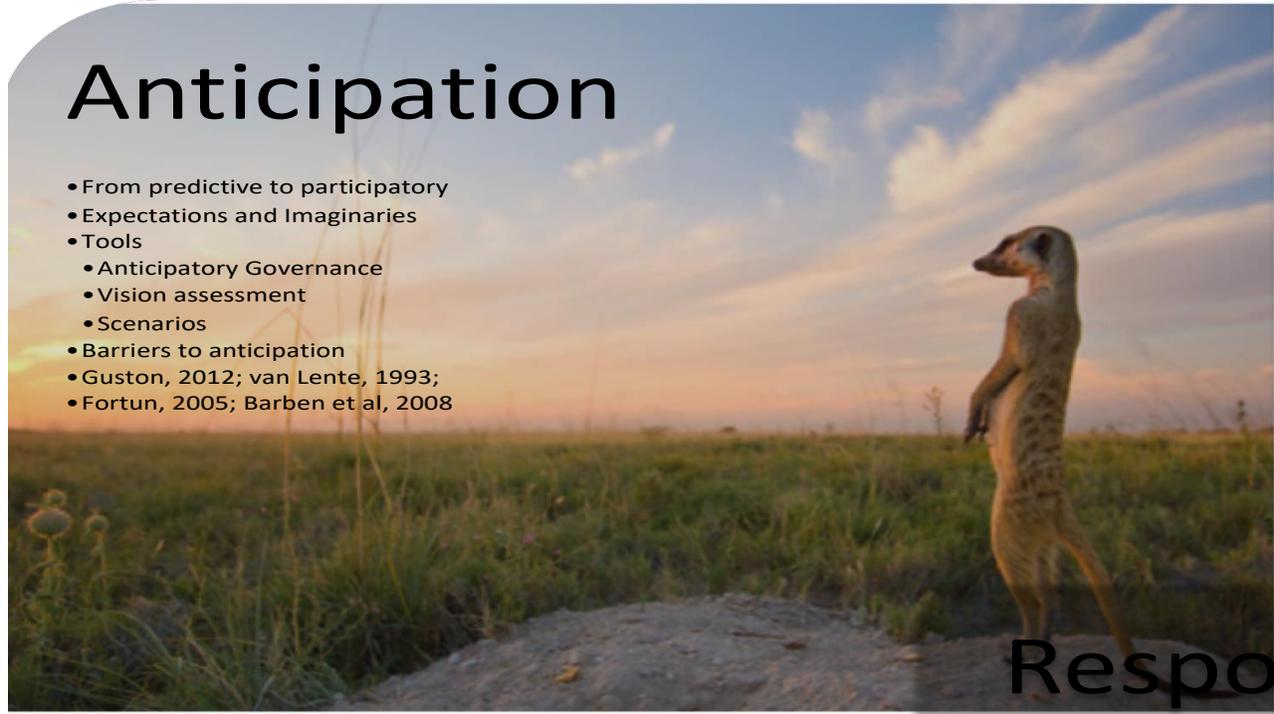
(Stilgoe, Owen and Macnaghten 2012)

# New lines of questioning on responsibility aligned with public concerns

<i>Product questions</i>	<i>Process questions</i>	<i>Purpose questions</i>
What are the likely risks and benefits ?	How should research and innovation take place?	Why should this research be undertaken?
How will the risks and benefits be distributed ?	How should standards be drawn up and applied?	Why are researchers doing it?
What other impacts can we anticipate?	How should risks and benefits be defined and measured?	Are these motivations transparent and in the public interest?
How might these change in the future?	Who is in control?	Who will benefit?
What don't we know about?	Who is taking part?	What are they going to gain?
What might we never know about?	Who will take responsibility if things go wrong?	What are the alternatives?
	How do we know we are right?	

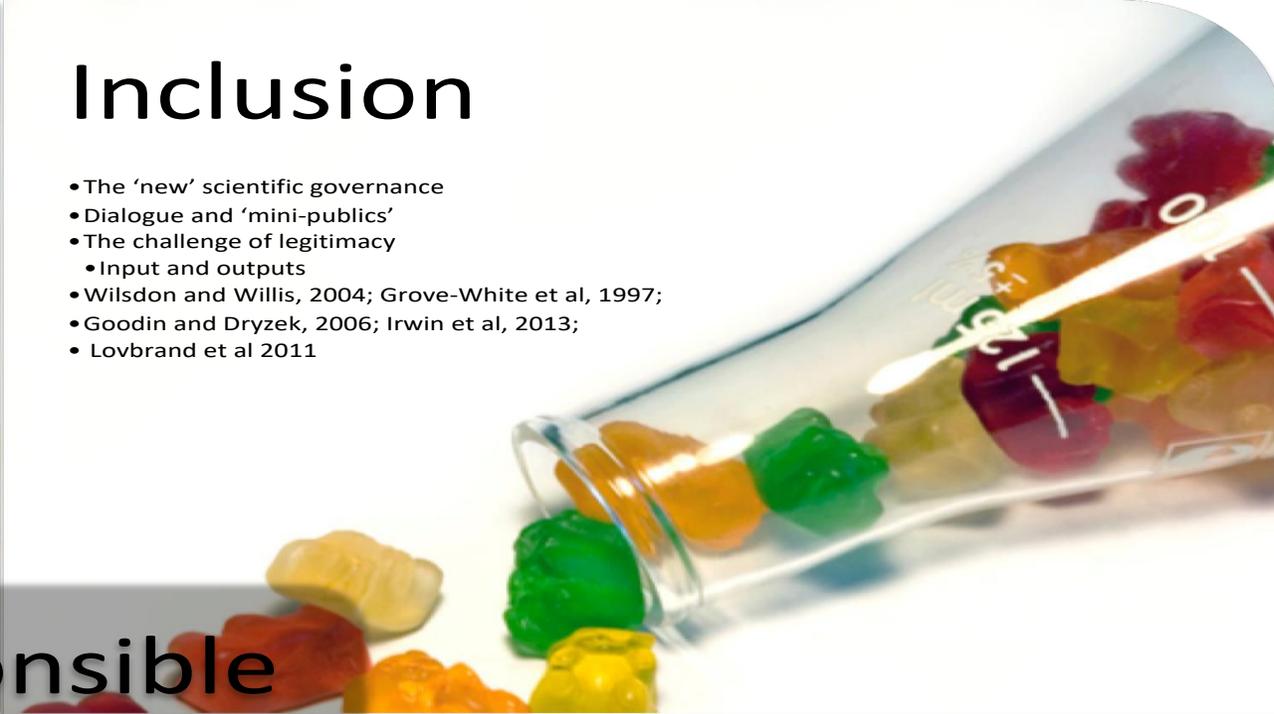
# Anticipation

- From predictive to participatory
- Expectations and Imaginaries
- Tools
  - Anticipatory Governance
  - Vision assessment
  - Scenarios
- Barriers to anticipation
- Guston, 2012; van Lente, 1993;
- Fortun, 2005; Barben et al, 2008



# Inclusion

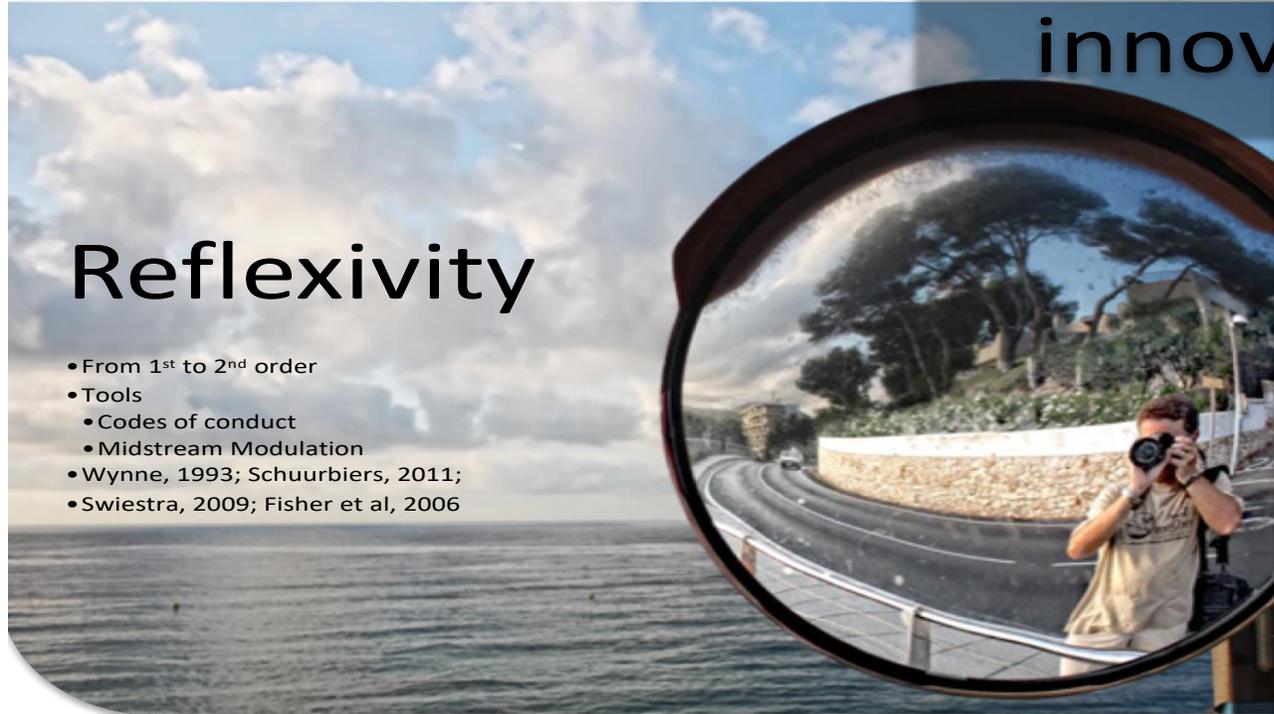
- The 'new' scientific governance
- Dialogue and 'mini-publics'
- The challenge of legitimacy
  - Input and outputs
- Wilsdon and Willis, 2004; Grove-White et al, 1997;
- Goodin and Dryzek, 2006; Irwin et al, 2013;
- Lovbrand et al 2011



# Responsible innovation

# Reflexivity

- From 1<sup>st</sup> to 2<sup>nd</sup> order
- Tools
  - Codes of conduct
  - Midstream Modulation
- Wynne, 1993; Schuurbiers, 2011;
- Swiestra, 2009; Fisher et al, 2006



# Responsiveness

- Answering and reacting
- Diversity and resilience
- Value-sensitive design
- De facto governance
- Political economy of innovation
- Responsibility as metagovernance
- Pellizoni, 2004; Collingridge, 1980; Friedman, 1996; Stirling, 2007; Kearnes and Rip, 2009



Anticipation!

What is possible?

What is plausible?

'What if' questions

What is known?

' A n t i c i p a t i o n '

Increasing resilience  
Shaping agendas for socially-robust research

<b>Dimension</b>	<b>Indicative techniques and approaches</b>	<b>Factors affecting implementation</b>
Anticipation	Foresight Technology assessment Horizon scanning Scenarios Vision assessment Socio-literary techniques	Engaging with existing imaginaries Participation rather than prediction Plausibility Investment in scenario-building Scientific autonomy and reluctance to anticipate

**inclusion**



How diverse is the group?

How serious and continuous is the discussion?

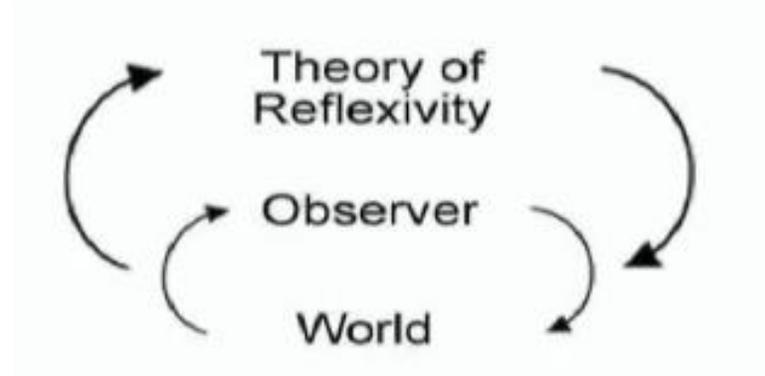
How early are people consulted?

How much care is given to group design?

‘ I n c l u s i o n ’

Quality of dialogue as a learning exercise

<b>Dimension</b>	<b>Indicative techniques and approaches</b>	<b>Factors affecting implementation</b>
Inclusion	Consensus conferences Citizens' juries and panels Focus groups Science shops Deliberative mapping Deliberative polling Lay membership of expert bodies User-centred design Open innovation	Questionable legitimacy of deliberative exercises Need for clarity about, purposes of and motivation for dialogue Deliberation on framing assumptions Ability to consider power imbalances Ability to interrogate the social and ethical stakes associated with new science and technology Quality of dialogue as a learning exercise



Self-referential  
critique

Mindful of  
framing of  
issues

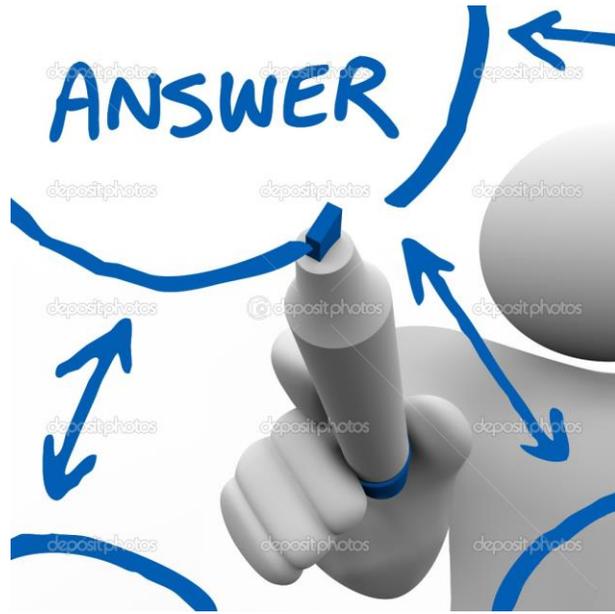
Mirror to one's  
own  
commitments

Aware of limits to  
knowledge

' R e f l e x i v i t y '

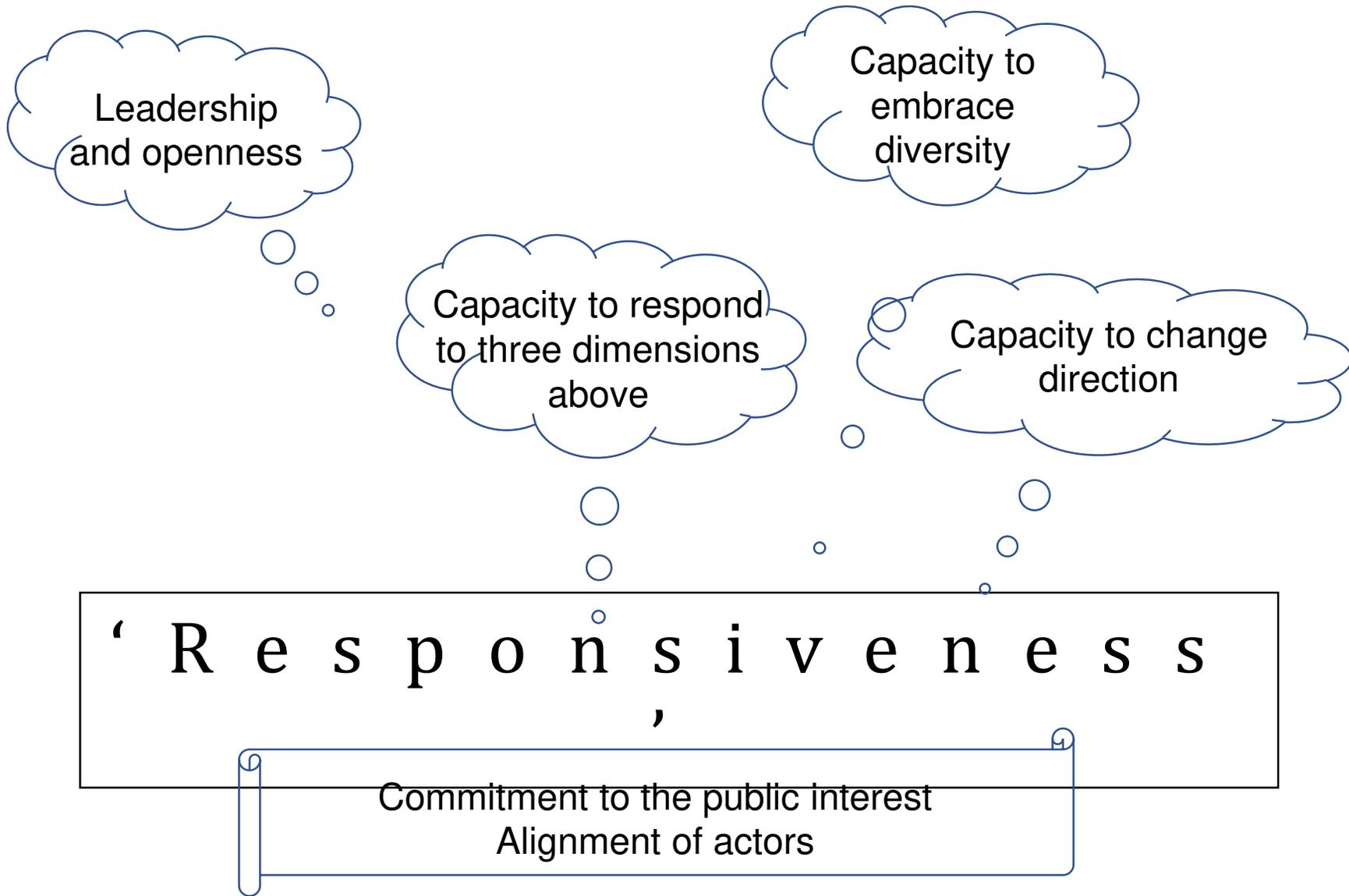
Institutional reflexivity  
A public matter

<b>Dimension</b>	<b>Indicative techniques and approaches</b>	<b>Factors affecting implementation</b>
Reflexivity	Multidisciplinary collaboration and training Embedded social scientists and ethicists in laboratories Ethical technology assessment Codes of conduct Moratoriums	Rethinking moral division of labour Enlarging or redefining role responsibilities Reflexive capacity among scientists and within institutions Connections made between research practice and governance



**react**

**RESPONSIVENESS**



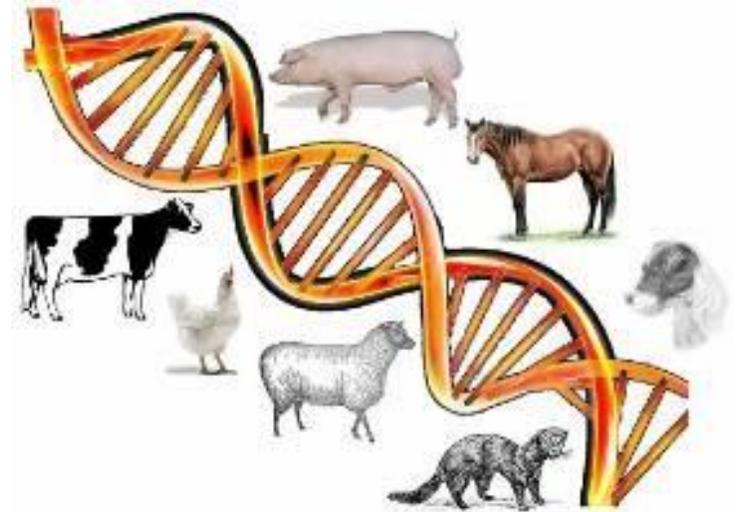
Dimension	Indicative techniques and approaches	Factors affecting implementation
Responsiveness	Constitution of grand challenges and thematic research programmes Regulation Standards Open access and other mechanisms of transparency Niche management Value-sensitive design Provision of information Labelling Moratoriums Stage-gates Alternative intellectual property regimes New institutional structures and norms	Strategic policies and technology ‘roadmaps’ Science-policy culture Institutional structures Institutional cultures Institutional leadership Openness and transparency Intellectual property regimes Technological standards



Just Editing: A responsible innovation approach to animal gene editing

# Applications in animal breeding

- Efficiency/ improvements in yield,
  - gains in reproductive efficiency e.g. chickens that produce only female offspring for egg laying)
  - edited animals that make more efficient conversion of inputs into outputs (e.g. pigs that can be fattened with less food through improved gut function)
- Health/ welfare of animals
  - adaption of livestock to the demands of intensive rearing practices (e.g. 'hornless' edited cows that can be kept in close proximity in confined spaces with less risk of injury)
- Disease resistance
  - through breeding resistance to viral pathogens (e.g. to breed pigs with resistance to African swine fever virus) or to engineer disease resistance to reduce the use of prophylactic antimicrobials in farming





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*Breed4Food partners:*







  
**Topigs Norsvin**



  Utrecht University

# Ethics Institute

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Genomics**

## Our research

“to examine the conditions (if any) under which the the technique of genome editing can and should be applied to animal breeding applications to guide responsive decision-making for scientists, breeders and government”



RESPONSIBLE  
RESEARCH AND  
INNOVATION IN  
PRACTICE

RRI as a platform for strengthening the relationship between  
Wageningen science and society

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# Some final remarks

- Collaborate with multiple actors and stakeholders
- Develop AIRR capacities
  - Anticipate possible and plausible impacts
  - Reflect on your own framings and do not assume your problem definition is either correct or universal
  - Include publics and society in deliberation (at an early stage)
  - Respond to the above dimensions and adjust course if necessary

We can't predict the future, but we can design a mechanism to make the best decisions on the way...

Thank you!