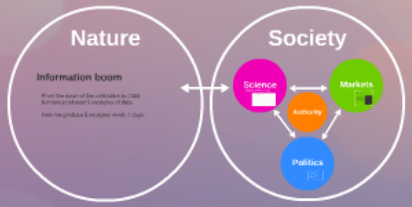
How computational methods can support food chain safety decision making?

Ákos JÓŹWIAK, NÉBIH



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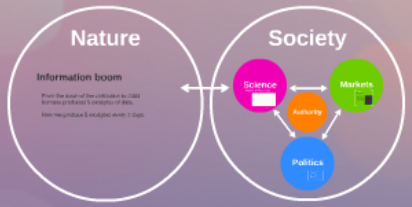
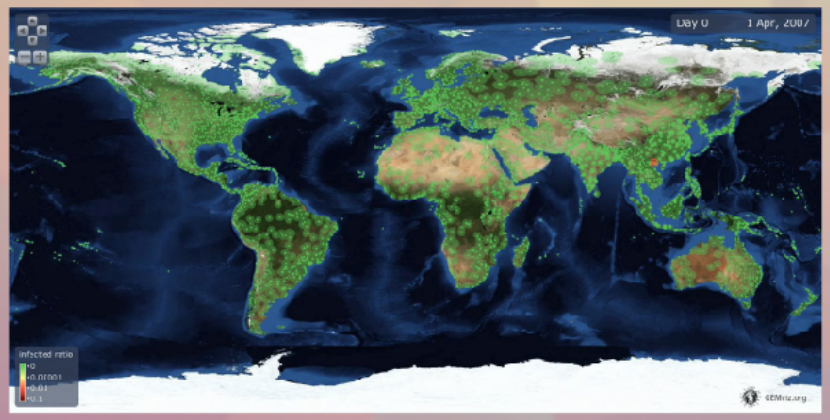


Food chain is actually a complex network



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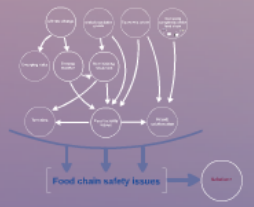
Many orders of magnitude

Data Science
&
Computational tools

Complex drivers



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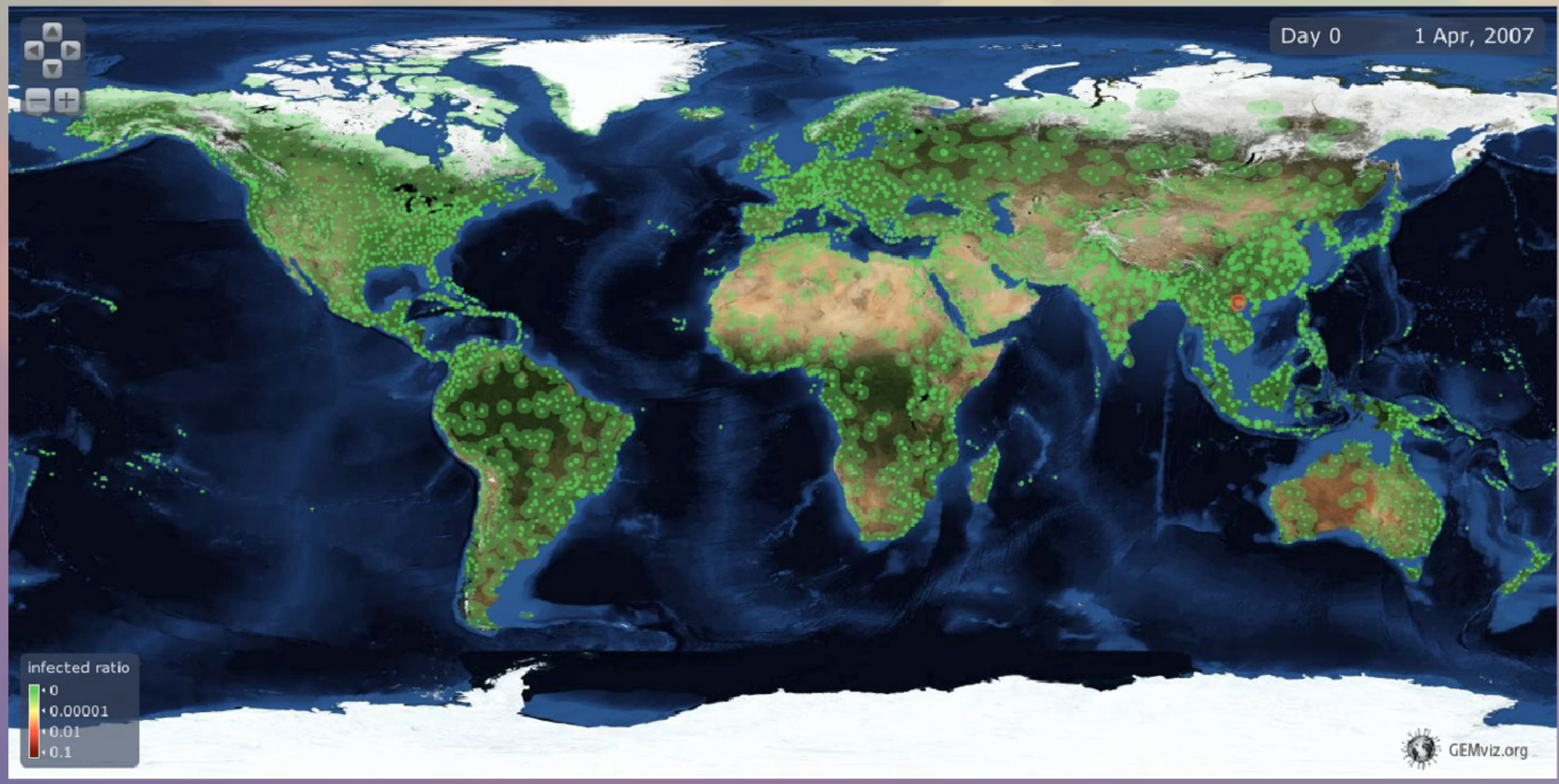

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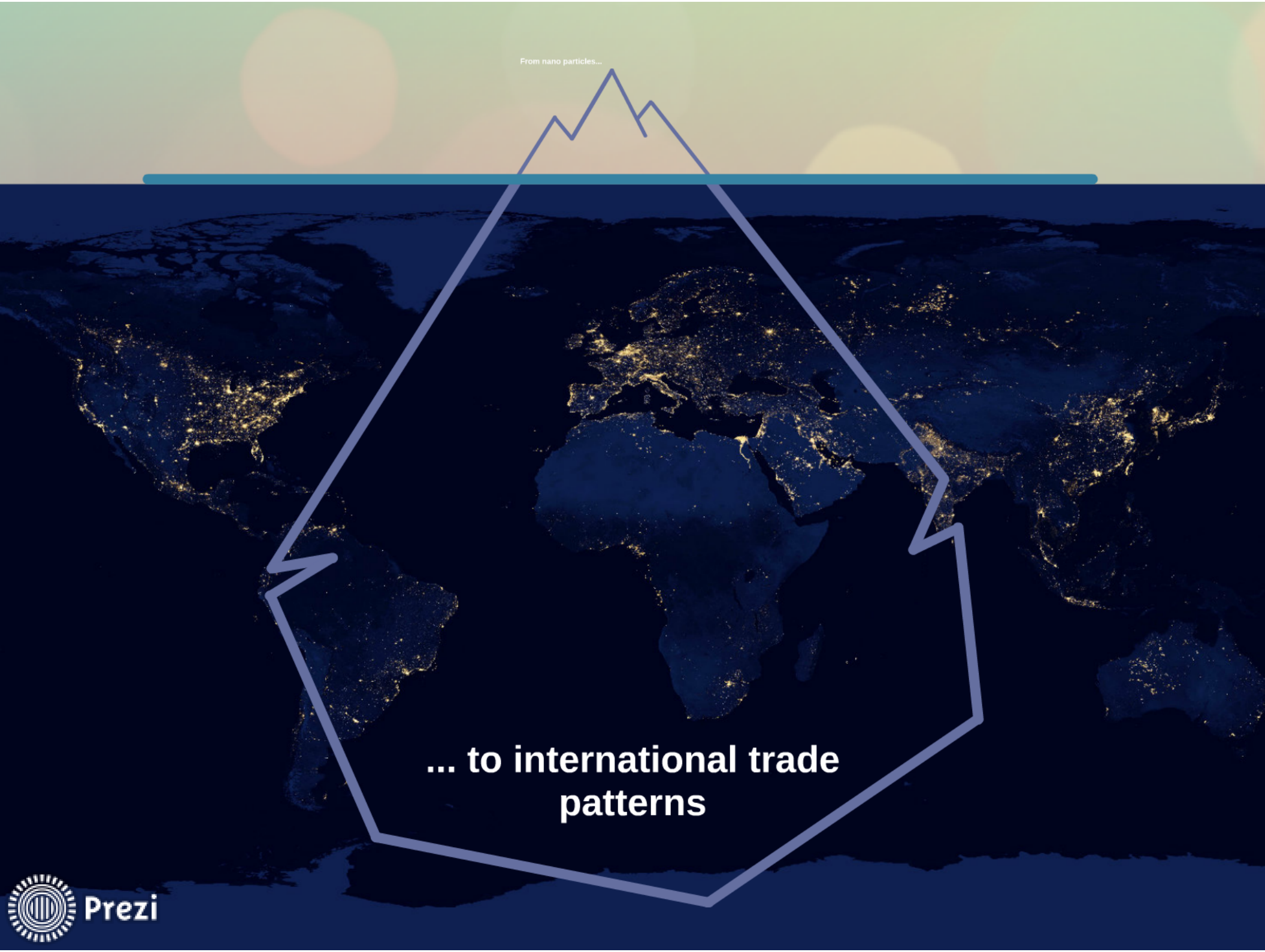
From nano particles...


From nano particles...
... to international trade patterns
Prezi

Many orders of magnitude

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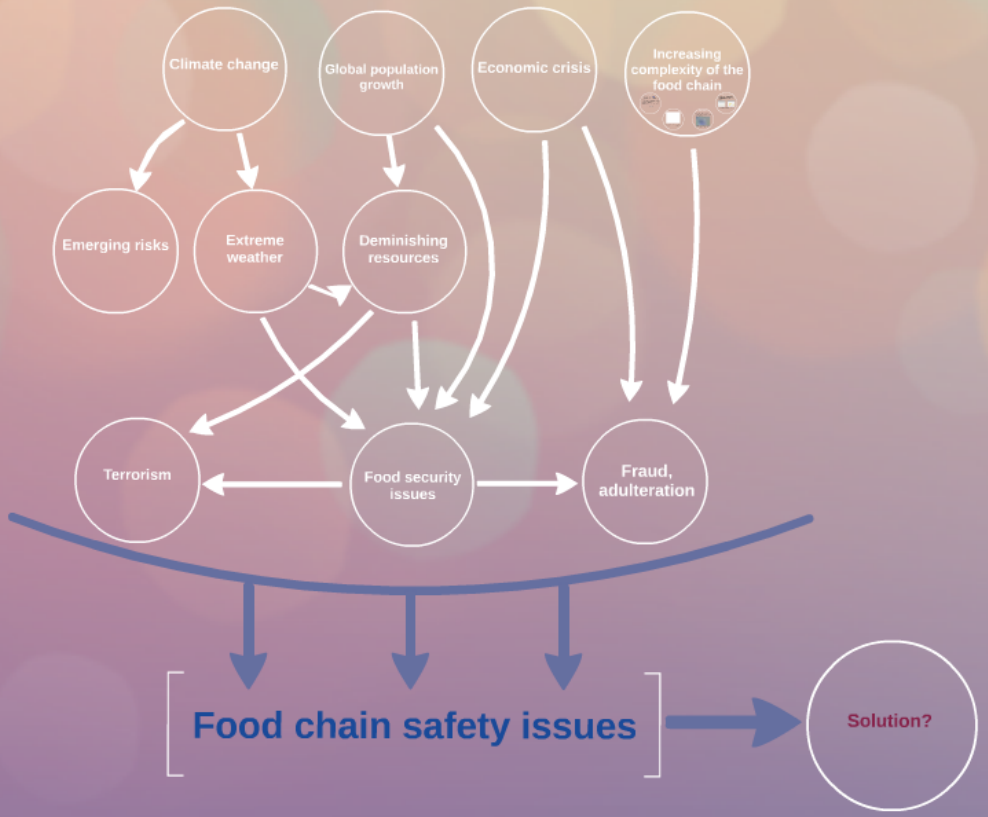

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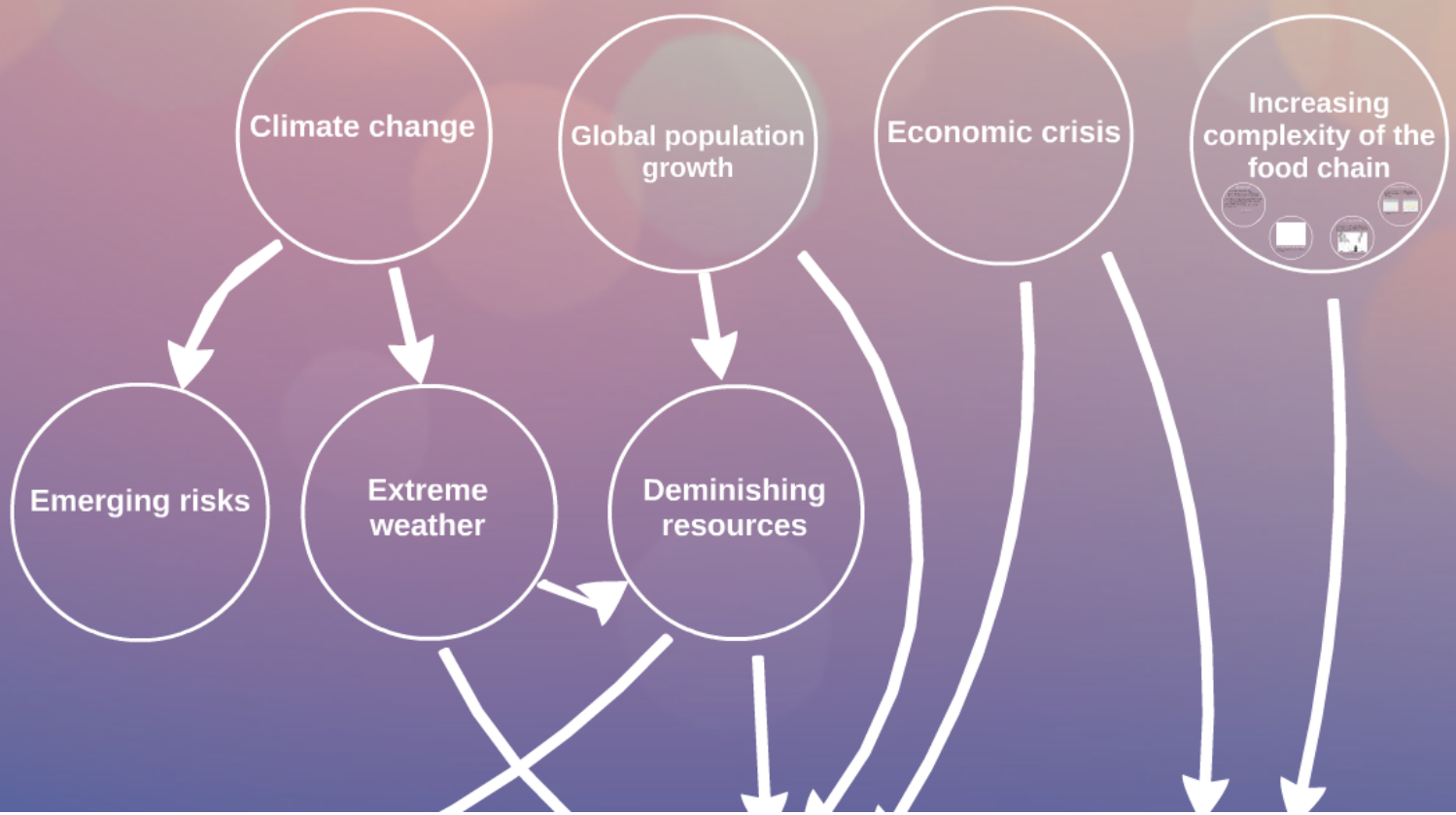

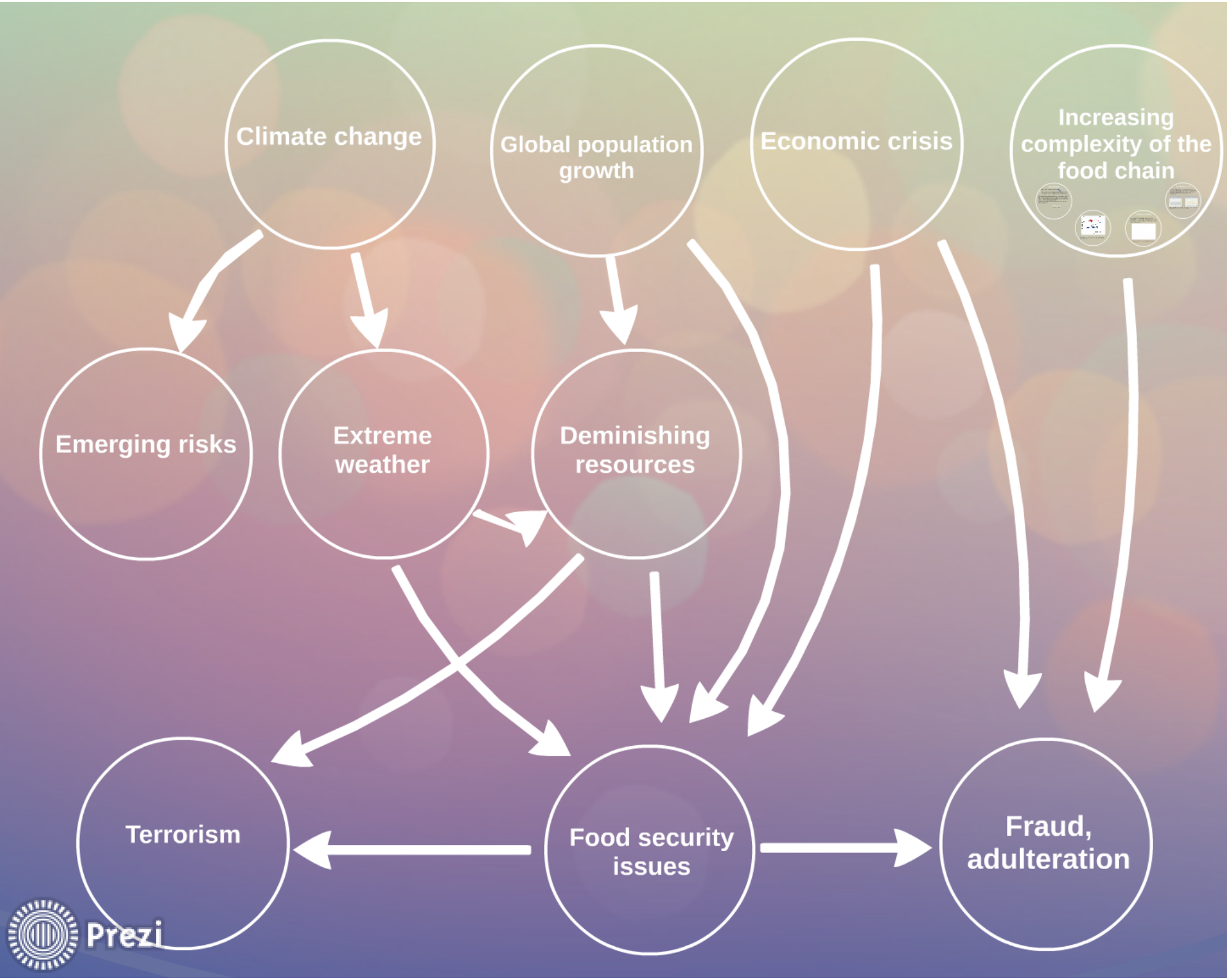
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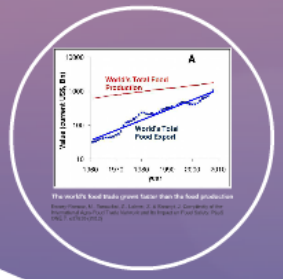
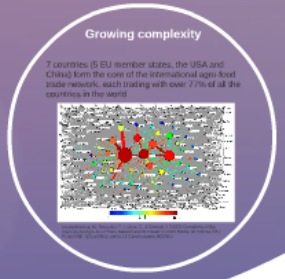


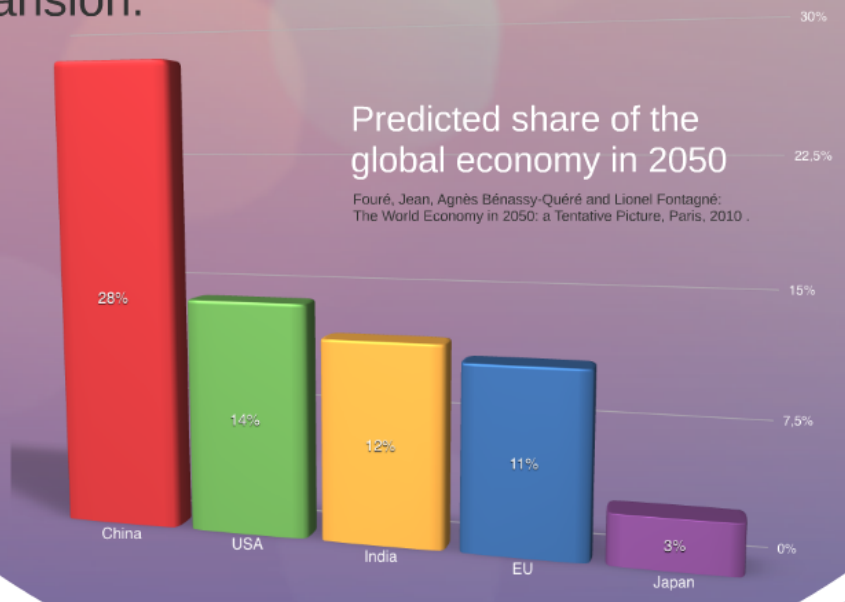


Global trends

2050: 9.3 billion people expected

international trade in food and feed is expected to rise significantly in order to nourish the global population

- The global economy up to 2010 was constantly growing (3.2% per year on average during the period between 1980-2010).
- This trend changed due to the economic crisis and it is very difficult to make any predictions now.
- However, it is clear that developing countries are facing a further expansion.



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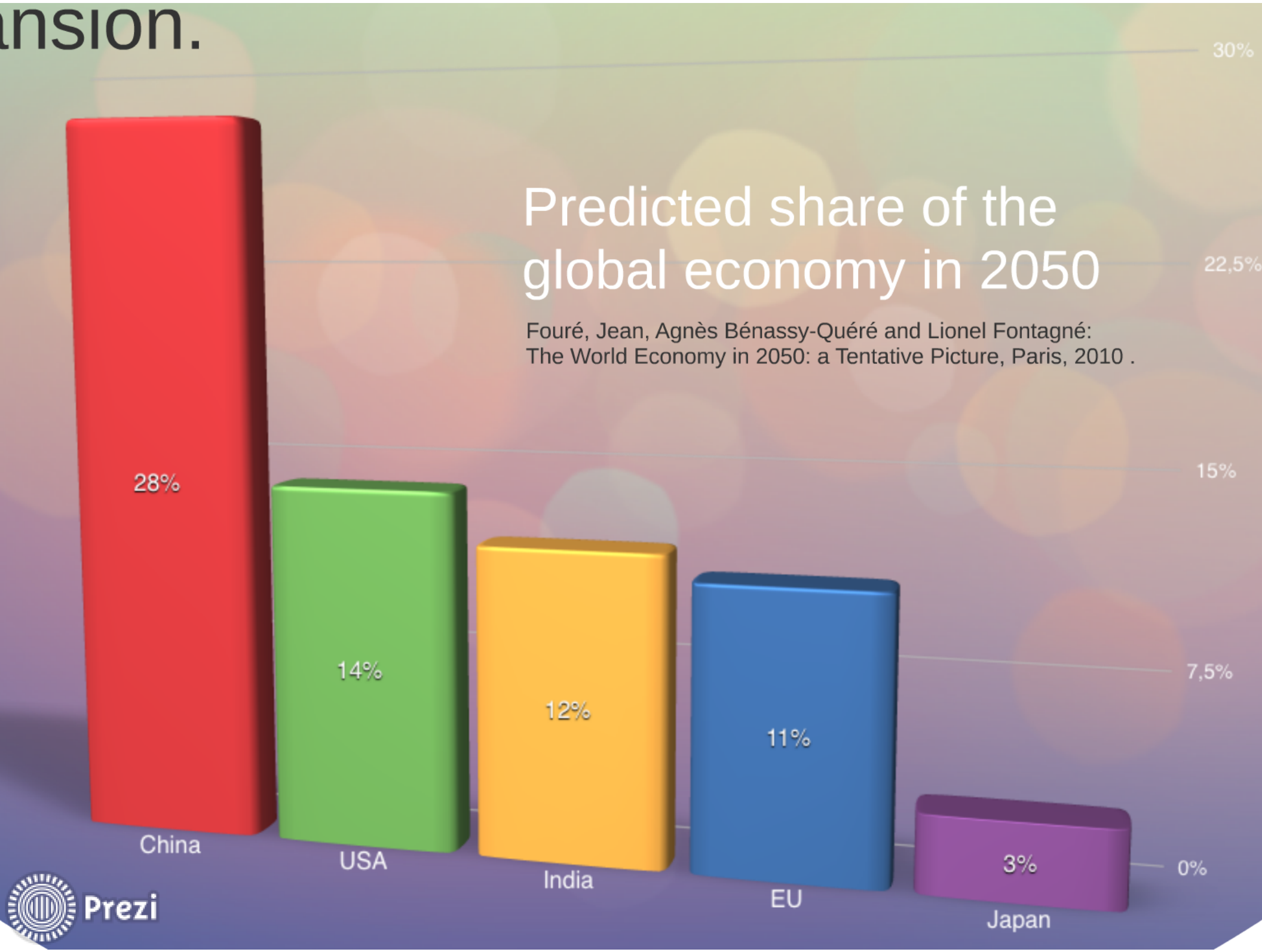
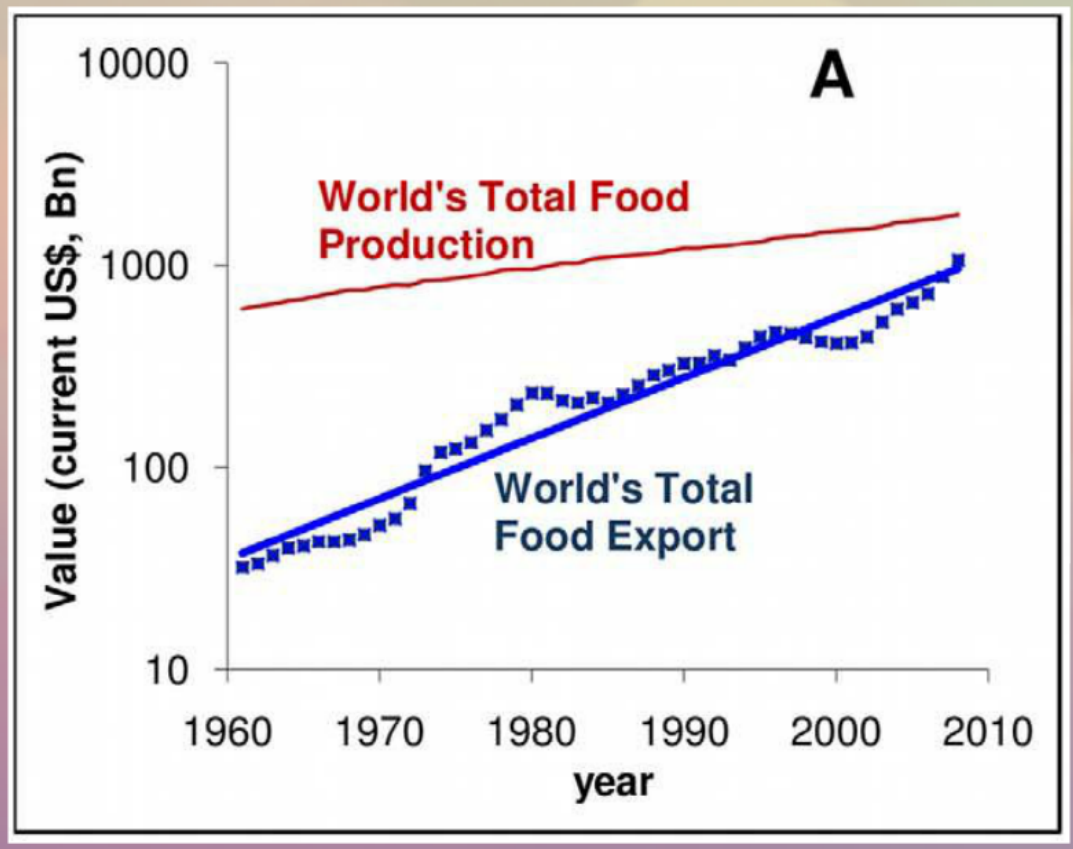


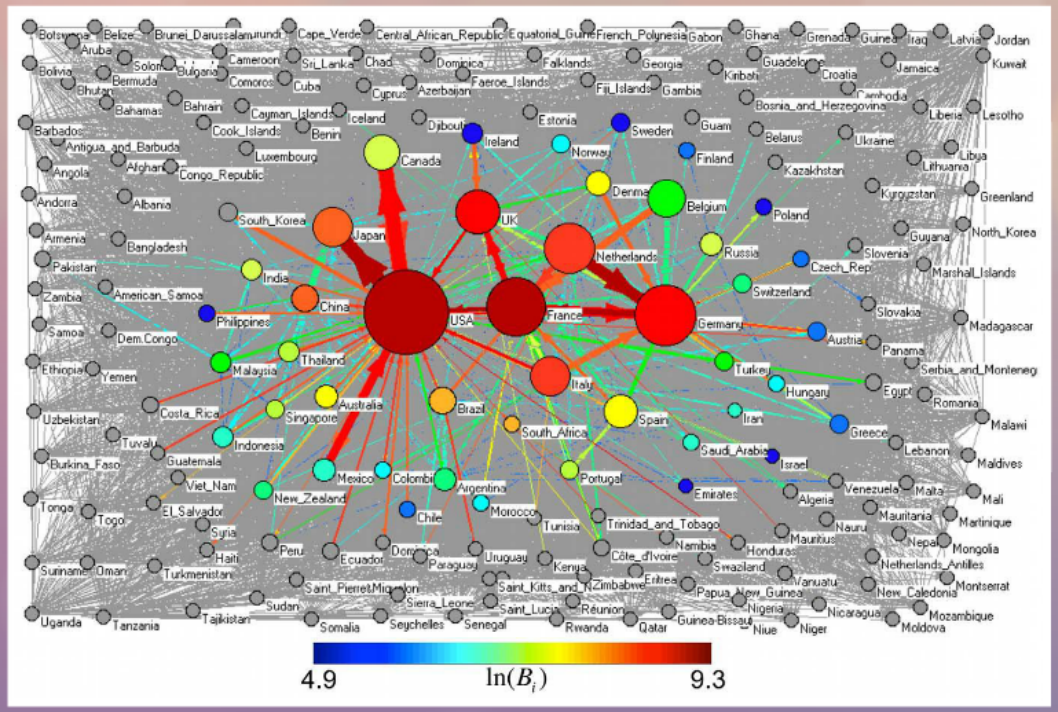


The world’s food trade grows faster than the food production

Ercsey-Ravasz, M., Toroczkai, Z., Lakner, Z. & Baranyi, J. Complexity of the International Agro-Food Trade Network and Its Impact on Food Safety. PLoS ONE 7, e37810 (2012)

Growing complexity

7 countries (5 EU member states, the USA and China) form the core of the international agro-food trade network, each trading with over 77% of all the countries in the world



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How global we are?

The sensed globalization is far from finished, actually this process is only the beginning and **the world we know is more local than global**: both our personal relations and business connections are realised in our direct environment.

Figure 1.2 Total Exports of Goods and Services As a Percentage of World GDP, 1810–2011

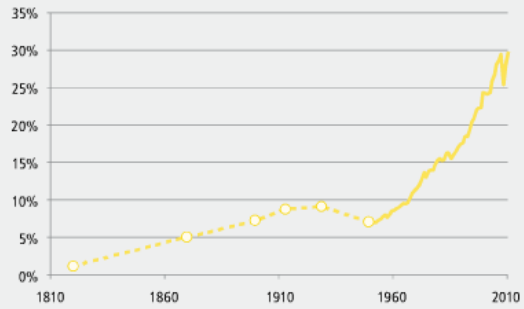
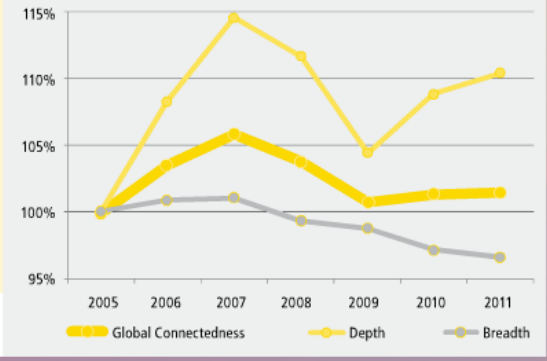


Figure 1.1 Global Connectedness Trends, 2005–2011 Overall Connectedness Depth and Breadth



Pankaj Ghemawat and Steven A. Altman: DHL GLOBAL CONNECTEDNESS INDEX 2012. Analyzing global flows and their power to increase prosperity

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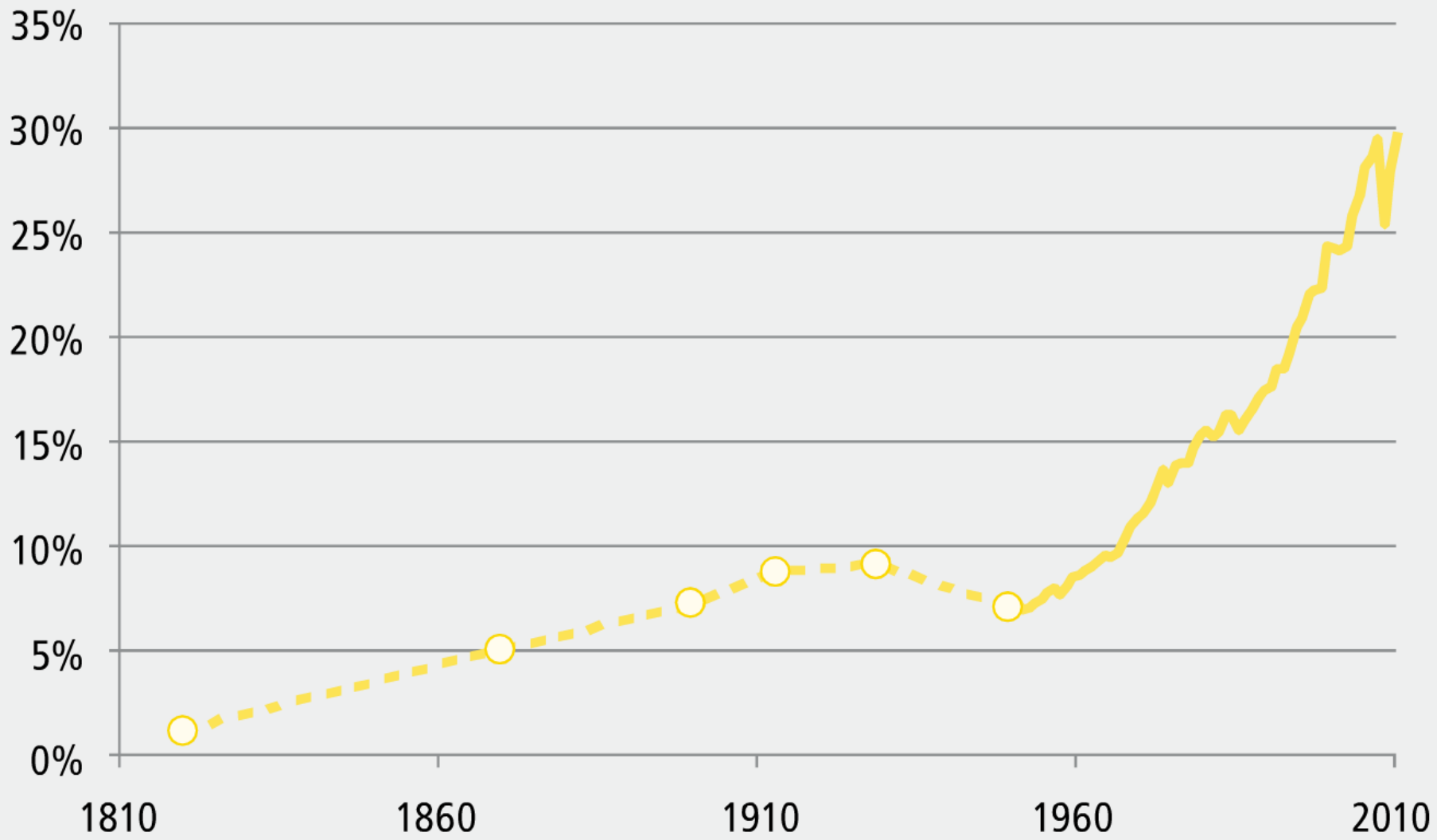

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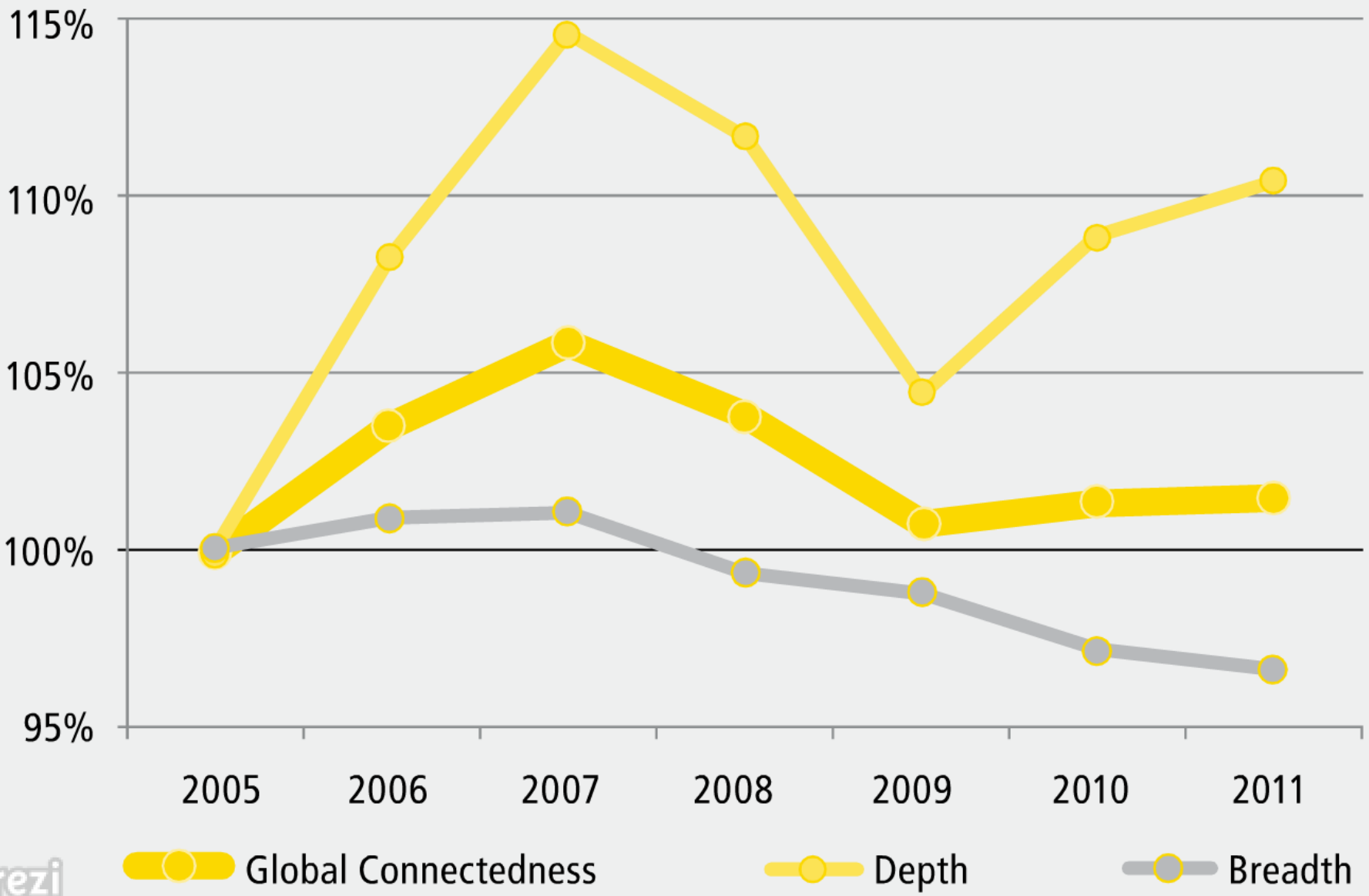

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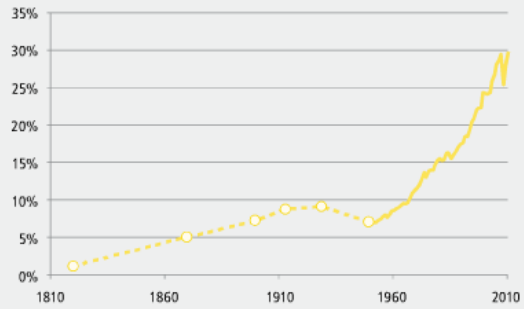

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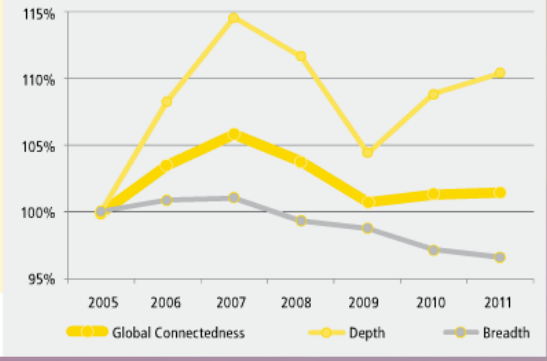

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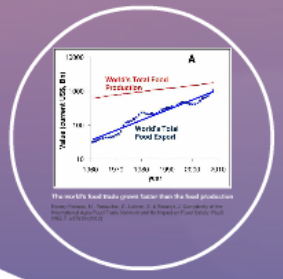
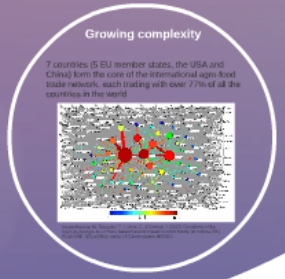
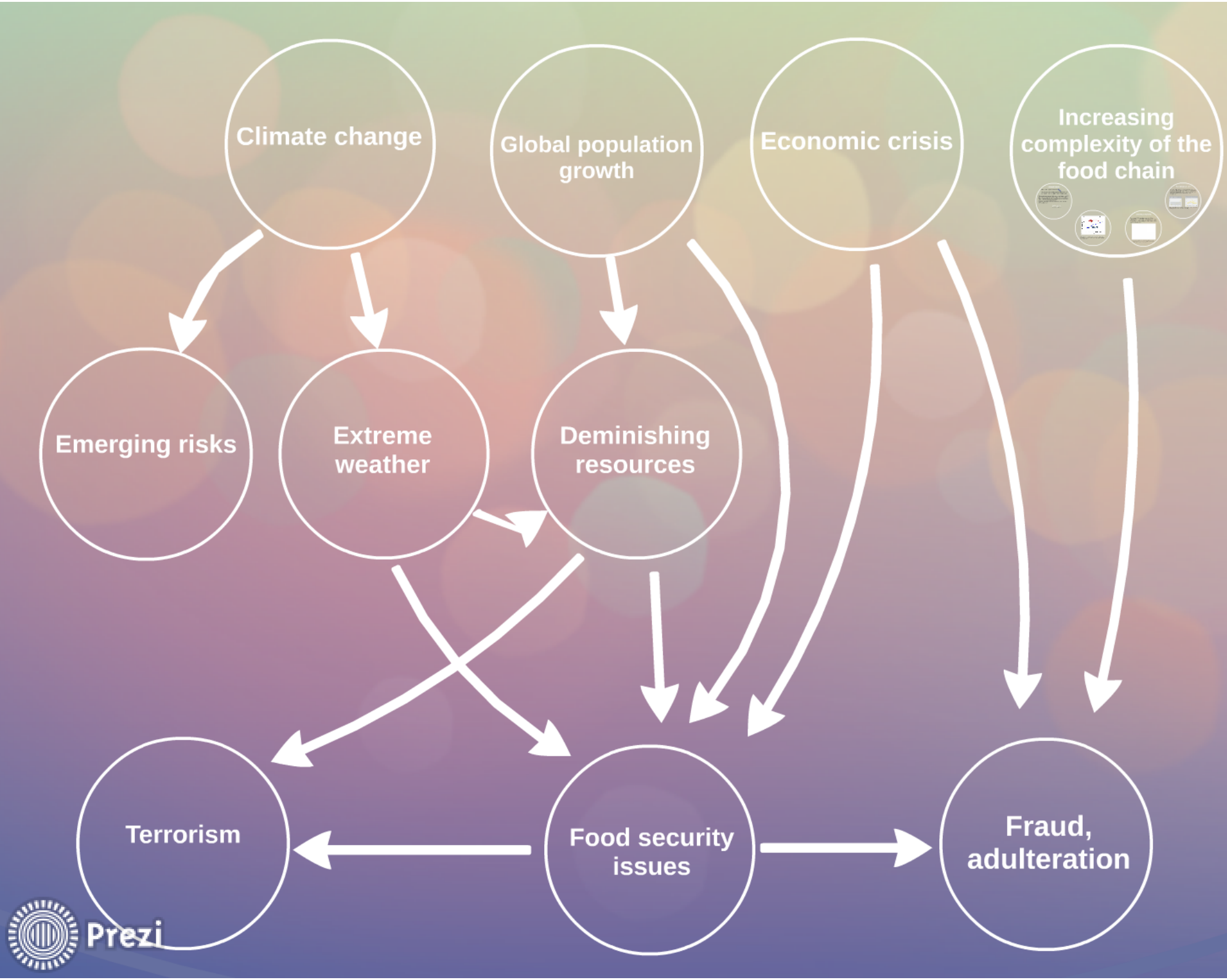
Increasing complexity of the food chain



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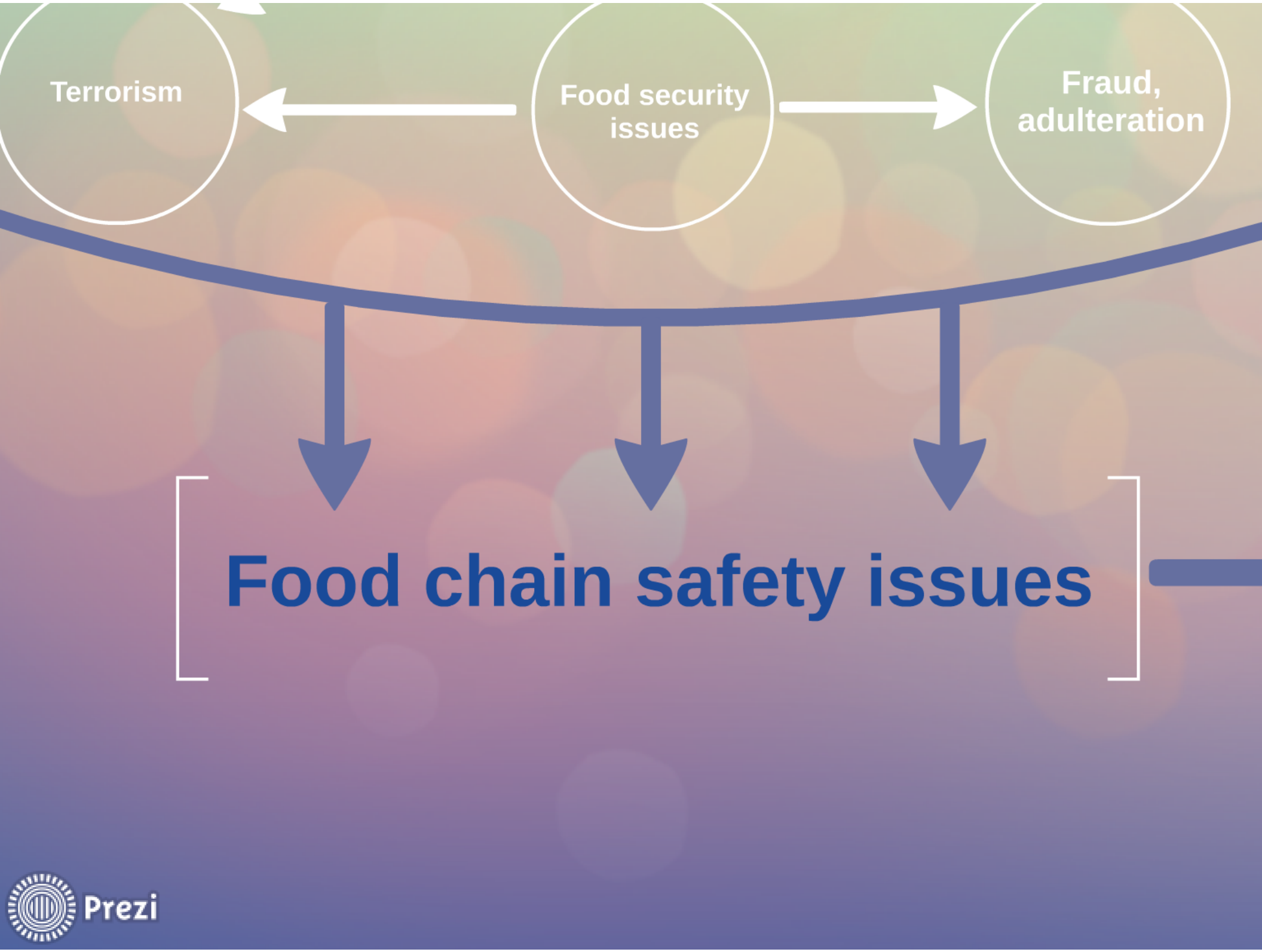
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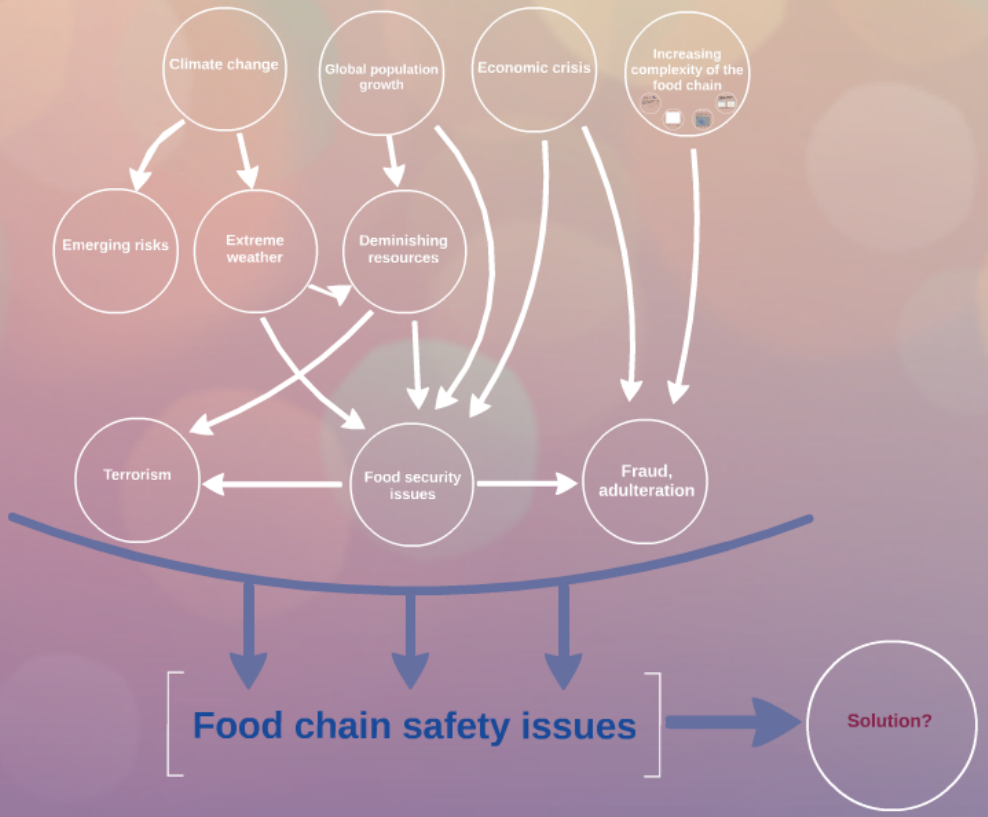
Food chain safety issues

Solution?

Complex drivers



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&
Computational tools

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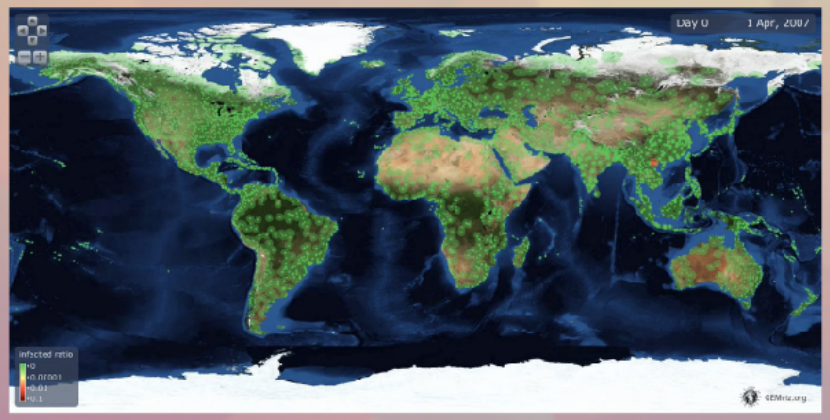

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Many orders of magnitude

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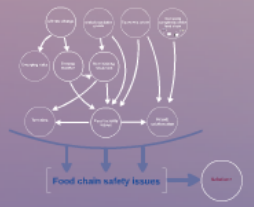

Nature

Information boom

From the dawn of the civilization to 2003 humans produced 5 exabytes of data.

Now we produce 5 exabytes every 2 days.

Society

Science

... brought us where we are

Markets

Authority

Politics

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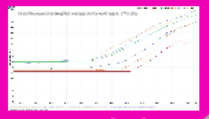

Markets

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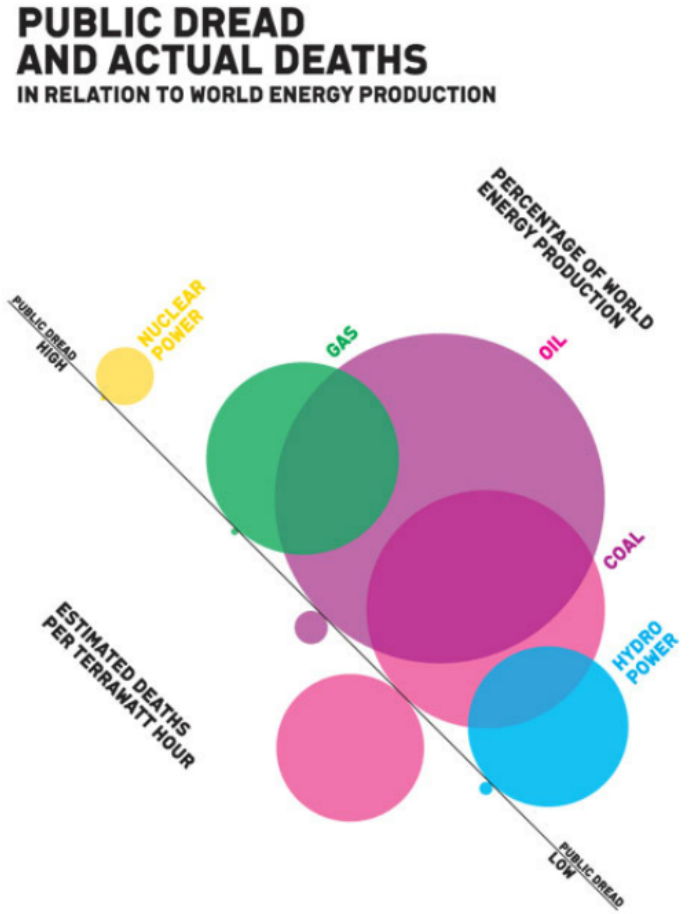
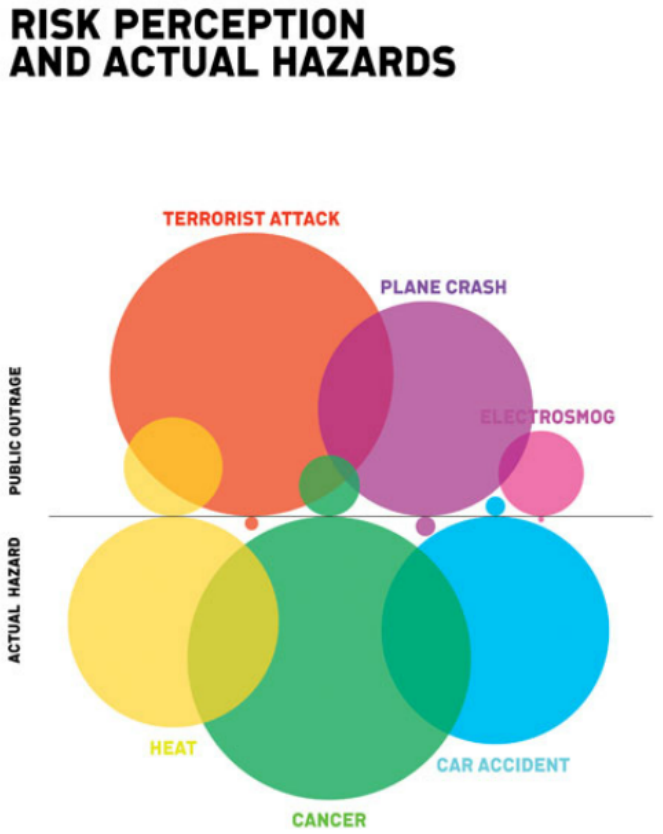
Politics

Society

Do we need to eat?

What is the risk perception of the society?





Source: Susanne Hertirch

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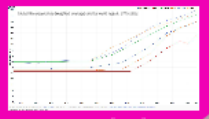

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Business

New technologies

- printing food with 3D printer
- soy and pea proteins to mimic meaty texture
- hydroponic greenhouses
- development of new adulteration technologies
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Politics

Policy-related scientific problems:

- uncertain facts
- disputes over ethics and values
- urgent decisions needed
- that may have far-reaching consequences

Policy makers are required to make difficult and firm decisions based on data characterized by high levels of uncertainty.

Post-normal science

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Post-normal science

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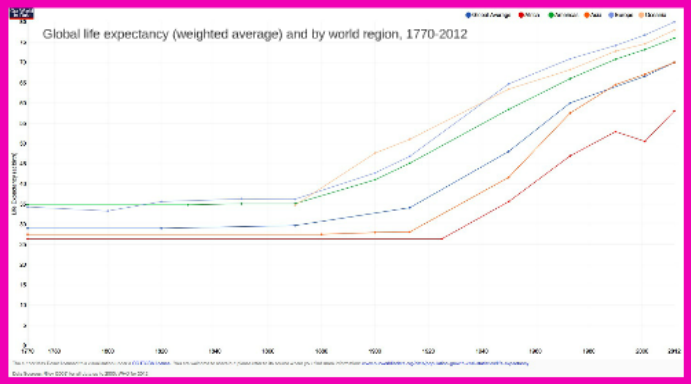
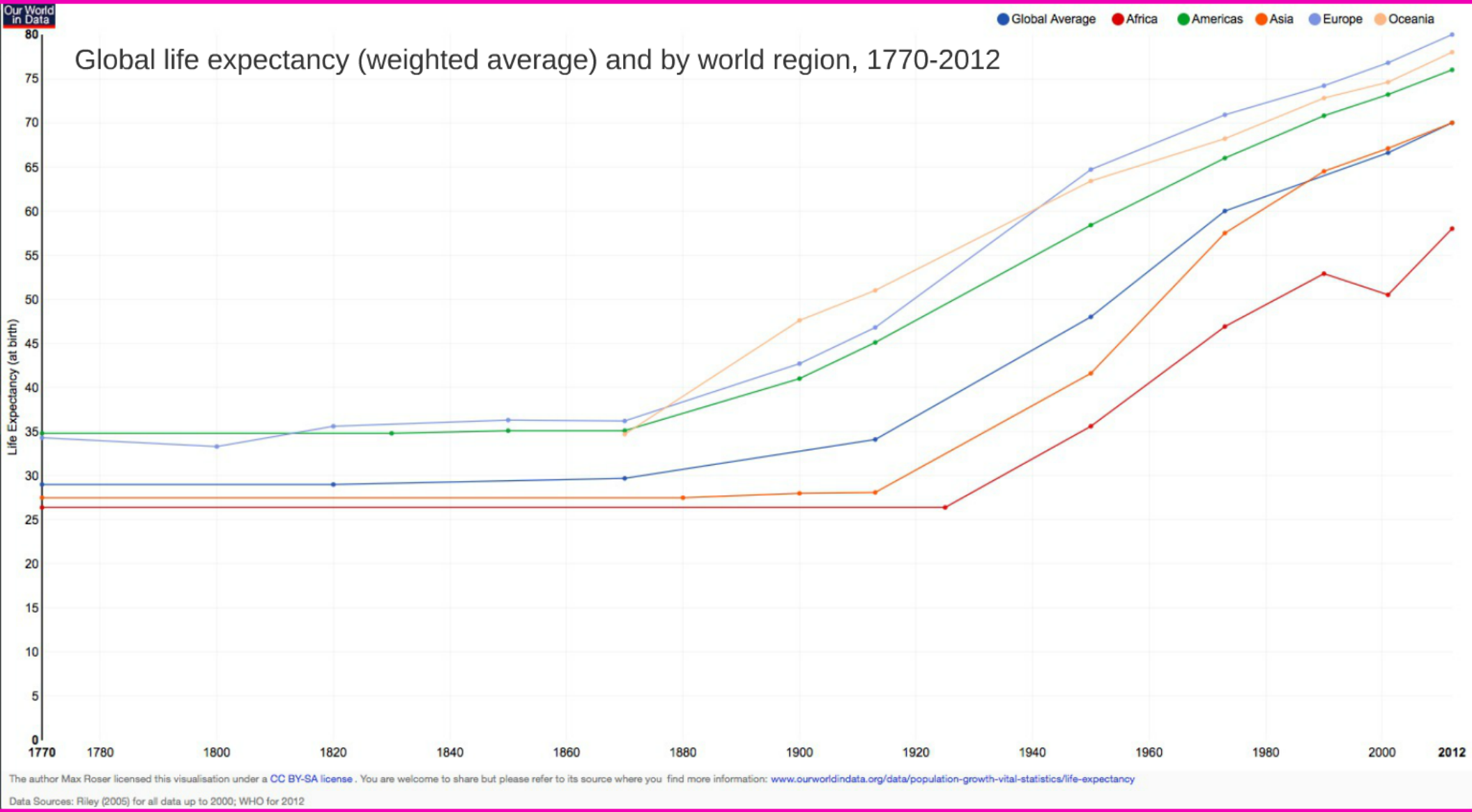


It's all where we are



Prezi

Assessment science: not pure

Pure science	Assessment science
• Curiosity driven	• Purpose driven

Assessment science: not pure

Pure science

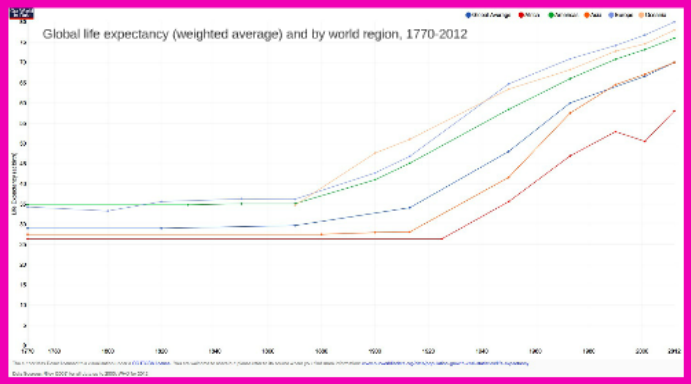
- Curiosity driven
- Disinterested
- Discipline based
- Scrutinized by peers in discipline
- Receptive environment

Assessment science

- Purpose driven
- Sponsored
- Cross-disciplinary and cross-institutional
- Publicly scrutinized
- Rejecting environment

Science

... brought us where we are



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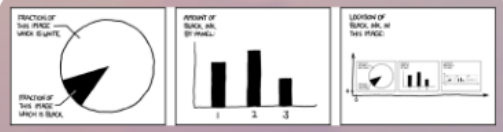
Seek for new approaches, new analysis and control methods

Computational science as a solution

- Big data
- Network science
- Data mining
- (Business) intelligence
- Quantified self
- STEAM (science, technology, engineering, arts, mathematics)
- ..

Important is...

...the story behind the numbers!



Source: xkcd.com

Creation and development of (big) databases is not only an IT problem

The ability of analysis and evaluation of input data and results: high-level knowledge of food chain science is needed enabling interpretation and validation.

Computational science as a solution

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- Meta-analysis
- Psychology
- Game-theory
- Decision theory
- Risk-benefit analysis
- Predictive modeling
- ...

Computational science as a solution

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Computational science

- able to detect patterns which can not be detected by a smaller set of data
- those **emerging patterns** can be surprising & counter-intuitive
- 'more is different'

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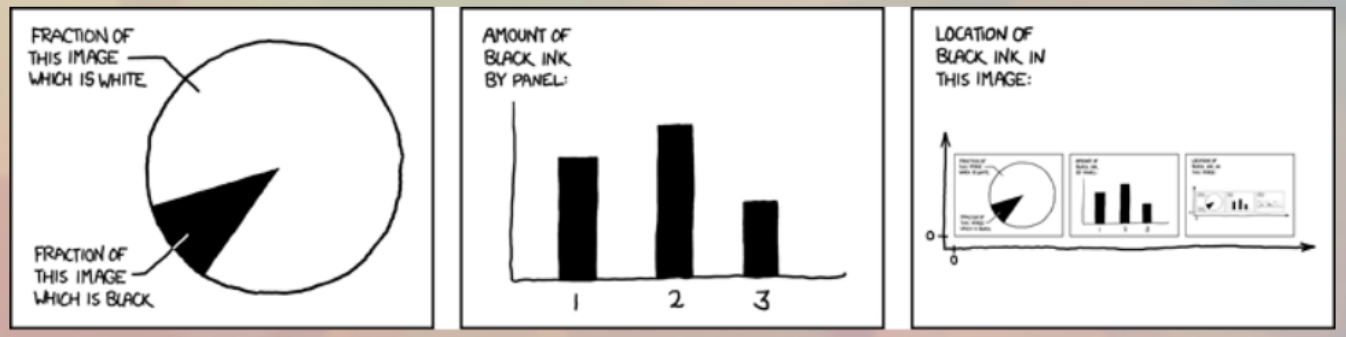

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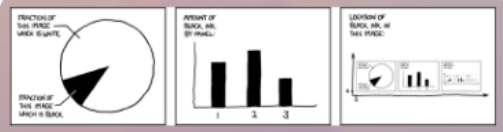

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