

Breeders' vision to meet future livestock sustainability goals through novel technologies – A modified Delphi study

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Margo
Chase-Topping



Pieter
Knap

TRAnSforming the **DE**bate about UK livestock
system transformation (**TRADE**)

Motivation

Livestock today face unprecedented threats

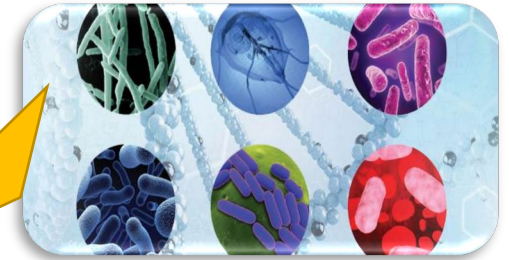
Extreme climate



Resource shortage



Infectious pathogens



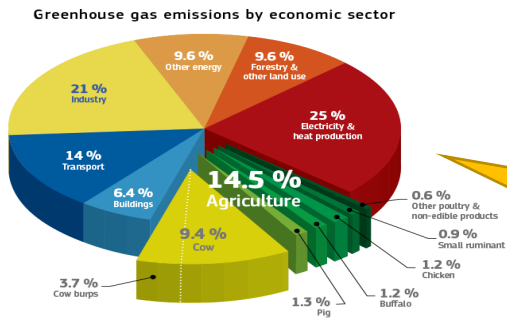
Sub-optimal rearing conditions



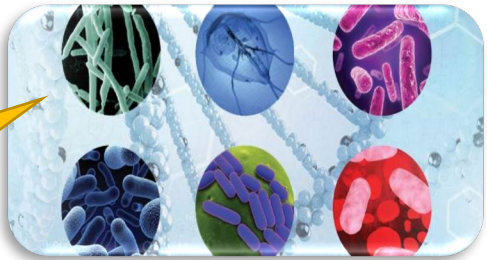
Motivation

... and have a negative impact on planetary health

Greenhouse gas emissions



Zoonotic diseases / anti-microbial resistance



Resource shortage



Loss in biodiversity



Motivation

“A future with a sustainable animal agriculture can be created with the contribution of animal breeding and reproduction.”

But how?

Can novel technologies help to
create Livestock 2.0?

Aims

1. Collect the opinion of animal breeders on novel breeding technologies for sustainable livestock production
2. Obtain a ranking of the technologies across different sustainability goals allowing for feasibility, cost-effectiveness and social acceptance
3. Determine barriers for adopting certain technologies

Approach

Modified Delphi study

Online questionnaire to collect expert opinions on how to achieve sustainability goals with novel breeding technologies

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Experts: Animal breeders

- For main farmed animal species in the UK:
Cattle (beef & dairy), sheep, pigs, chickens (broilers & layers), ducks, turkeys, salmon
- Work for breeding company, breed society, levy board or other public body, consultancy
 - considerable UK market
 - able to influence implementation of technologies
 - cover a range of influential positions, e.g. director of research, marketing, breeding goal & genetic evaluations, consultancy



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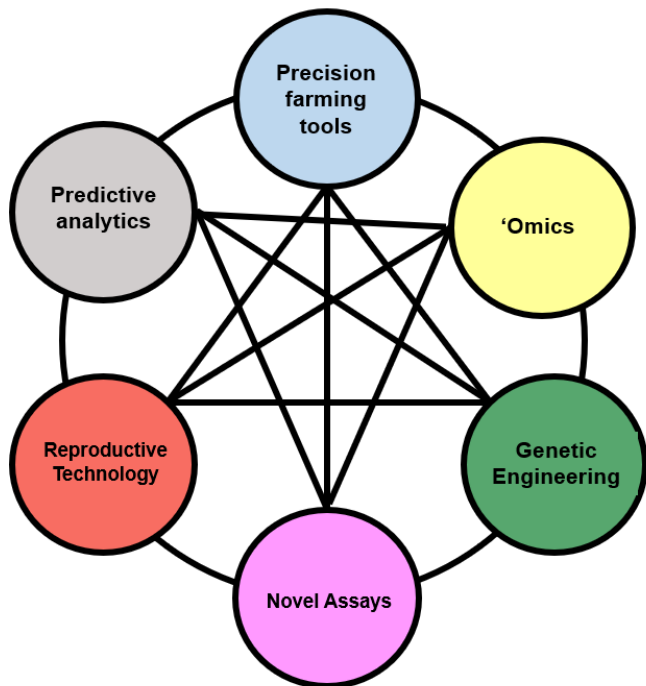


Technologies:

Focus on new technologies that may be **useful for animal breeding**, where **significant advances** have been made, and where **adoption in the UK** may be **considered feasible**

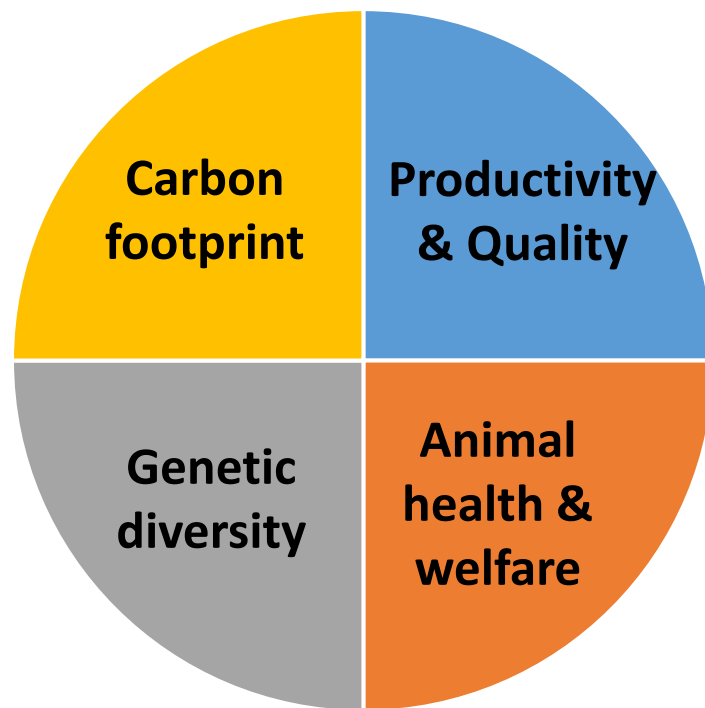
Online questionnaire

6 groups of technologies

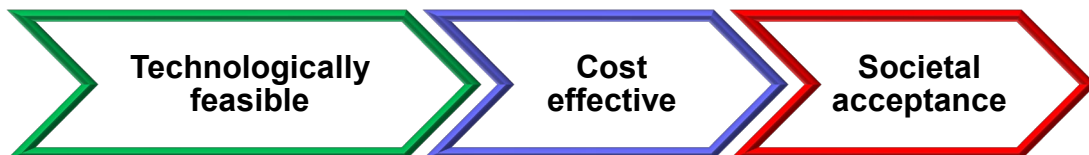


+

4 sustainability goals

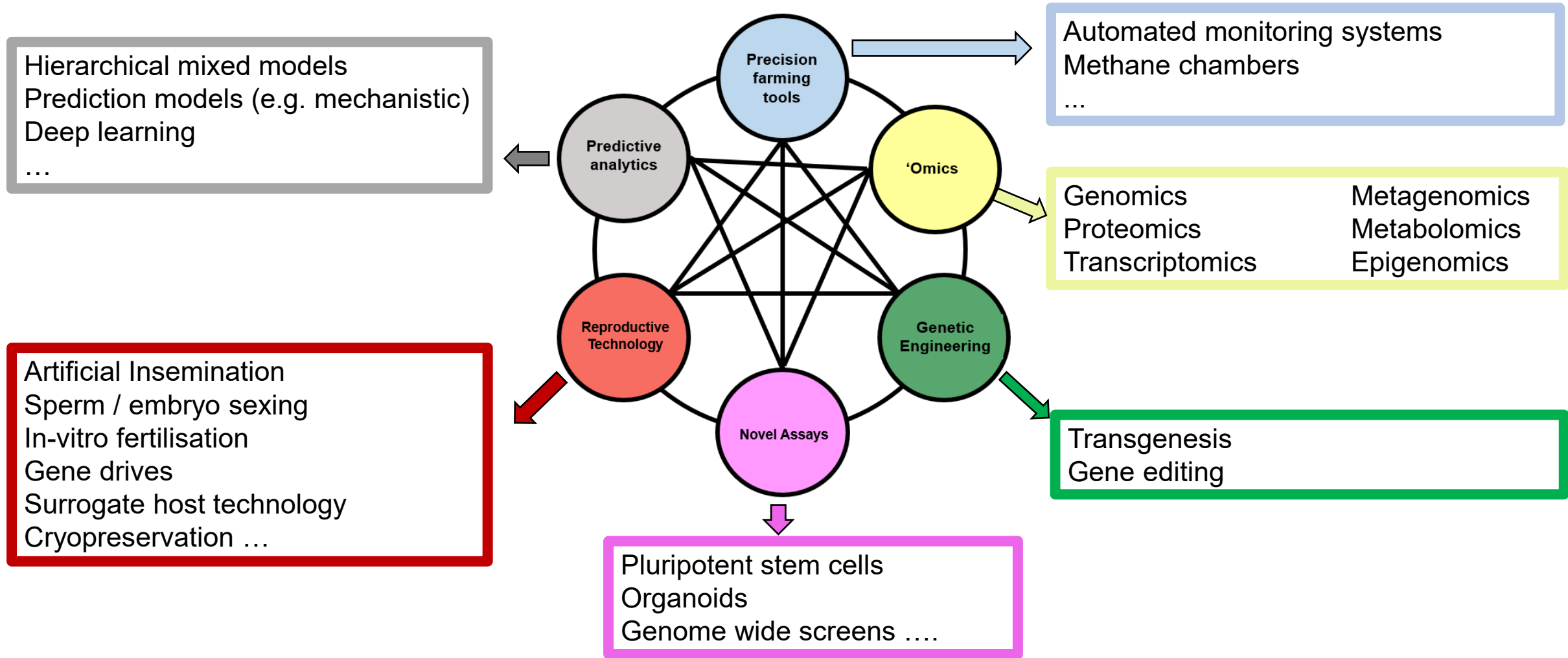


3 criteria for implementation



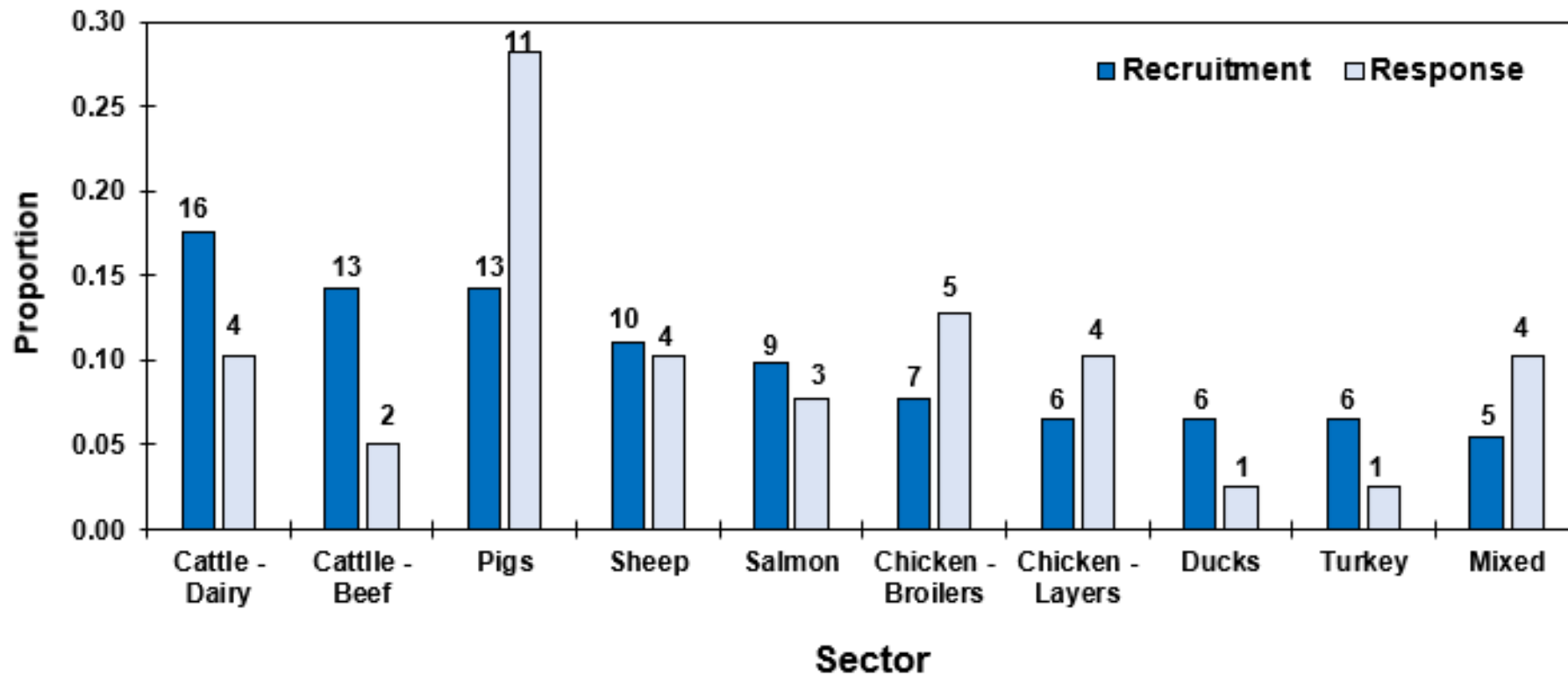
Novel technologies

- Presented in a booklet that the participants read prior to answering the questionnaire

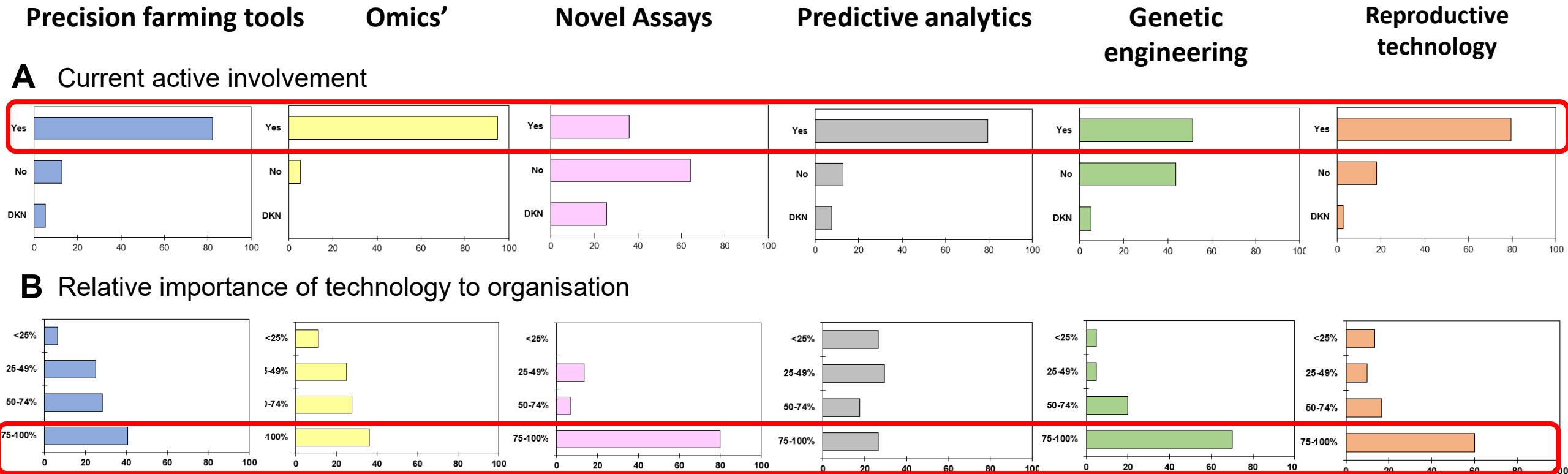


Recruitment population vs Response population

- Survey link was sent to 91 potential panel members across all sector
- To date 43% (39/91) responded – THANK YOU!
 - All sectors covered, though not equally



Preliminary results: 1. Current use of technology



A: Is your organisation currently actively involved in the development, testing or implementation of the following new technologies (Yes, No , do not know (DKN))

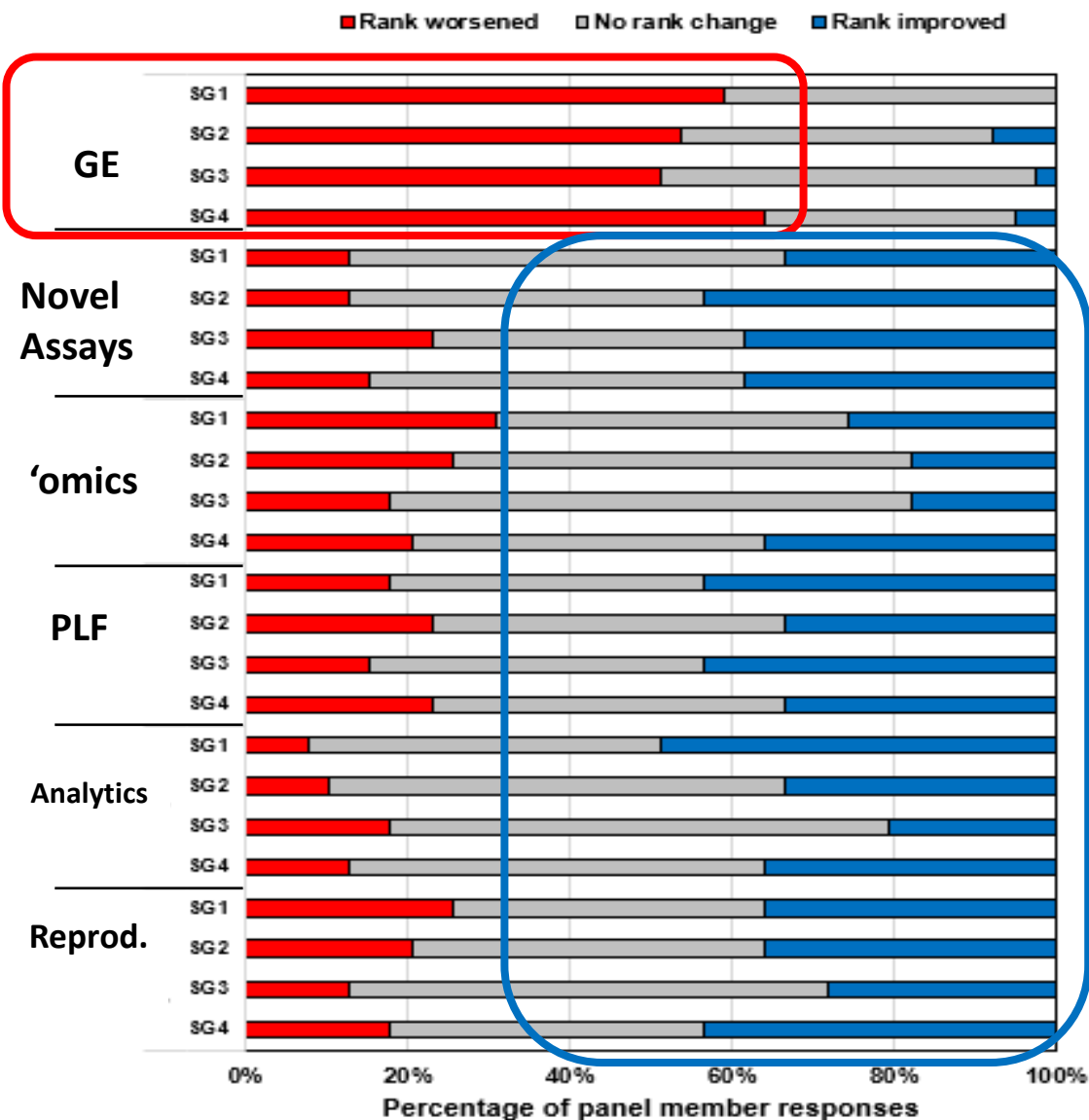
B: If you use a technology what is the relative importance of each technology to your organisation yearly workflow in terms of percent of worktime allocated to each technology (<25%, 25-49%, 50-74%, 75-100%)

2. Ranking based on technological feasibility only for each Sustainability Goal (SG)

Technology Group	SG1 Env. footprint rank (range)	SG2 Productivity & quality rank (range)	SG3 Genetic diversity rank (range)	SG4 Animal health & welfare rank (range)
Precision farming tools	2 (1-4)	1 (1-3)	4 (1-5)	1 (1-6)
'Omics	1 (1-3)	1 (1-3)	1 (1-3)	1 (1-6)
Genetic engineering	5 (1-6)	5 (1-6)	5 (1-6)	4 (1-6)
Novel assays	5 (2-6)	5 (1-6)	5 (1-6)	5 (1-6)
Reproductive technologies	4 (1-5)	4 (1-5)	3 (1-5)	5 (1-6)
Predictive analytics	2 (1-4)	3 (1-4)	1 (1-4)	3 (1-6)

- Rankings of the technology groups based on technological feasibility only were fairly consistent for all 4 sustainability goals
- 'Omics was the highest ranked technology group, either alone (SG1) or tied (SG2 - 4)
- Large variation in ranking between experts

3. Change in ranking



- For most technology groups the experts' rankings either **did not change** (grey) or **improved** (blue) after cost and societal acceptance were considered
- Rankings for Genetic Engineering worsened (red) across all sustainability goals.

4. Overall Ranking across all Sustainability Goals (SGs)

Technology Group	Technology only rank (range)	Technology + Cost rank (range)	Technology + Cost + Society rank (range)
Precision farming tools	2 (1-6)	3 (1-6)	1 (1-6)
'Omics	1 (1-6)	1 (1-6)	3 (1-6)
Genetic engineering	5 (1-6)	5 (1-6)	6 (1-6)
Novel assays	5 (1-6)	5 (1-6)	5 (1-6)
Reproductive technologies	4 (1-6)	4 (1-6)	4 (1-6)
Predictive analytics	2 (1-6)	1 (1-6)	1 (1-6)

Across all sustainability goals, accounting for cost and societal acceptance **Precision Farming Tools & Predictive analytics** are tied for the top technology group

5. Barriers to Adoption

Cost

Public opinion

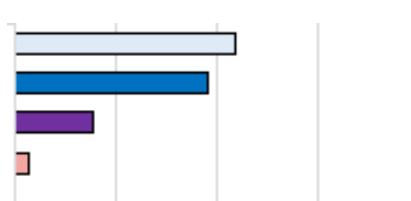
Regulations

PLF

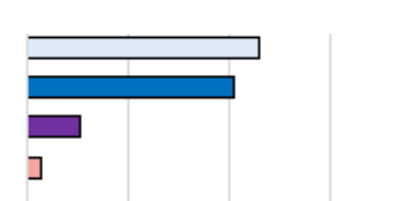
Effect:
None
Small
Medium
Large
Prevent



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None
Small
Medium
Large
Prevent

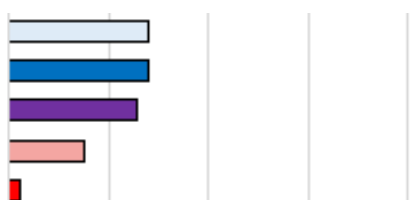


Effect:
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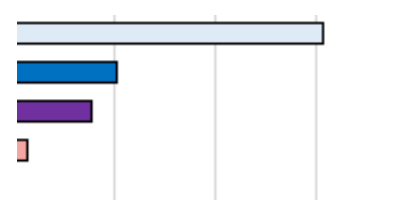


Analytics

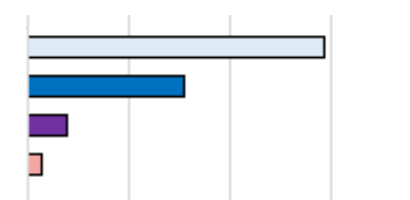
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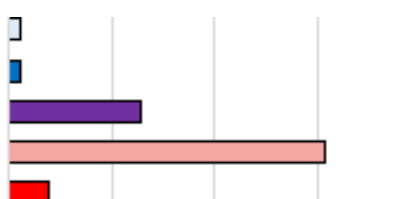


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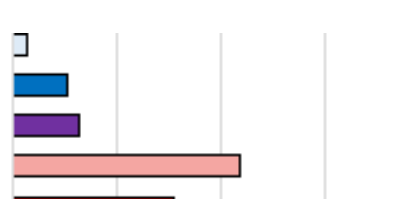


Genetic Engineering

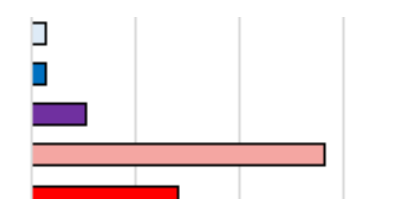
None
Small
Medium
Large
Prevent



None
Small
Medium
Large
Prevent



None
Small
Medium
Large
Prevent



- Cost is the largest perceived barrier, except for Genetic Engineering!

Summary & Conclusions

- These **results are preliminary**:
 - some groups were underrepresented.
 - likely species differences & other factors, not yet examined
- **Breeders have a strong vision** about future technologies to improve sustainability
 - **But different opinions**
- **Rankings differed slightly between sustainability goals**
- **Cost has a large effect on the adoption** of all technology groups, more so than public opinion and regulations (except for Genetic Engineering)
- Overall **winner: Predictive Analytics & Precision Farming Tools**
 - Lowest ranking: Novel assays & Genetic Engineering



Acknowledgements

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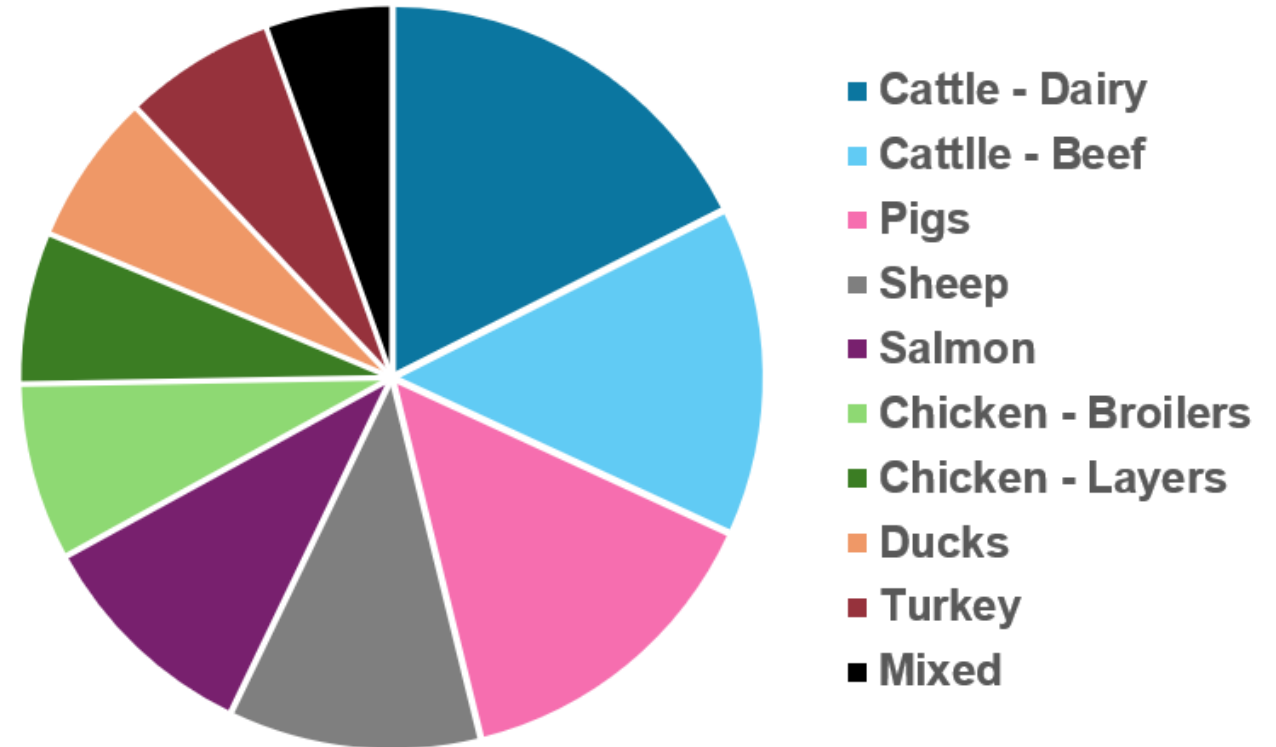
**Special thank you to everyone who
completed the survey**



The survey deadline has been **extended to September 23rd** so there is still a chance to add your opinion to the discussion. We would especially like comments from Cattle (beef and dairy); Breeding societies which are underrepresented in this presentation

Recruitment population

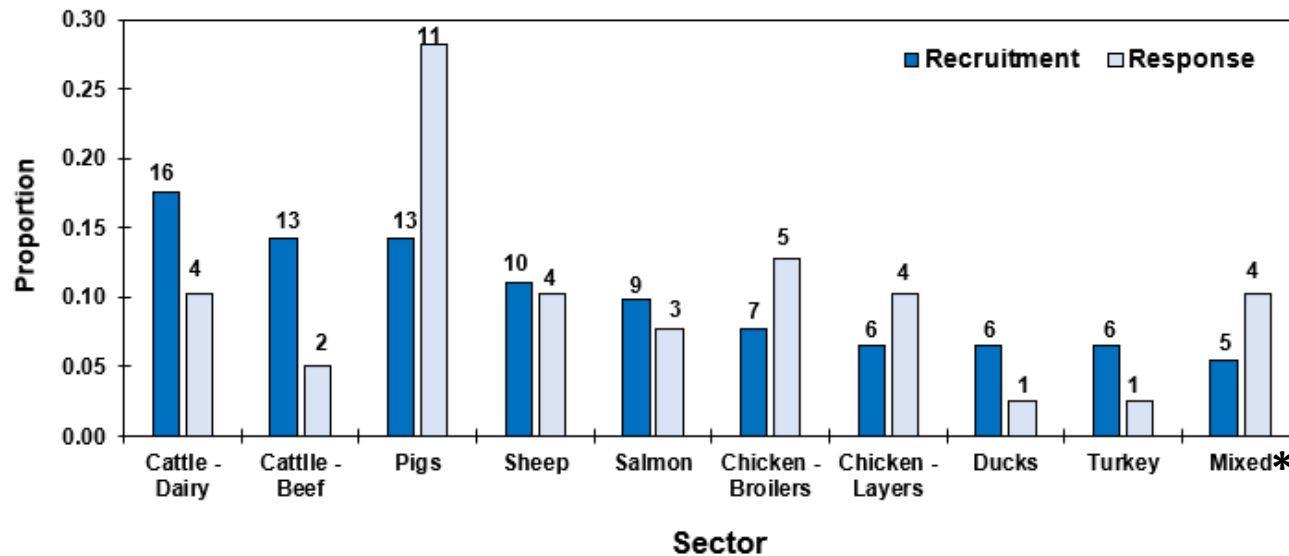
- **Survey link was sent to 91 potential panel members from various sectors**
- **Source**
 - **Breeding company (n=59; 65%)**
 - **Breed society (n=14; 15%)**
 - **Levy board (n=4; 4%)**
 - **Other* (n=14; 15%)**



*Other includes genetic evaluation service, consultancy, conservation charity; semen distribution

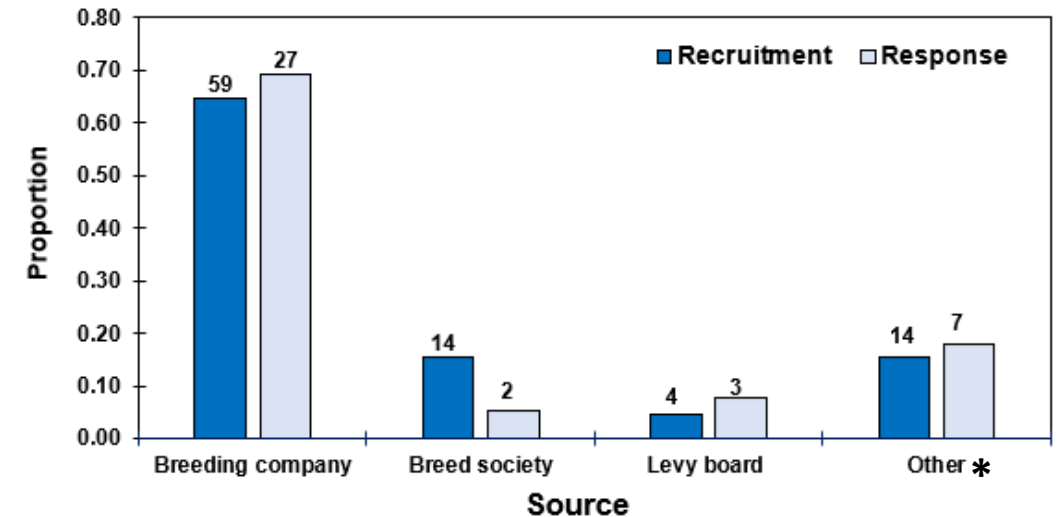
Recruitment population vs Response population

- To date n=39 responses; 43% (39/91) responded – THANK YOU!
- Comparison of the proportion of panel members who completed the questionnaire to the panel members in the recruitment list for Sector (left graph) and source (right graph)



Numbers above the bars represent the number of panel members who completed the questionnaire

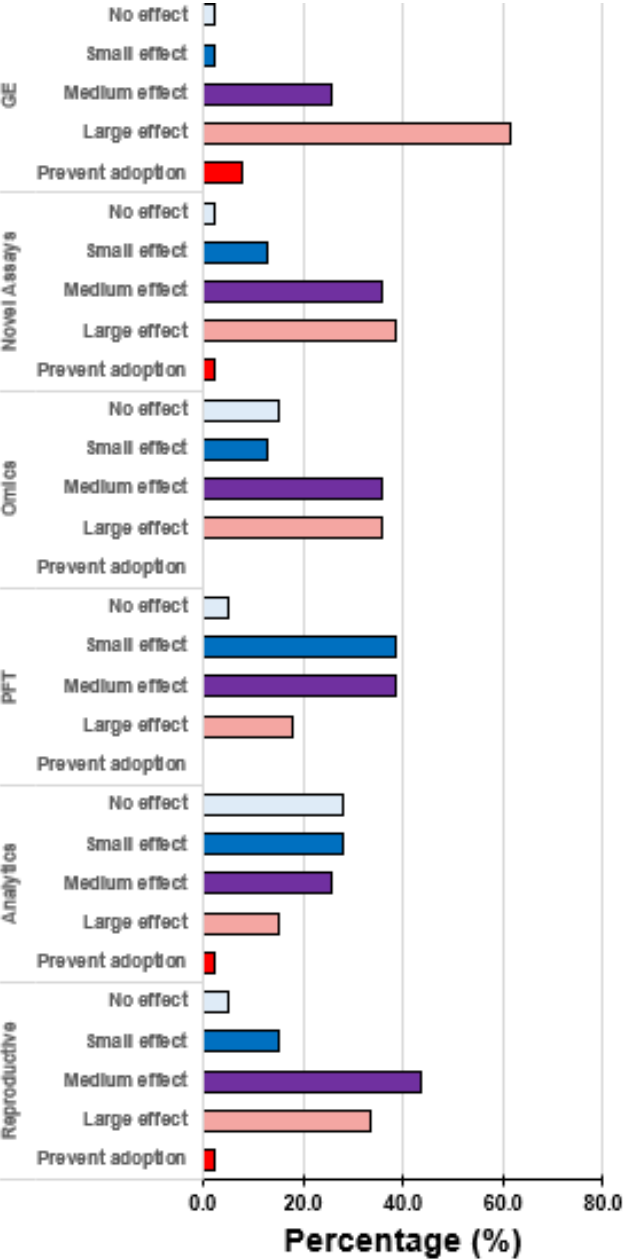
*Mixed can include panel members from Cattle beef/Dairy background



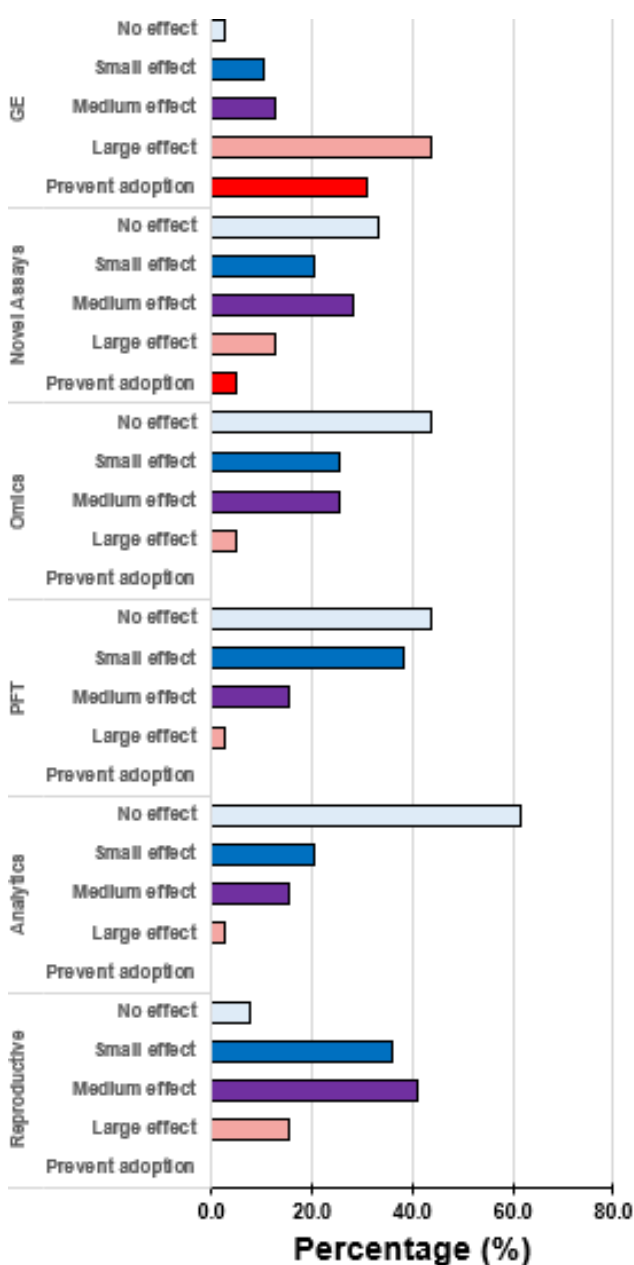
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Barrier - Cost



Barrier – Public opinion



Barrier - Regulations

