

# On the transferability of dairy cattle genetic/genomic breeding technologies.

Political role of the scientific knowledge about "G\*E" interaction

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Lidia Chavinskaia (*Supervisors: Pierre-Benoît Joly (LISIS) and Vincent Ducrocq (GABI)*)

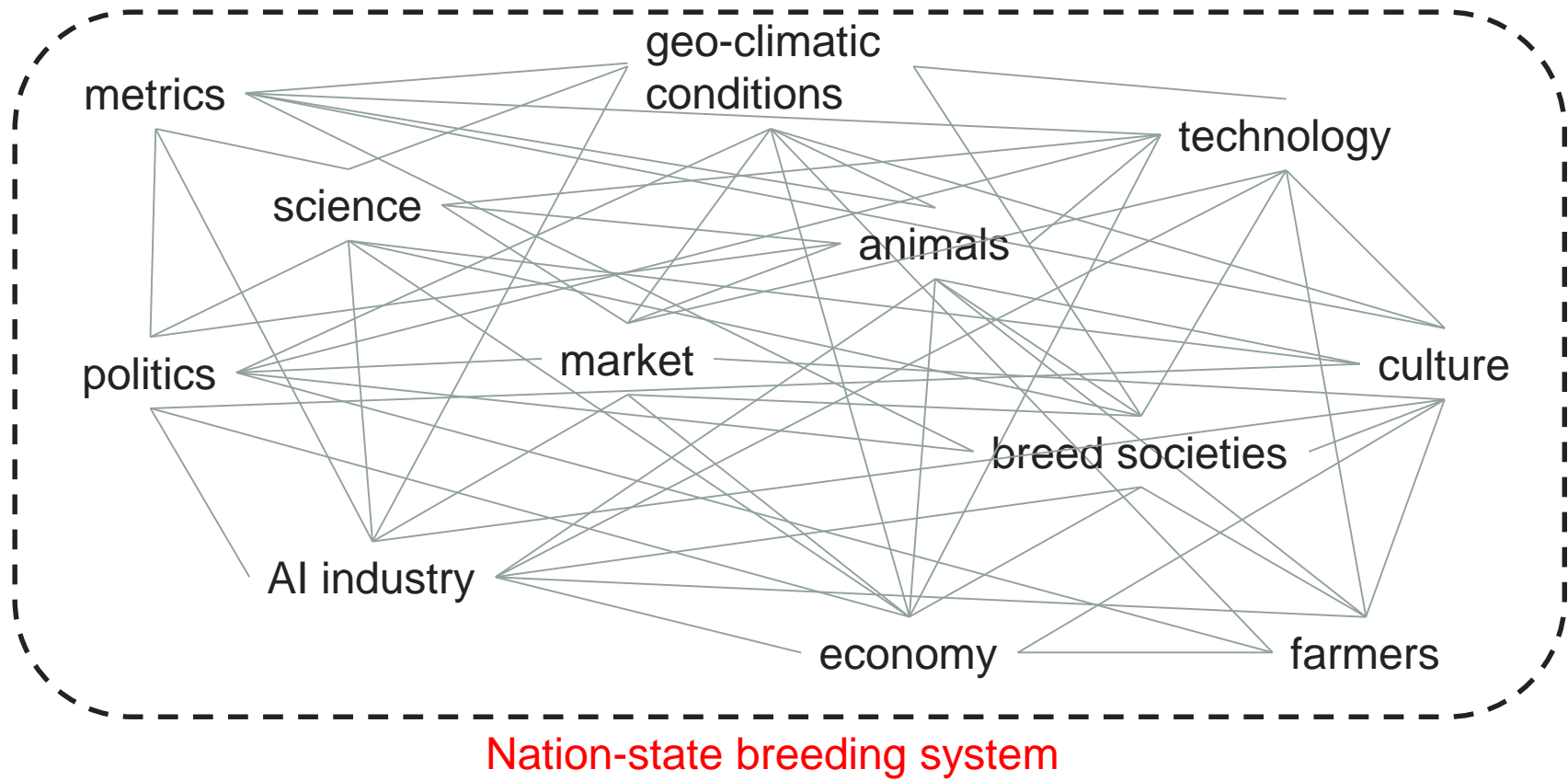
lidia.chavinskaia@inra.fr



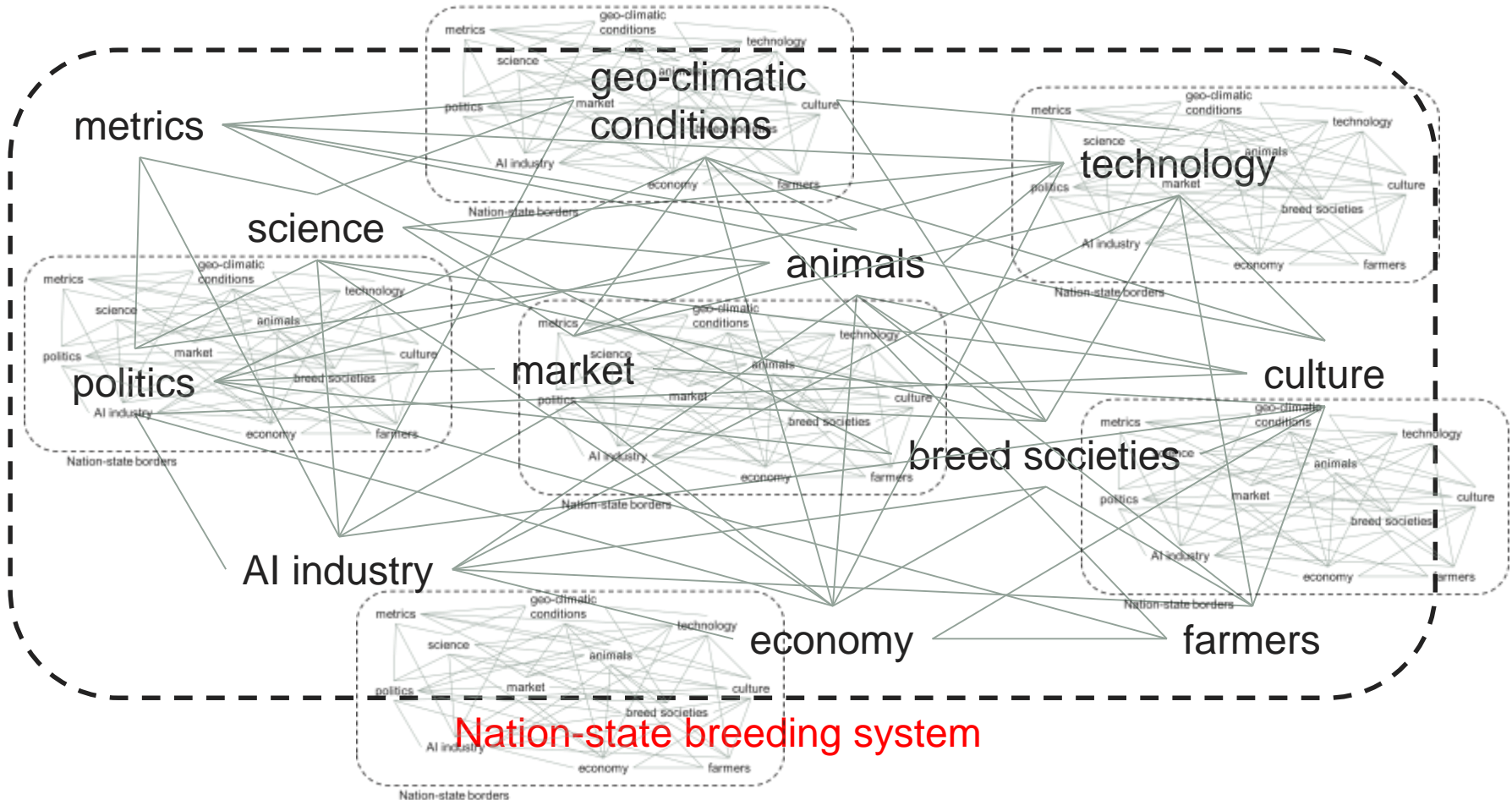
# Science and Technology Studies (STS)

- Interdisciplinary research field based on sociology and anthropology of science
- Idea of the science as a social activity → idea of a **co-production of science/technology and society**
- **Actor-Network Theory (ANT)** - theoretical and methodological approach to social theory where everything in the social and natural worlds exists in constantly shifting **sociotechnical networks** of relationships. **Human and nonhuman** elements count symmetrically
- Methodology: following actors (qualitative analyses of interviews and participant observation)

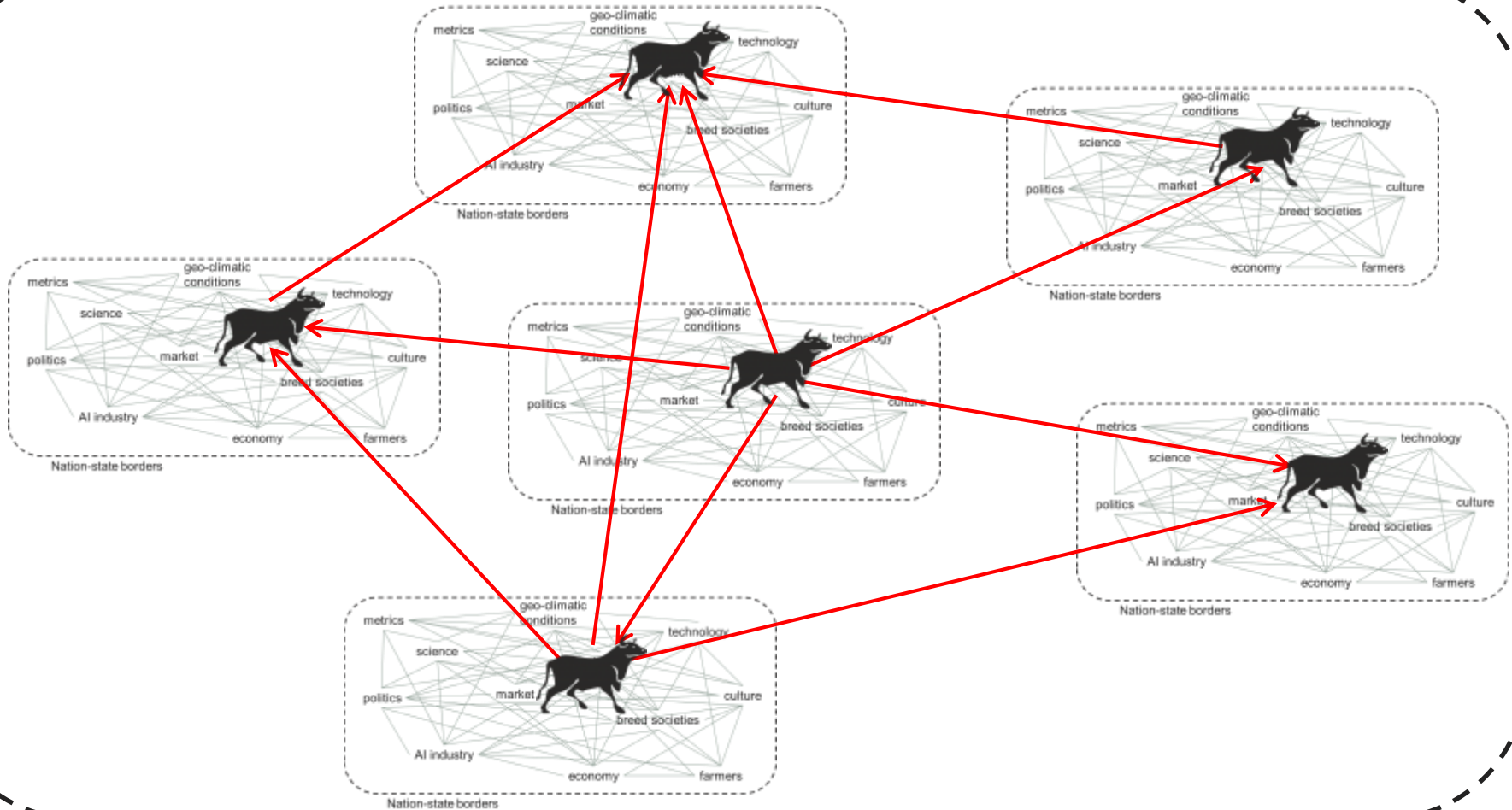
# Cattle breeding as a socio-bio-technical network



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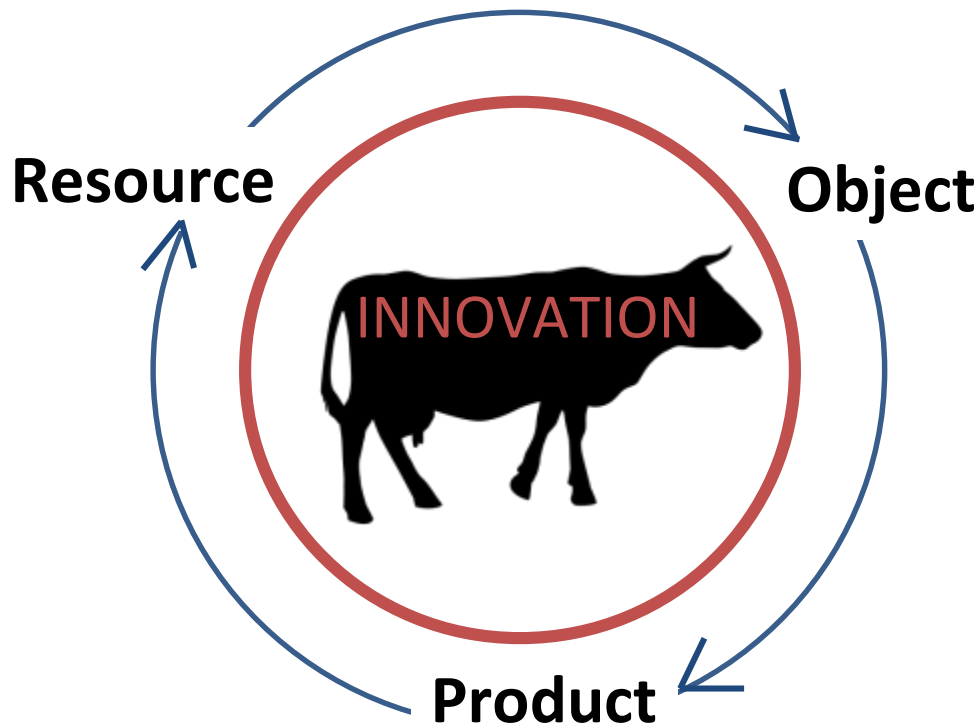


# Cattle breeding as a socio-bio-technical network

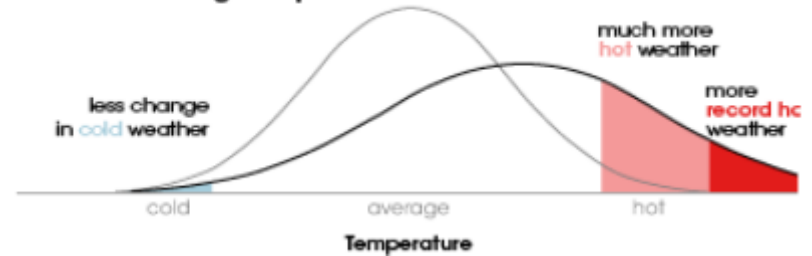


Globalized market

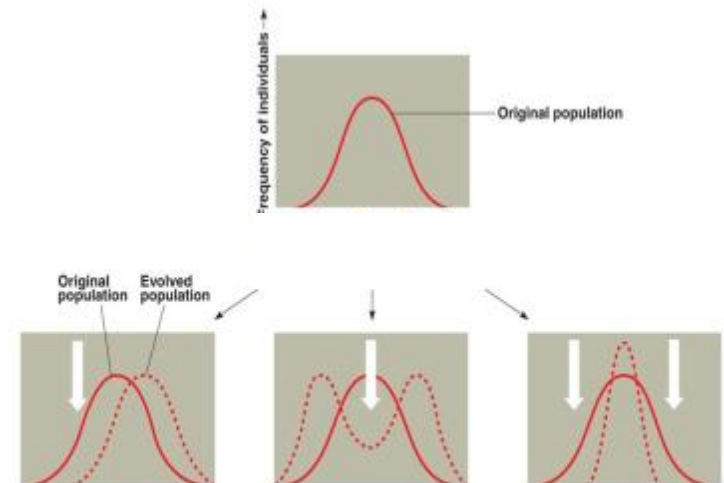
# Cattle breeding as innovation



Increase in Average Temperature and Variance



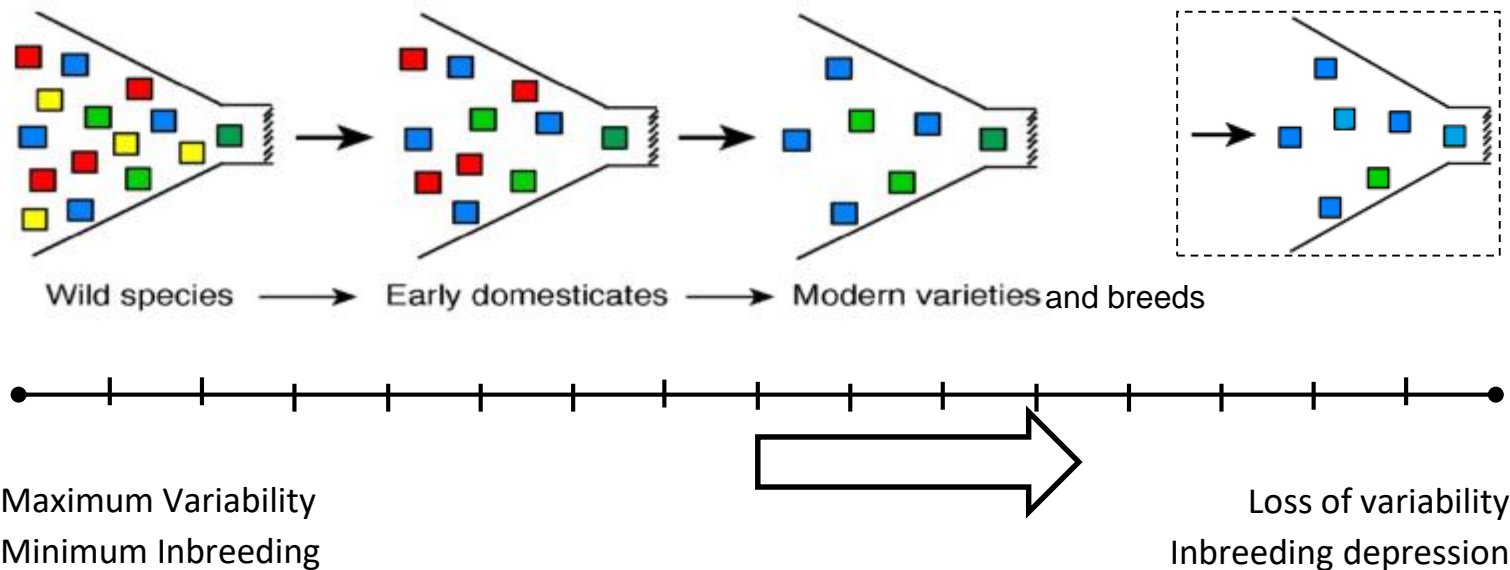
<https://www.earthobservatory.nasa.gov/>



(a) Directional selection (b) Disruptive selection (c) Stabilizing selection

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# Diversity within breeding



# Market forces

- Standardization of living animals as industrialized objects:
  - Standards of breeds (stud books)
  - Specialization of animals (beef, dairy...)
  - Measures of performances
- Low of the “increasing return” (Callon 1994)
  - “Star system”
  - “Globalized genetic recruitment” (CDN study in IDELE 2018)



*Farmer satisfaction*  
**BY DESIGN..  
NOT CHANCE**



# Science is a source of diversity



**Is Science a Public Good?**  
**Fifth Mullins Lecture,**  
**Virginia Polytechnic Institute,**  
**23 March 1993**

**Michel Callon**  
*Institute for Advanced Study, Princeton*  
*Ecole des Mines de Paris*

- *"Science [...] is a **source of diversity and flexibility.**"*
- *"**Diversity and the local** are at the heart of science."*
- *"One of its intrinsic principles is **that of fight against irreversibility and convergence [of the market].**"*
- *"The most effective way of fighting [...] remains **lending support to emergent collectives and encouraging their proliferation.**"*

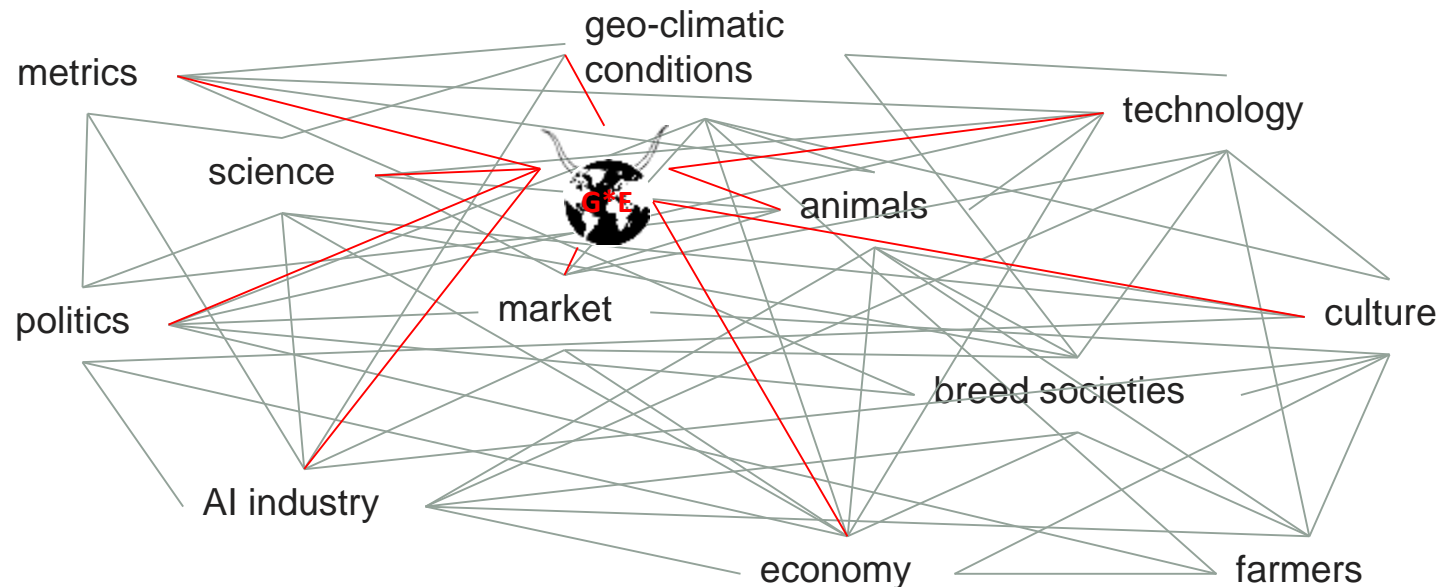


# Knowledge about the "G\*E interaction"

*D. S. Falconer (1952), "The Problem of Environment and Selection," The American Naturalist 86, no. 830 (Sep. - Oct., 1952): 293-298.*

*James J.W. (1961), "Selection in two environments", Heredity volume 16, 145-152*

$$P_i = G_i + E_i + \mathbf{G_i * E_i} + \Delta_i$$



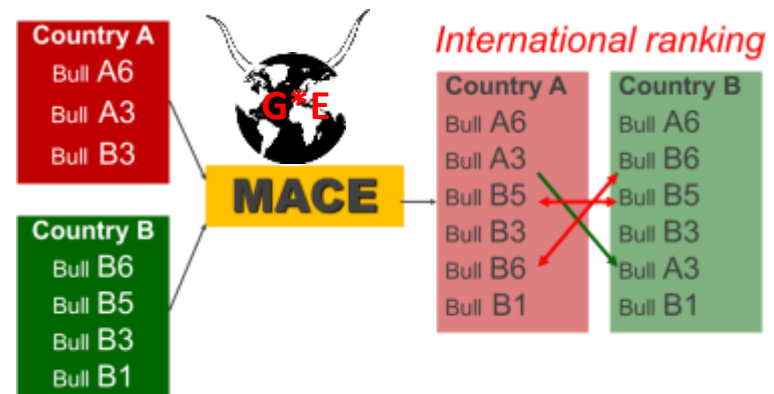
# Mobilizing knowledge

## *Interbull* (International Bull Service Evaluation)



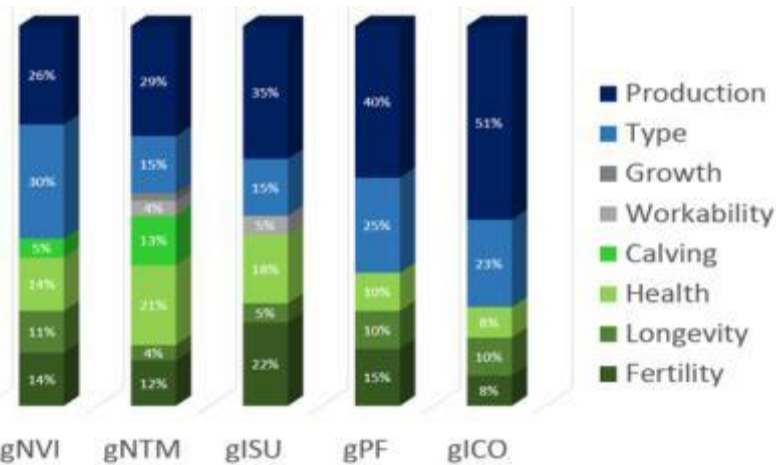
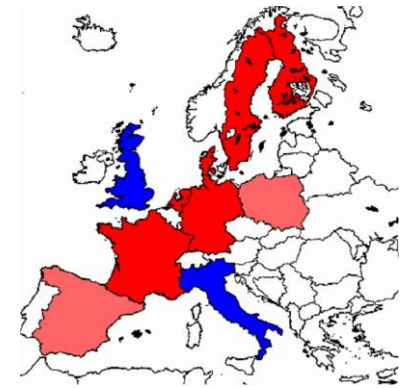
- Issue of comparison of breeding values at the globalized market against the north-american market dominance.
- **Commensuration** (Espeland and Stevens 1998, Desrosières 2014): a socio-technical process making qualitative things comparable through a common metric
- **Multi-trait, Across country evaluations (MACE)** (L. Schaeffer (1993)

$$Y = c + g + s + e$$



# Removing knowledge

*Eurogenomics (consortium of European cattle breeding industrial organizations sharing reference populations for a better reliability of the genomic evaluation)*



**Unique European Evaluation**



Source: <http://www.eurogenomics.com>

« How to ignore what we know? » (Dedieu and Jouzel 2015)

# Making knowledge mobile

**GENOSOUTH** (*Scientific collaborative project INRA - South Africa*)

Propagating the knowledge and supporting new emerging technological networks (Callon 1994)



See poster 66.34 M. Van Niekerk, F. Naser and V. Ducrocq *"Fixed and random regression models for South African Holstein under two production systems"*

# Conclusion

- The knowledge about G\*E interaction has a political implication on the international transferability of genetic improvement technologies in cattle.
- Two logics in permanente struggle:
  - Science promotes G\*E mobilization in new technological breeding networks (now, in particular, in developing countries) on behalf of the genetic diversity.  
→ Knowledge transfer and reconstruction of sociotechnical network locally
  - Market forces tend to ignore it on behalf of the economic competitiveness and free circulations of products.  
→ Extension of existing networks through the transfer of products (animals)
- These frictions are inherent and necessary for the international circulation of innovations




**Science**



**Market**



# Acknowledgements

-  INRA and SelGen Programme for financial support
- My supervisors: Vincent Ducrocq and Pierre-Benoît Joly
- All the interviewed people having accepted to share with me their experience, information and time.
- My STS colleagues listening with a big interest to my cows' stories.

**Thank you for your attention!**

