Extreme Events

IIASA (www.iiasa.ac.at) and ETLA (www.etla.fi) held the ***Extreme Events*** book publishing event (in Finnish) and to the concluding seminar of the ***Game Changers and Finland*** project (in English) on 15 June 2011 at Hotel Kämp in Helsinki (www.hotelkamp.com). Please find the presentations on the following slides of this file:

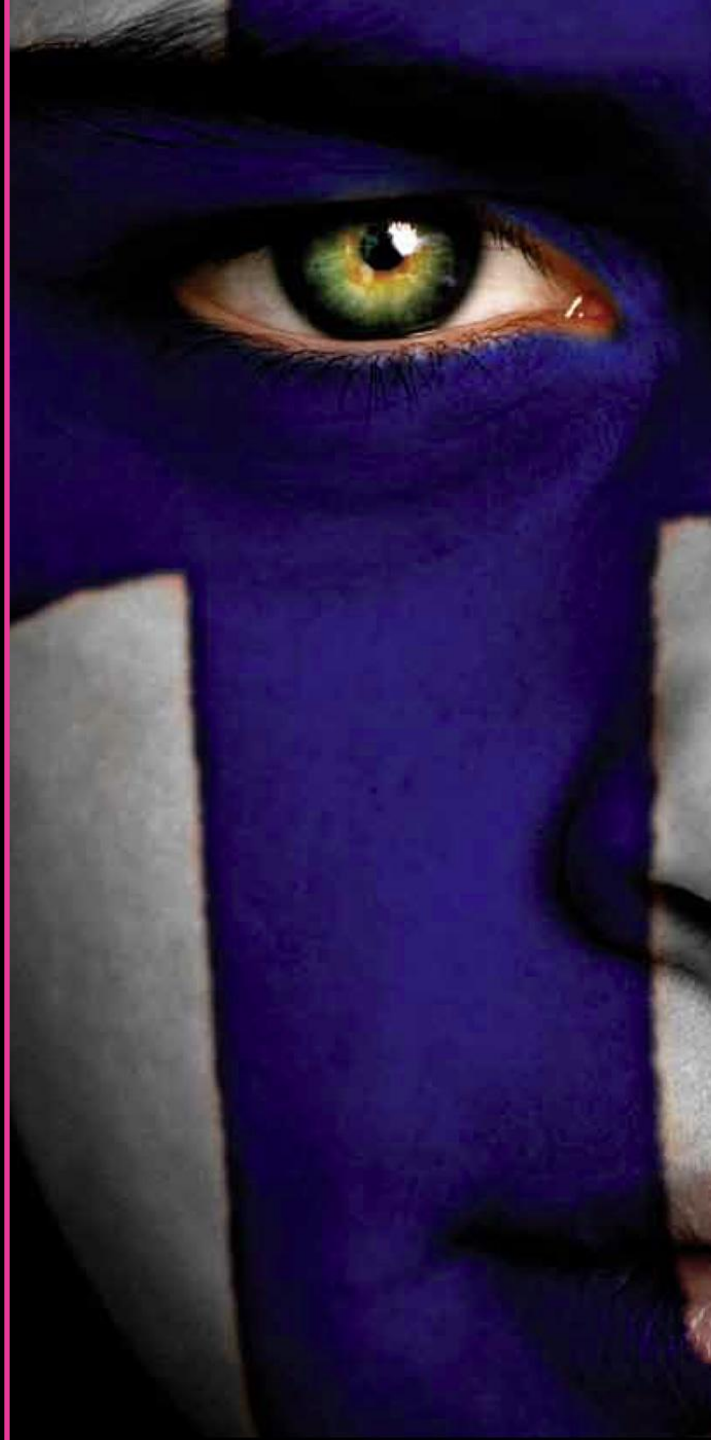
Book Publishing (the "Extreme Events" book free-of-charge at Xevents.fi/Xevents.pdf)

Seminar – Part I

Seminar – Part II

Extreme Events

Game Changers



International Institute for Applied Systems Analysis

Systems analysis and methodological development for application in critical areas of global change – major focus:

POPULATION
ENERGY
LAND USE & FORESTRY
EVOLUTION & ECOLOGY
ATMOSPHERIC POLLUTION & MITIGATION
DISASTER & RISK

Funded by 19 nations.

Game Changers Project
Partnerit

Sitra, TEM, Huoltovarmuuskeskus, UPM Kymmene, Fountain Park, Metso, Itella, Tekes, Etla ja Sanoma
Skotlannin hallitus

Game Changers Project
Tulokset

15.6.2011

J. Casti, L. Ilmola, P. Klimek, O. Lehtonen, M. Lex, J. Liesiö, P. Rouvinen and U. Bilge

J. Honkatukia, P. Ormerod, A. Salo, S. Thurner, M. Tykkyläinen, M. Wilenius

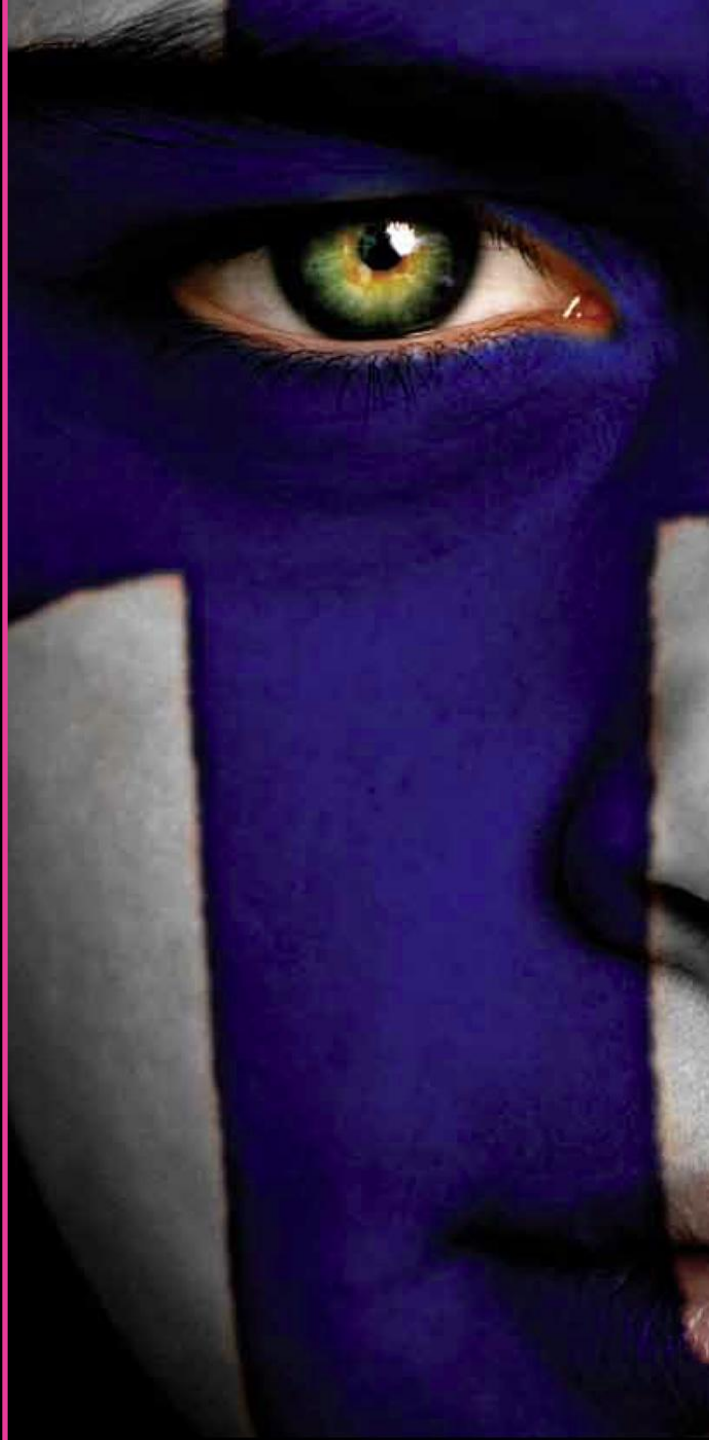
IIASA Exploratory Projects/ Xevents

Extreme Events

Extreme Events: An Overview

(Katsaus ääri-ilmiöihin)

Research Director
Petri **Rouvinen**
ETLA



Johdanto kirjaan & iltapäivän ohjelmaan

— • —

Toistuvat isot yllätykset pysyvä & kasvava osa arkipäiväämme

Nyky-yhteiskunta otollinen sisäsyntyisille sekä altis ulkoisille ääritapahtumille

Ääritapahtumia tulisi pohtia laajasti koko maan tasolla – *Mitä ”kukaan” ei nyt tee!*

Extreme Events

John Casti
Leena Ilmola
Petri Rouvinen
Markku Wilenius

MARCH 28 & APRIL 4, 2011 THEDAILYBEAST.COM

Newsweek®

Apocalypse Now

Tsunamis. Earthquakes. Nuclear Meltdowns. Revolutions. What the #@%! Is Next?

What the #@%! Is Next? Paljonkin!

Kompleksisuuden & hallintamekanismien ristiriita

Globaalit verkostot yllättävät, kaukaa & tehokkaasti

Litteä maailma & sama info: Sopuli-ilmiöt & kuplat

Turbulenssia muuttuvista yhteiskuntajärjestelmistä

Useat globaalit kriisit lähellä kriittisiä pisteitään
(mm. ympäristö, rahoitus/talous, köyhyys, turvallisuus, luonnonvarat, ruokahuolto)

Nyky-yhteisö tehokas & dynaaminen mutta...
sekä synnyttää että on herkkä ääritapahtumille

What the #@%! Is Next? Ei listaa:

Ei kykyä hahmottaa ääritapahtumia ilman esikuvia

Sosiaalisuus satunnaista & ”takaisinkytkeytyvää”

Aina useita seikkoja, joita emme hahmota/tiedä

Sos. ääritapahtumien ennustaminen mahdotonta

Ei yhtä ”yllätysten teoriaa”, mutta ääritapahtumia voidaan hahmottaa, niihin voidaan vaikuttaa & varautua sekä lisätä niiden nettohyötyjä

Extreme Event / Xevent / Ääritapahtuma

Harvinainen & ehkä merkittäväkin yllätys

– Uhka tai mahdollisuus, joskin tuhoaminen nopeampaa
– Liikkeelle sysäävä sekä sitä seuraavat tapahtumat
– Äärimmäisyyden määrittää ympäröivä konteksti

Tapahtuma?
Harvinainen?
Merkittävä kenelle?
Tap./kohteen piirteet?
– Vaistot & mielialat?
Merk. missä/miten?
Ajankohta/aikaväli?
– Varoitusaika?
– Tapahtuma-aika?
– Vaikutusaika?
– Ennen/aikana/jälkeen?

Luonto	*vs*	Ihminen
Voimistuva	*vs*	Heikkenevä
Positiivinen	*vs*	Negatiivinen
Lyhyt tähtäin	*vs*	Pitkä tähtäin
Tilastollinen	*vs*	Perustava epäv.

Mustan Joutsenen paradoksi

Tietty ”oma” ääritapahtuma **epätodennäköinen**

Se, että **joku** oma tai muiden ääritapahtuma meitä koskettaa, **todennäköistä**

Kuva: Shutterstock

Tavoitteet ääritapahtumiin liittyen

Positiivisten todennäköisyyden lisääminen &
Negatiivisten todennäköisyyden vähentäminen

Ennen / aikana / jälkeen :
Kustannusten/haittojen minimointi &
Rahallisten & hyötyjen maksimointi

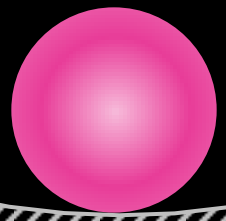
Kustannus-hyöty analyysi, joskin ”ikävän teoreeman” mukaan *tapahtuman todennäköisyyden lähestyessä nolla & vaikutusten ääretöntä, normaali kustannus-hyötyanalyysi ei päde* (Weitzman 2009)

Miten tutkia tapahtumaa X, jollaista ei historiallista esikuvaa & johon liittyvä dynamiikka paljastuu vasta realisaation myötä?

Ei mitenkään!? Mallinnus ei ole avainroolissa – lukuisia lähestymistapoja, joilla haarukoidaan ongelmakenttää: skenariot, simulaatiot, verkostoteoriat, agenttipohjaiset mallit, sumea logiikka, hiljaiset signaalit...

— • —

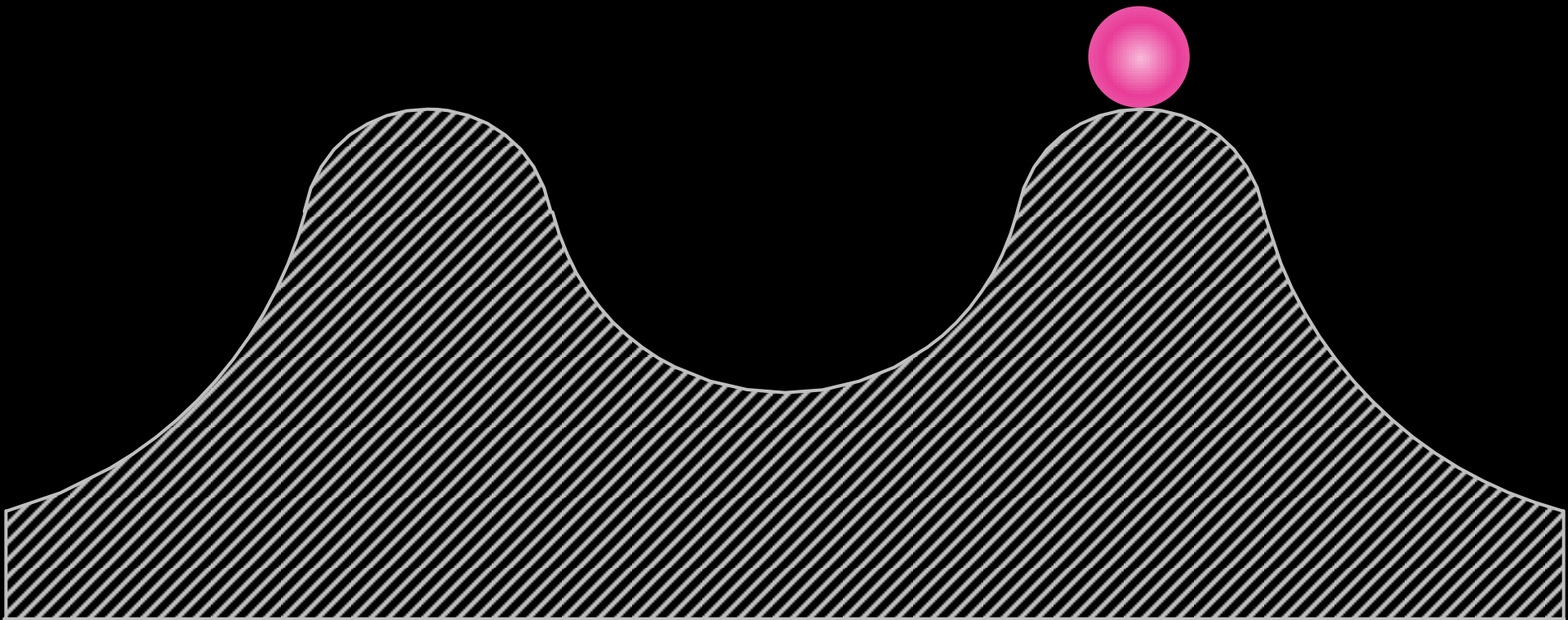
Itse kunkin illuusio maailmasta tasapainottava & ehdollinen lähiympäristölle



Missä kohtaa laajempaa maisemaa oikeasti ollaan?
Uusi tasapainotila ääritapahtuman jälkeen?

— • —

Selitykset esim. 1991 & 2009 ennustevirheille:
Ei olisi voinut ja pitänyt nähdä... Ehkä ei, mutta
juuri nuo hetket ovat historian käännekohtia!



Ääritapahtumia ei voi ennustaa eikä (täysin) estää tai hallita

Ääritapahtumia voi ennakoida ja niihin voi varautua
- Oikeat kuumemittarit ja niiden kriittiset arvot
- Reservit, säästöt, varastot, vakuutukset
- Ketteryys, joustavuus, monipuolisuus

Dynaaminen ”luovasti uudistuva” markkinatalous huono ääritapahtumiin valmistautumisessa & välittömässä kosketuksessa, mutta ok jälkipyykissä

Makrotason systeemisiä ääritapahtumia ei pohdita eikä niihin varauduta

Ääritapahtumiin liittyy usein nopea & runsas julkisen rahan käyttö

Ääritapahtumien pohdinta osaksi julk. päätöksentekoa?

Valmiussuunnitelmat osaksi hyvää hallintotapaa?

Tilastoll. & perustava epäv.?

Kuva:
Taleb, Goldstein & Spitznagel:
Harvard Business Review.

Extreme Events

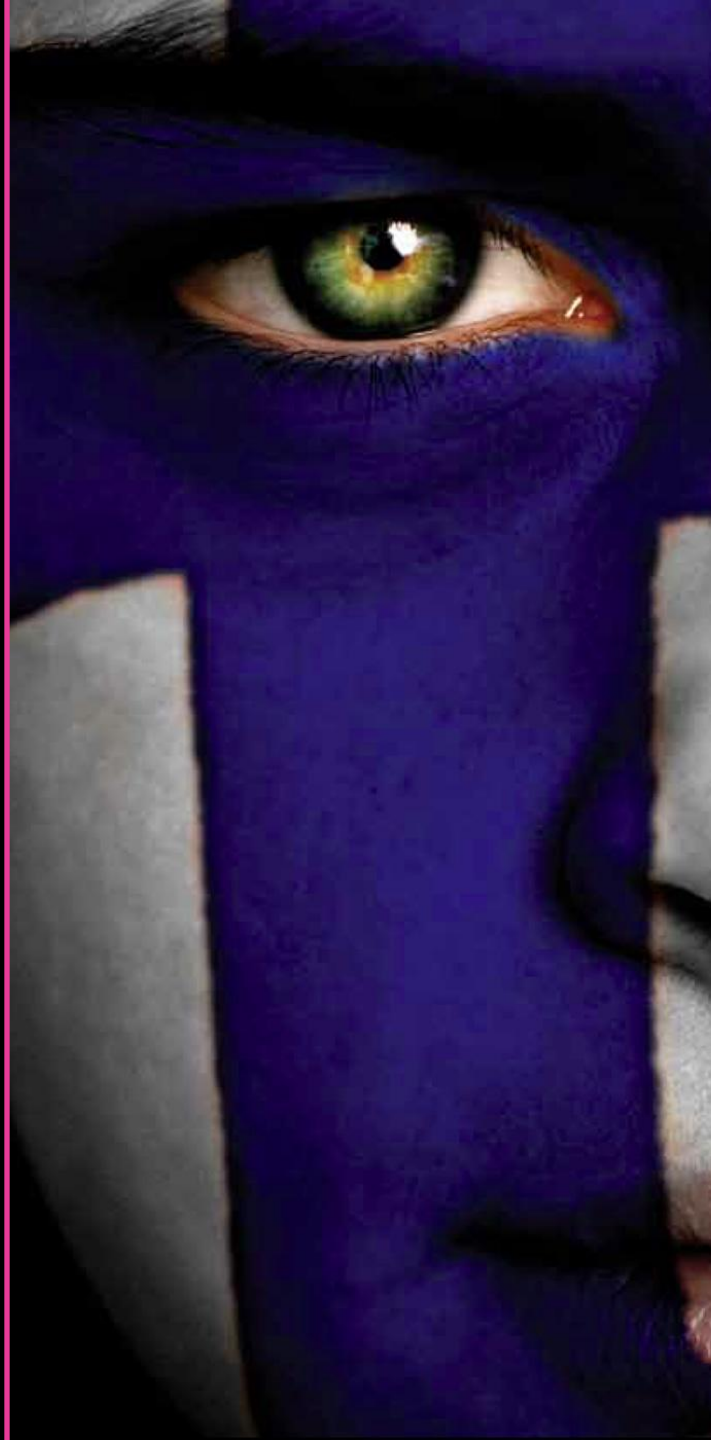
Game Changers

Main Findings

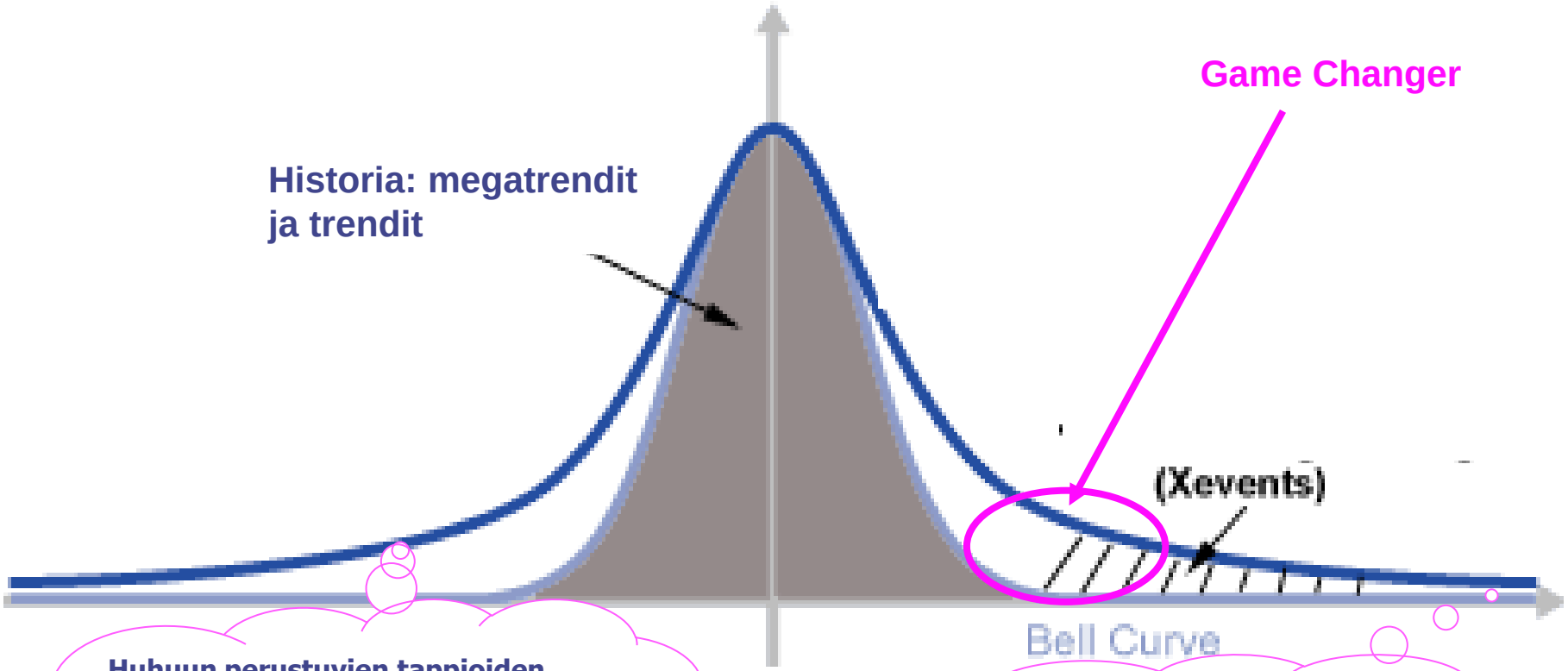
Senior Research Scholar

Leena Ilmola

IIASA



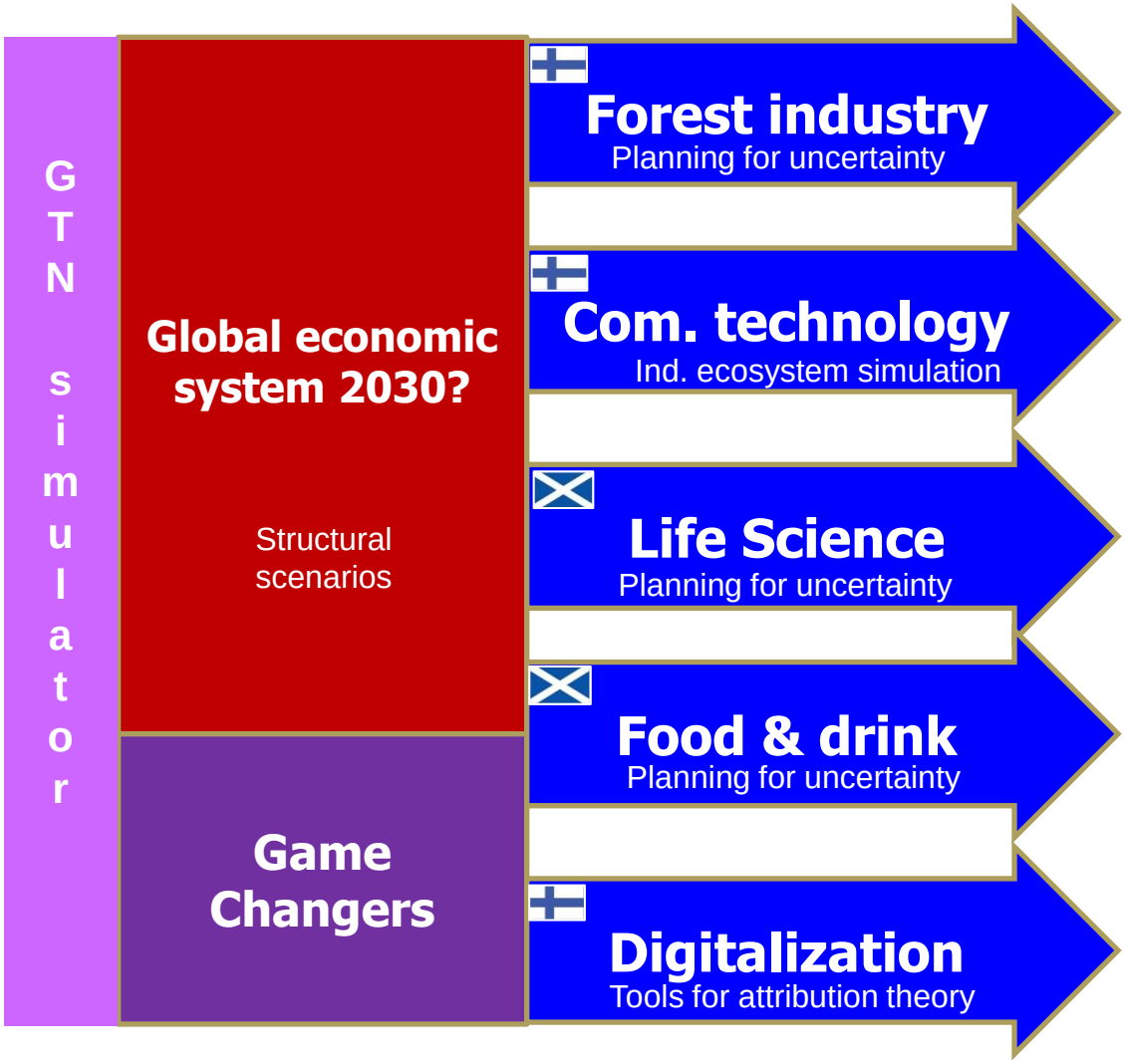
Epävarmuus lisääntyy



Huhuun perustuvien tappioiden syntyminen Espanjan vihannesviennille, tai ranskalaisten maanviljelijoiden myynnin romahtaminen 90%, ei saanut mitään todennakoisyyttä.

2008–9 rahoituskriisin toden-näköisyys historiadatan valossa 0,0000000000000000000007

Game Changers 2/2010-3/2011



Mita kaikki tämä vaikuttaa pienen avoimen talouden kilpailukykyyn?

Yhteenveto

ESIMERKKEJÄ TULOKSISTA

Globaalin talouden syklisyys kasvaa

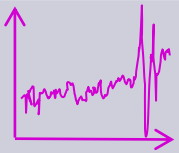
	Stable & Turbulent World	Volatile World
Scenario in brief	 The structure of the global economy is hierarchical (one world or blocs). Economy is pretty stable (rules) until the shock of power centers causes huge turbulence.	 The global economic system is unpredictable and behavior is very volatile. Small change in external or internal conditions may cause a major shift in the behavior.
Prerequisites	Fast climate change, resource scarcity severe, capitalism (financial system) fails in some areas	Global growth period 2010-2020, technology development fast (does not solve scarcity problems)
Drivers	Globalization, many relatively strong nations, strong ideologies, clash of cultures, political power strong, wars (trade/military conflicts)	Knowledge drives economy, quantum computing, zero energy sources , global financial system collapsed, globalization is over, no reliance on policy makers
Structure drivers	Strong IPR, public sector role strong, successful global operations track record	Open source development, climate change is mitigated,/failure, resource scarcity, no ideologies

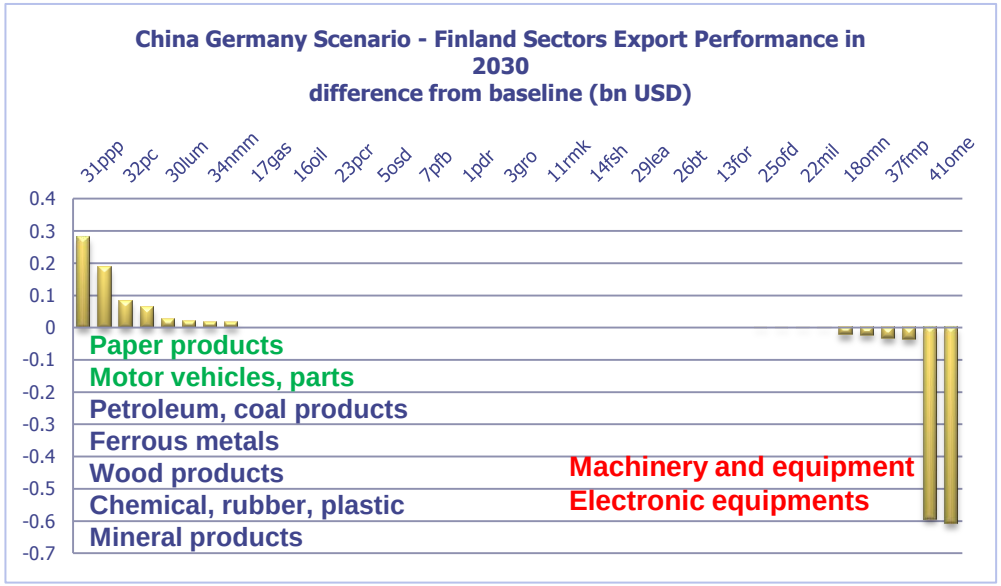
Globaali talousjarjestelmä 2030

- **Syklisyys kasvaa**
- **Tempo tiivistyy**

- **Kaiken kattavasta suunnittelusta syklin mukaiseen strategiaan ja toimintamalliin**

Globaalin talouden syklisyys kasvaa

	Stable & Turbulent World	Volatile World
Scen ario in brief	 The structure of the global economy is hierarchical (one world or blocs). Economy is pretty stable (rules) until the shock of power centers causes huge turbulence.	 The global economic system is unpredictable and behavior is very volatile. Small change in external or internal conditions may cause a major shift in the behavior.



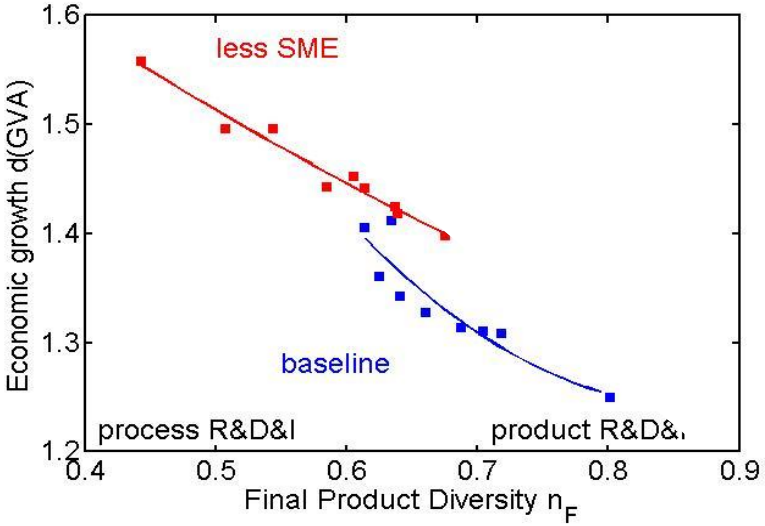
Globaali talousjarjestelmä 2030

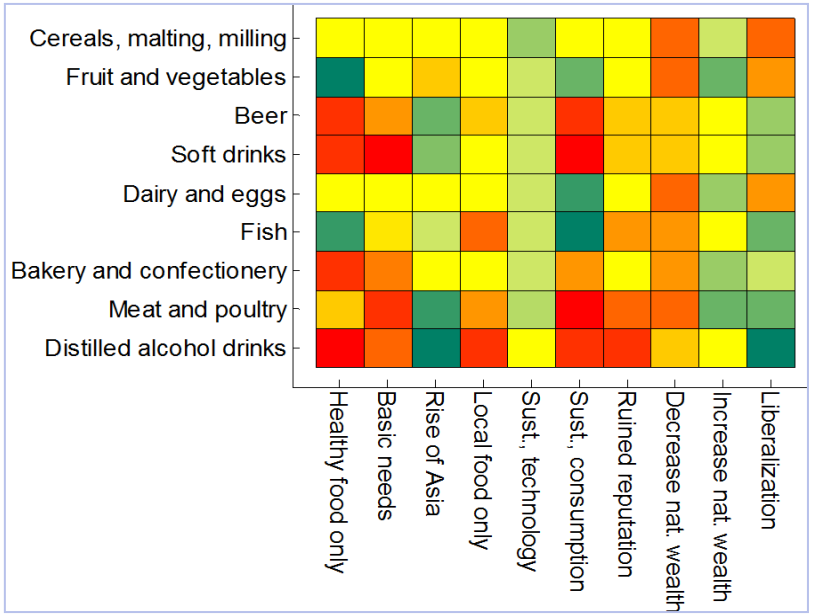
- Syklisyys kasvaa
- Tempo tiivistyy
- **Kaiken kattavasta suunnittelusta syklin mukaiseen strategiaan ja toimintamalliin**

Top 20 kauppasimulaattori

- Mutta vaikutukset saattavat olla vahaisiakin
- **Kaikkeen ei kannata reagoida, pitkat stabiilit kaudet ovat myos mahdollisia**

Ekosysteemit selviävät





Viestintäteknologiasektori

- **Muutaman suuren yrityksen ekosysteemi tuottaa kasvua, mutta on herkkä muutoksille**
- **Tuoteinnovointi tuottaa resilienssiä, mutta ei kasvua**

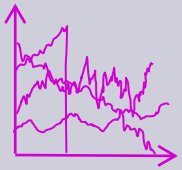
- **Jos epävarmuudet lisääntyvät, pienten yritysten verkosto on parempi rakennemalli**

Skotlannin Food & Drink

- **Kehittyneet korkean jalostusarvon alat herkkiä muutoksille**
- **Perusteollisuus kestää muutokset**

- **Toimiva ekosysteemi koostuu toisensa tasapainottavista yrityksistä**

Kokonaisuus ratkaisee

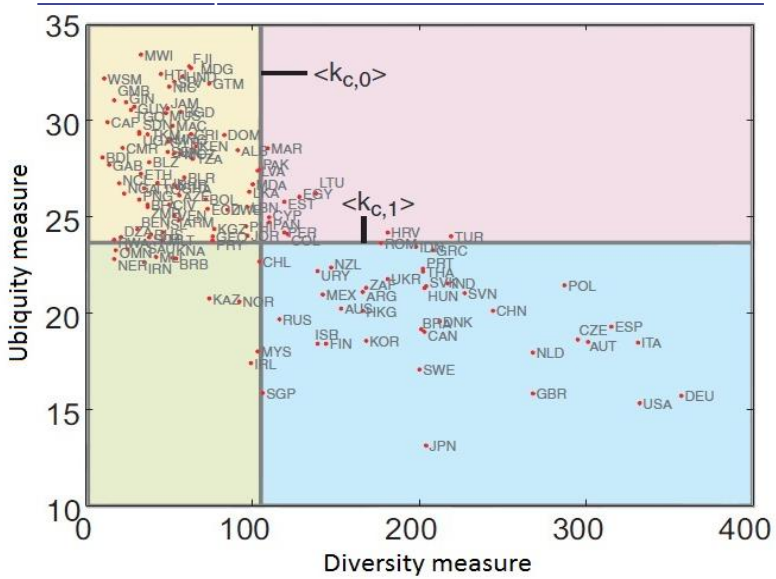
	Multiplex
Scenario in brief	 Global system consists of different domains with different structures and behaviours. Uncertainty and systemic behavior. Each domain has its own dynamics, but it is possible that small changes cascade through system
Prerequisites	Assymmetric development (local/sector specific regulation, bloc development, standardization, climate change agreements, polarization)
Drivers	Diverse set of drivers, domain specific, systemic drivers, external shocks cascading throughout the system
Structure drivers	Role of public sector, International regulation, polarization of growth

Globaalin talous: Multiplex 2030

- **Monta eri markkinaa, joilla hyvin erilainen käyttäytymistapa > erilaiset menestystekijät**
- **Systeemin häiriöt/muutokset leviävät kaikkialle**

- **Globaalin toimijan on hallittava kaikki toimintamoodit**

Kokonaisuus ratkaisee



LOCALIZED PRODUCTION	SCALE FREE PORTFOLIOS
Invest in small production units close to the deinked pulp and large markets. Micro mills in cities make quick re-cycling possible.	Integrate printing paper industry with biorefineries. Use wood also for producing other high-value products and by-products.
Organize own recycled paper collection and sorting company Search partners for printing paper company fusions.	Concentrate on big production units in low cost areas. Vertical integration. Use Multiple revenue possibilities .

Globaalin talous: Multiplex 2030

- **Monta eri markkinaa, joilla hyvin erilaiset menestystekijät**
- **Systeemin häiriöt/muutokset leviävät kaikkialle**

- **Globaalin toimijan on hallittava kaikki toimintamoodit**

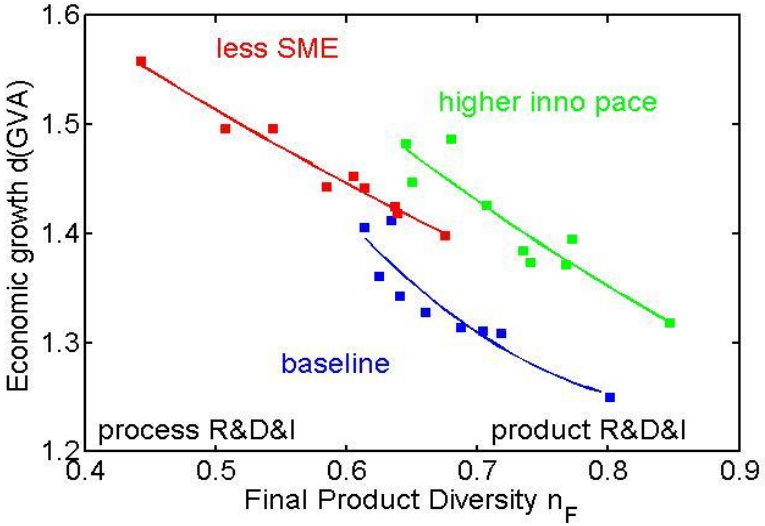
Viennin rakenne

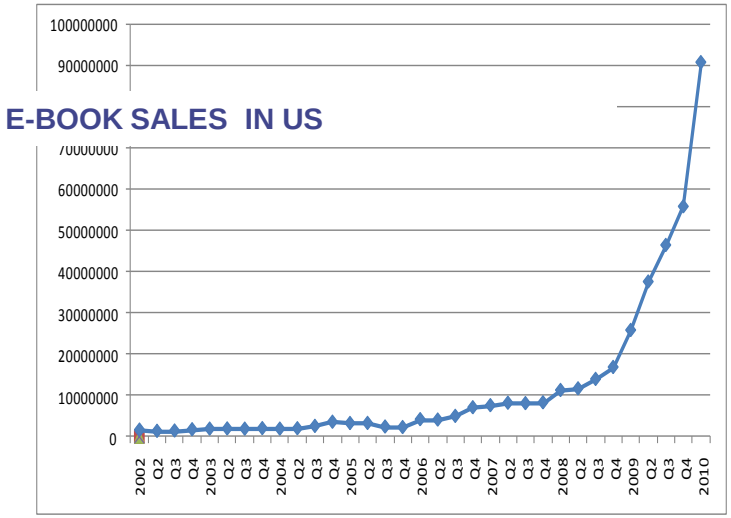
- **Moninaisuus tuottaa myös kasvua**

Globaali metsäteollisuus
> Joustava portfolio: seka massa-tuotantoa etta räätälöityja bisneksiä

- **Kestava portfolio on moni-muotoinen, myös toimintatavoiltaan**

Rytmi ja ajoitus





http://www.publishers.org/main/IndustryStats/documents/S12008Final.pdf

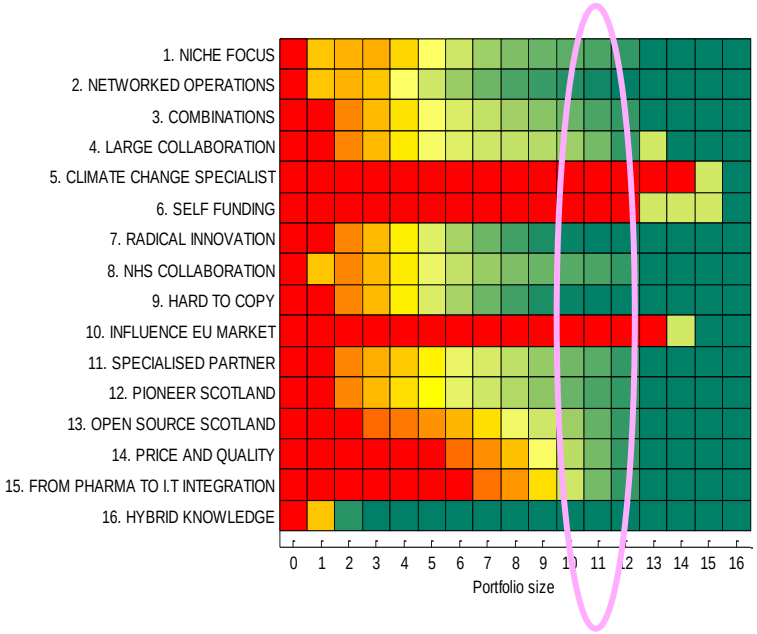
Viestintäteknologiasektori

- **Mita kovemmat innovaatiovaatimukset, sitä parempi**
- **Tietoinen fokus erilaisille nopean rytmin innovaatiomarkkinoille**

Painetun viestinnän digitalisoituminen

- **Ekosysteemin rakentaminen vie aikaa**
- **Jos kasvua halutaan ei kannata olla pioneeri**

Epävarmuus ei uhka, vaan menestystekijä



Portfolio

	Core	Contingent
New	**Radical Innov.** **Networked operations** Specialized partner Open source Scotland	Climate change specialist Influence EU market Self funding
Current	**Hard to Copy** **Hybrid knowledge** Niche Focus NHS collaboration Combinations Pioneer Scotland	Large collaboration IT integration Price and quality

Globaali metsateollisuus, Skotlannin Food&Drink ja Life Scences

- **Epavarmuuksien systemaattinen analyysi tuottaa joustavuutta**

- **Haasteena ei ole riskien minimointi vaan mahdollisuuksien maksimointi!**

Miten menestytään yllätysten maailmassa?
AUTOMAATTINEN SOPEUTUMINEN

Rakenne

- Kansallinen portfolio: painopistealueista diversifiointiin
- Suurteollisuudesta ekosysteemeihin
- Massatuotannosta pienten erilaisten bisnesten portfolioon

Ohjaus

- Fokusoidusta strategiasta syklin mukaiseen toimintaan

Oikeat valinnat

- Investoinnit? - Koulutus? - Tuotantorakenne?

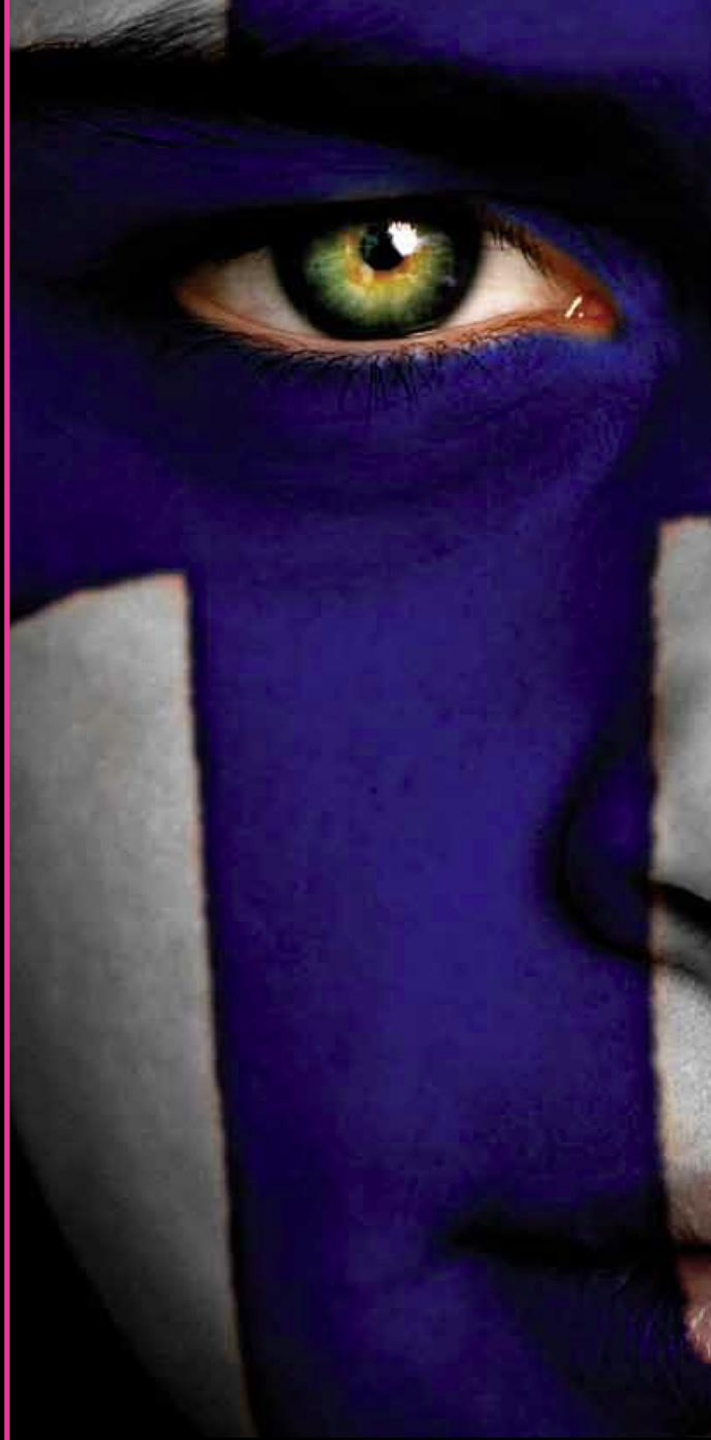
Miten menestytään yllätysten maailmassa? KASVU

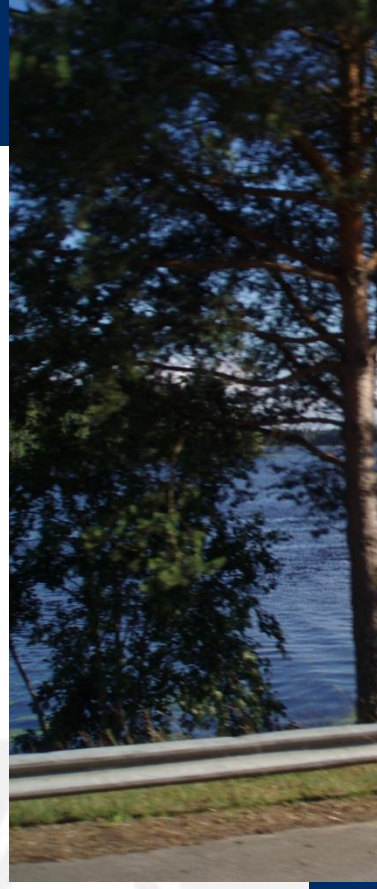
- Nopeus
  - Tilastoista toimintaympäristön seurantaa
  - Muutoksen hidastamisesta innovaatiovauhdin (ja konkurssien) suosimiseen
  - Teknologiainnovaatioista nopeaan vanhan ja uuden kombinointiin
- Kompleksisuus
  - Kombinaatiot (perustutkimus)
  - Monimuotoinen rakenne
  - Julkisen ja yksityisen sektorin yhteinen tarjoama vientimarkkinoille
- Lyhytaikainen kasvu
  - Resurssien uudelleen allokointi

Extreme Events

Future trends

Professor
Markku Wilenius
Finland Futures Research Centre
Turku University





Future Trends

GAME CHANGERS SEMINAR

Hotel Kämp June 15, 2011

Prof Markku Wilenius
University of Turku
Finland

Two fundamental questions

Is there something called progress?

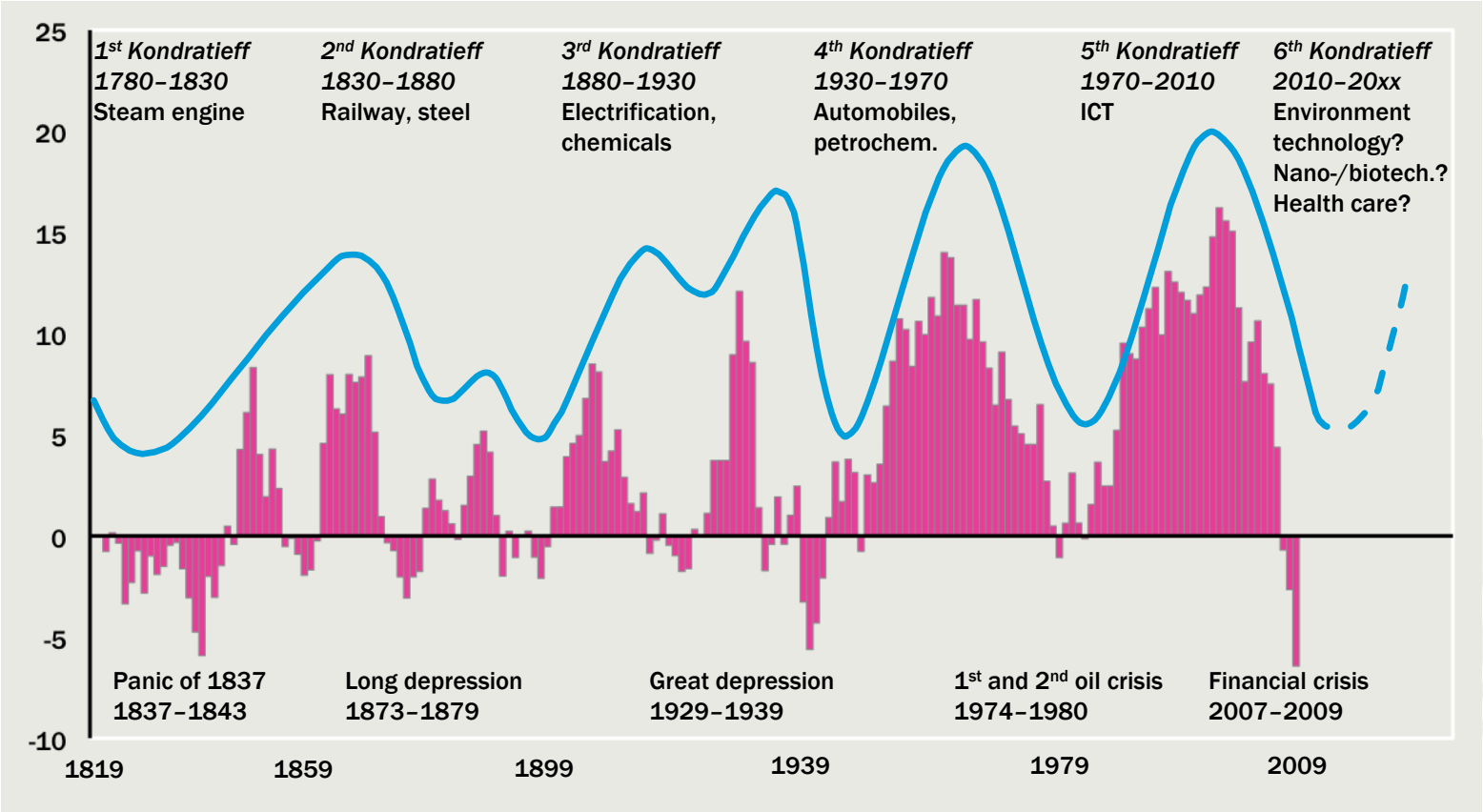
Is a trend but a reflection of collective consiousness?

I am required by law to tell you that everything you ordered today may be harmful to your health.

To understand changes in our socio-economic system, we need to see the patterns…

Modern economies fluctuate in a cycle of 40–60 years

Rolling 10-year yields of the Standard & Poors 500 equity index and the Kondratieff's waves

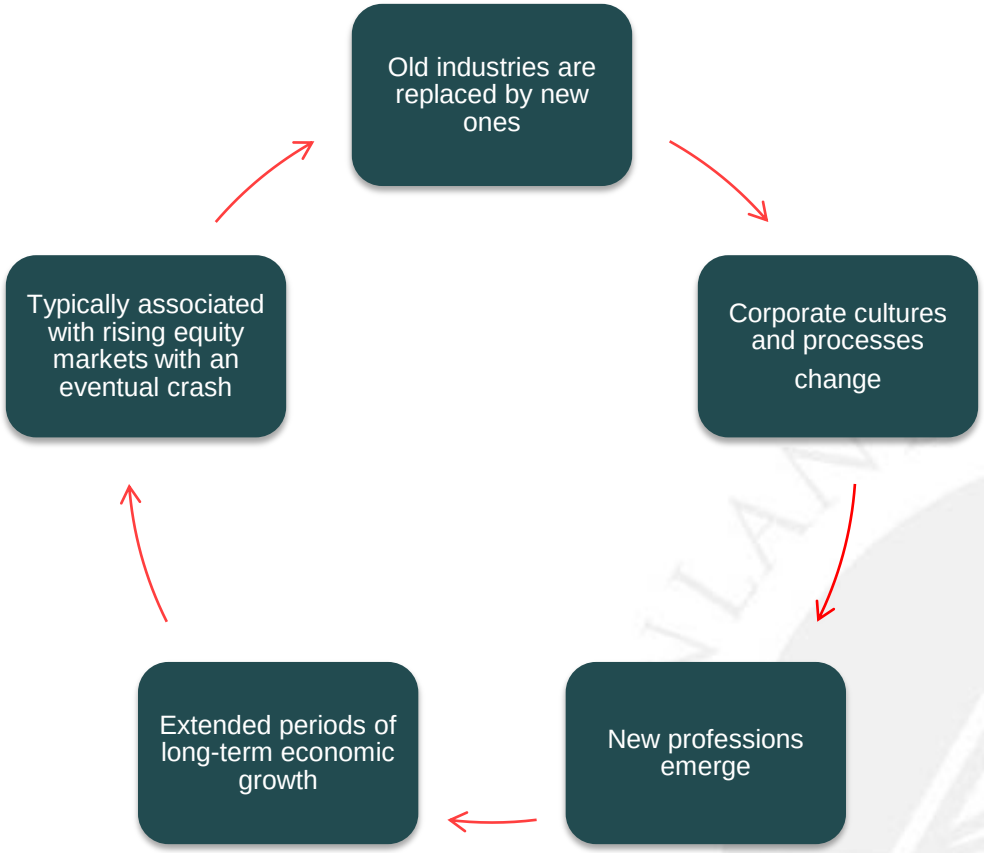


Trajectories for a new cycle: exhaust of old innovation, excess financial capital, severe recession, social change…

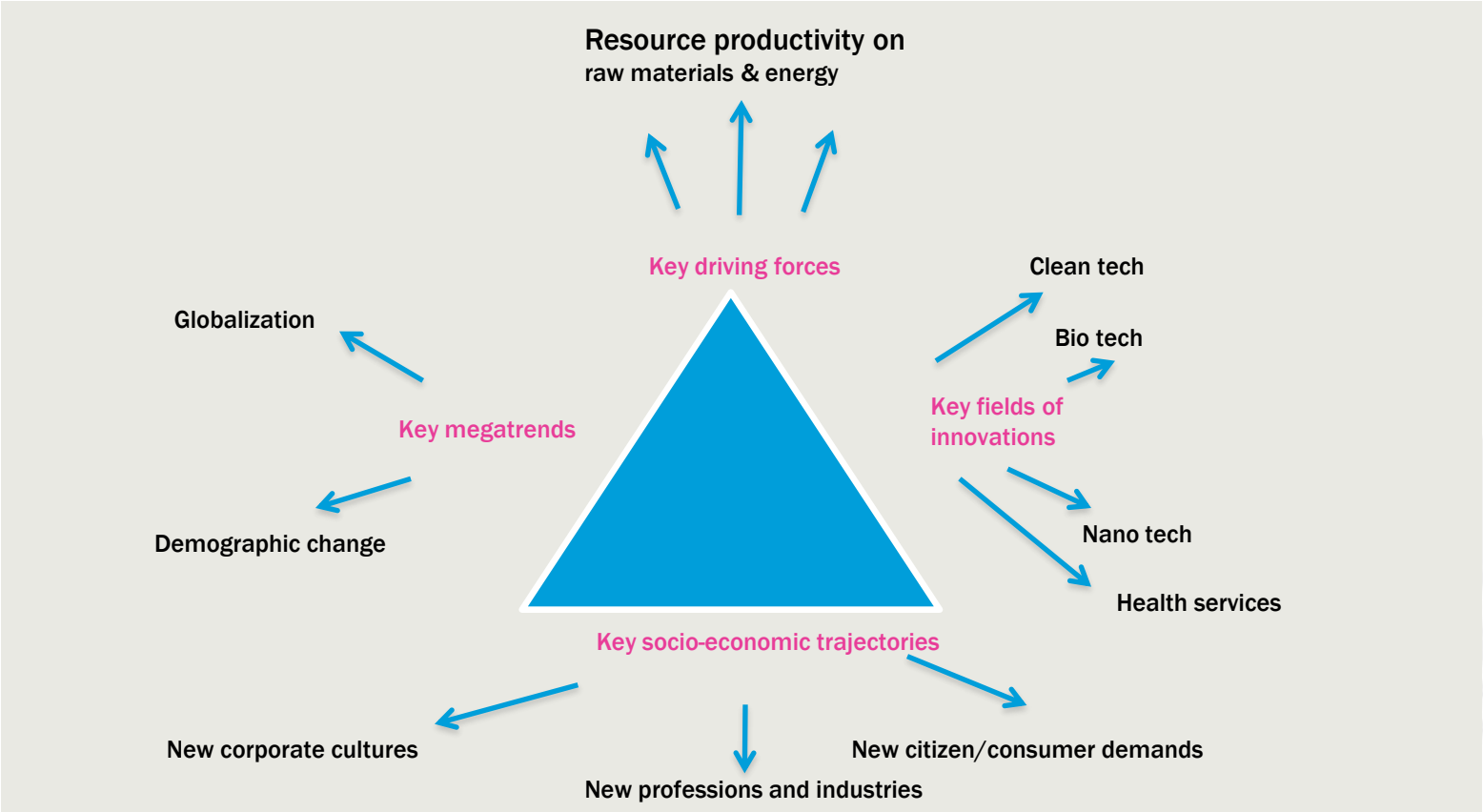
Data source: Datastream. Allianz Global Investors Capital Market Analysis.

Casti–Ilmola–Rouvinen–Wilenius 2011: Extreme Events. Xevents.fi/Xevents.pdf

Factors for each wave

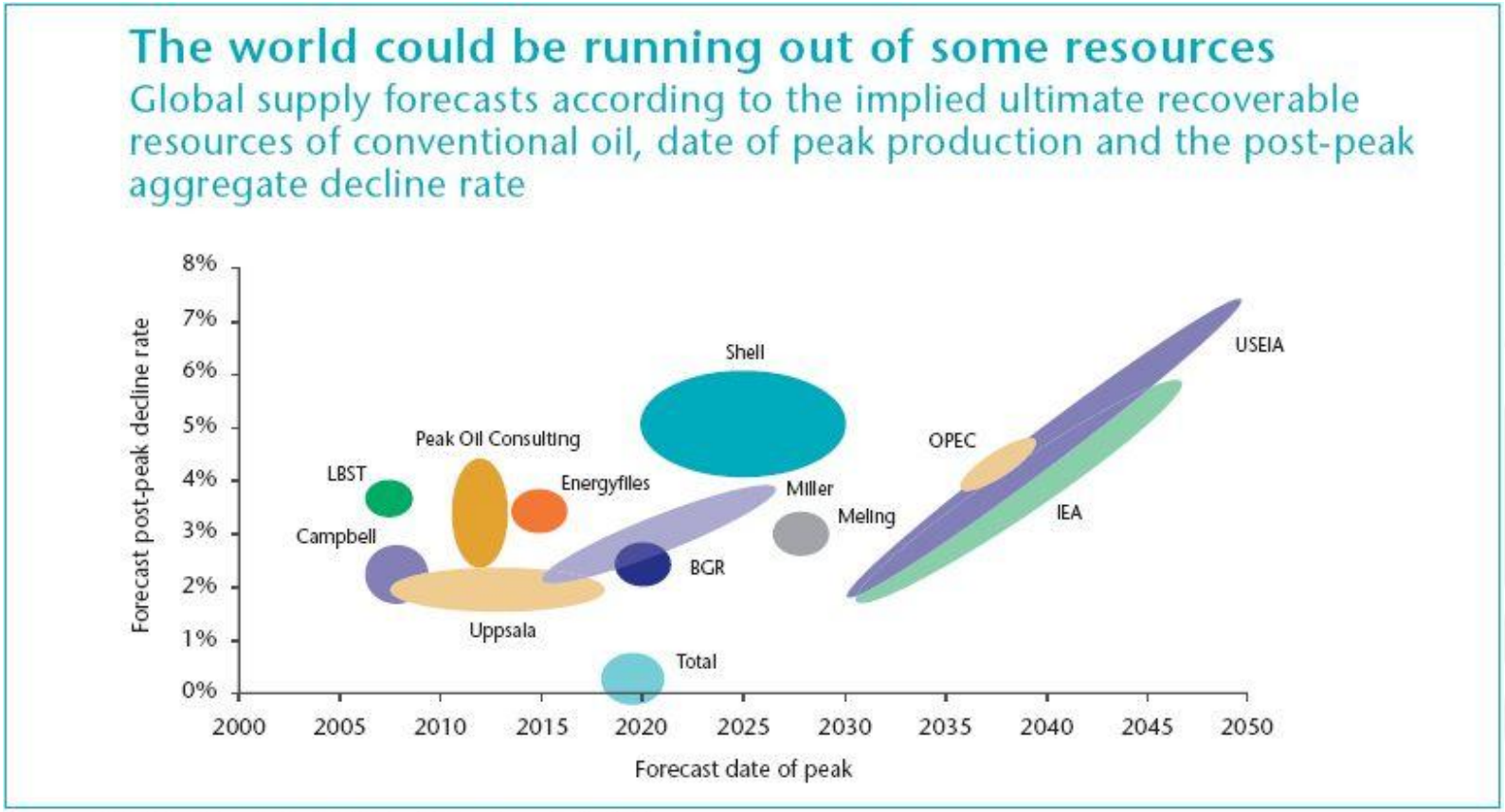


The implications of the 6th wave



Source: Casti–Ilmola–Rouvinen–Wilenius 2011: Extreme Events. Xevents.fi/Xevents.pdf

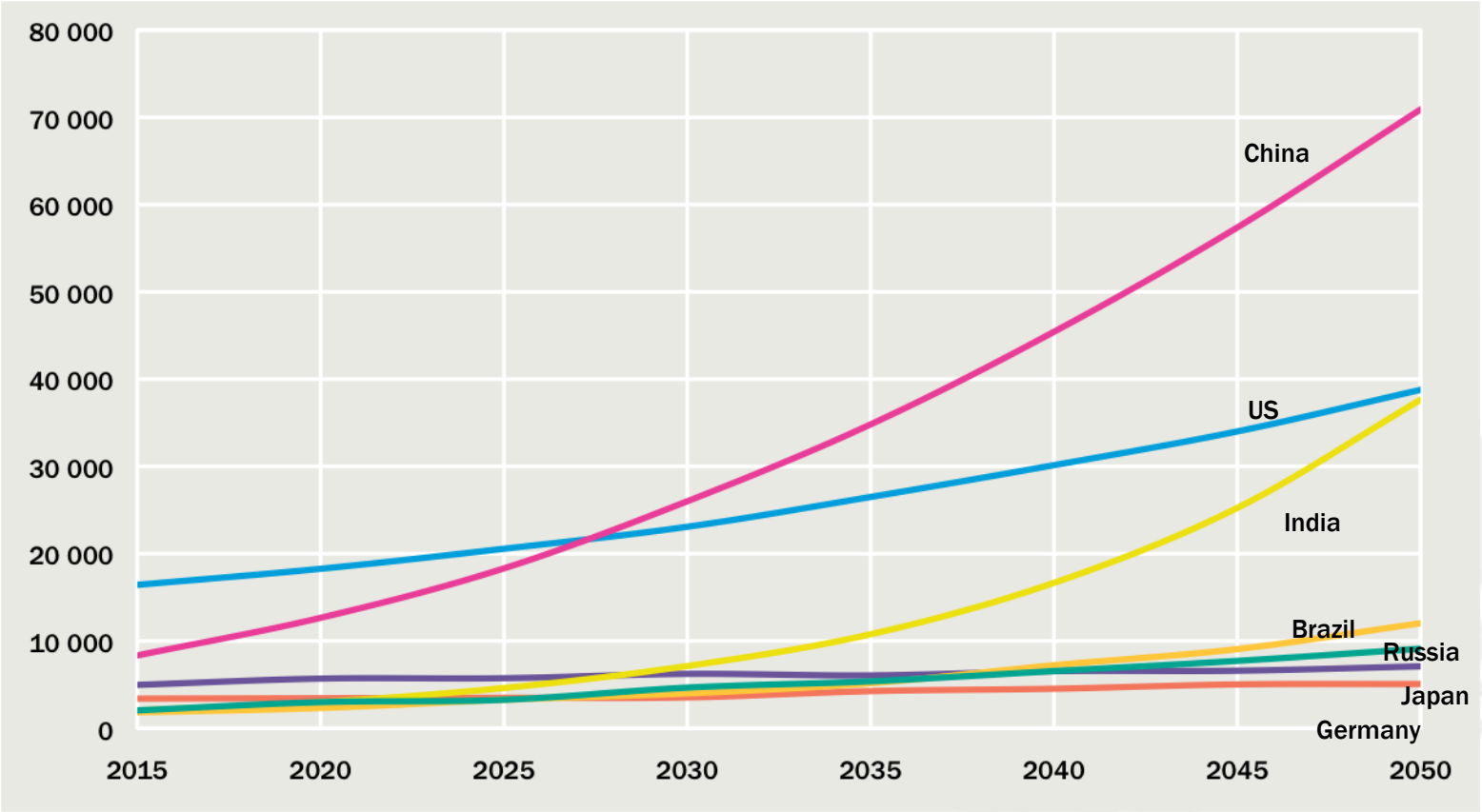
Peak oil: one factor behind resource productivity increase demand…



Source: UKERC, *The Global Oil Depletion Report*, 2009

Globalization: how much turbulence behind this development?

GDP forecasts for selected economies, 2015–2050, billions of US$

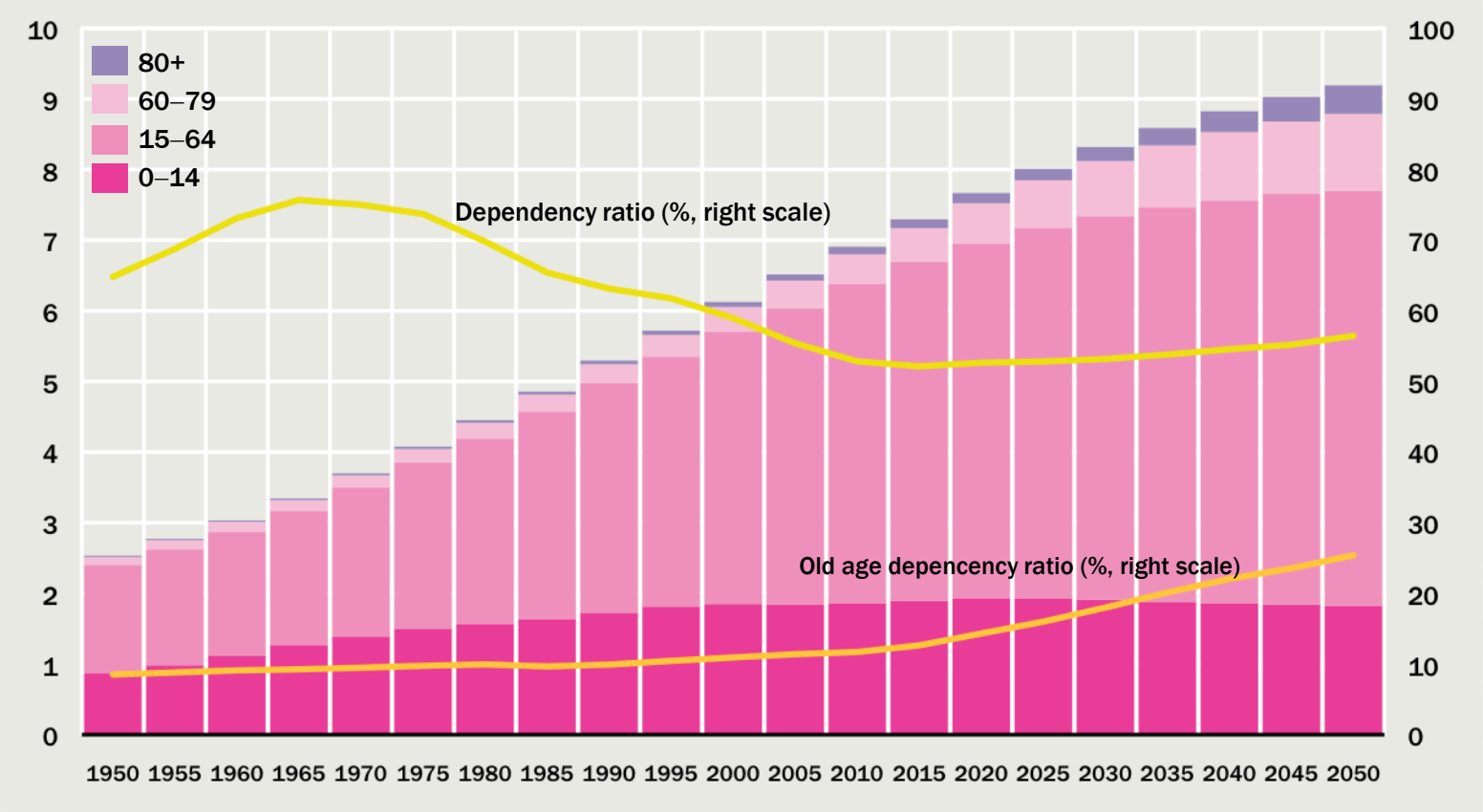


Source: Goldman Sachs.

Casti–Ilmola–Rouvinen–Wilenius 2011: Extreme Events. Xevents.fi/Xevents.pdf

Demographic change: Population growth, longevity and aging are the key issues for the next wave

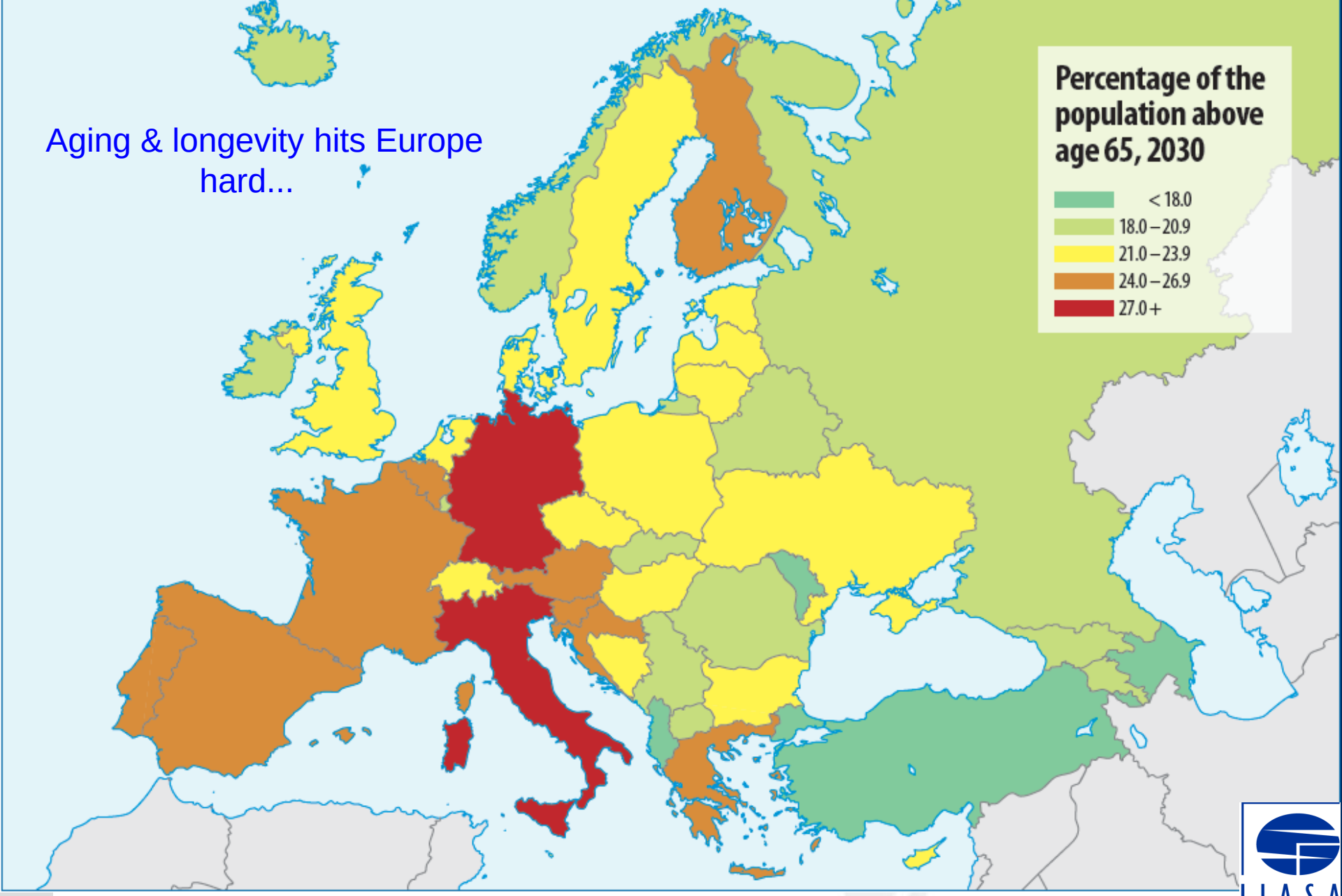
Development of world population, billions of persons



Sources: UN Department of Economic and Social Affairs, Allianz SE.

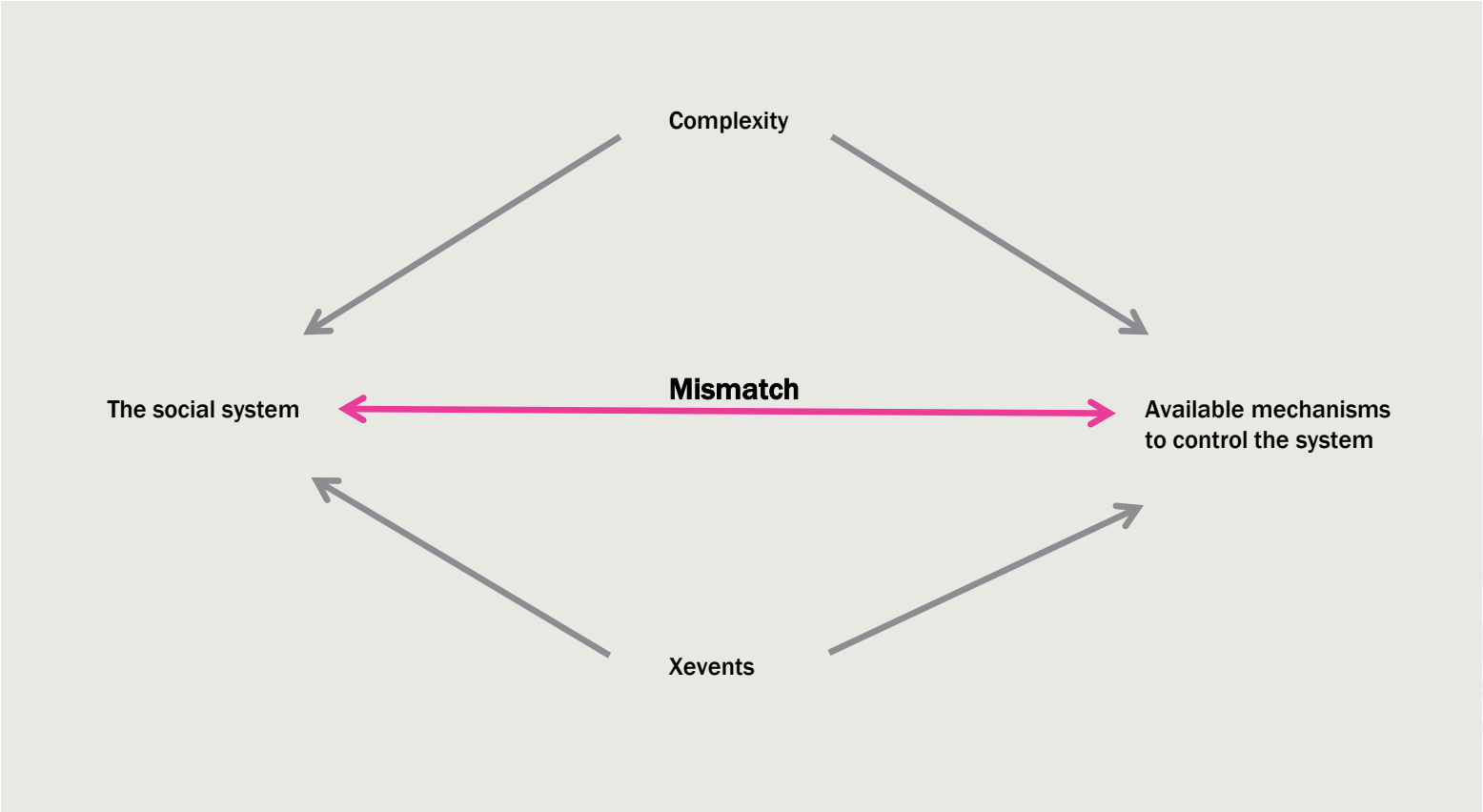
Casti–Ilmola–Rouvinen–Wilenius 2011: Extreme Events. Xevents.fi/Xevents.pdf

Aging & longevity hits Europe hard...



Source: Prof. Wolfgang Lutz/Global Education Trend scenario, World Population Program, IIASA 2009

Typical for the next Kondratieff cycle 2010-2050: mismatch between the system's complexity and its control mechanisms



Source: Casti–Ilmola–Rouvinen–Wilenius 2011: Extreme Events. Xevents.fi/Xevents.pdf

And surprises are incresingly available particularly for those who think they know…

"I think there is a world market for maybe five computers."

-- Thomas Watson, chairman of IBM, 1943

"Heavier-than-air flying machines are impossible."

-- Lord Kelvin, president, Royal Society, 1895.

"Drill for oil? You mean drill into the ground to try and find oil? You're crazy."

-- Drillers who Edwin L. Drake tried to enlist to his project to drill for oil in 1859.

"Who the h_ll wants to hear actors talk?"

-- H.M. Warner, Warner Brothers, 1927.

"There is no reason anyone would want a computer in their home."

-- Ken Olson, president, chairman and founder of Digital Equipment Corp., 1977

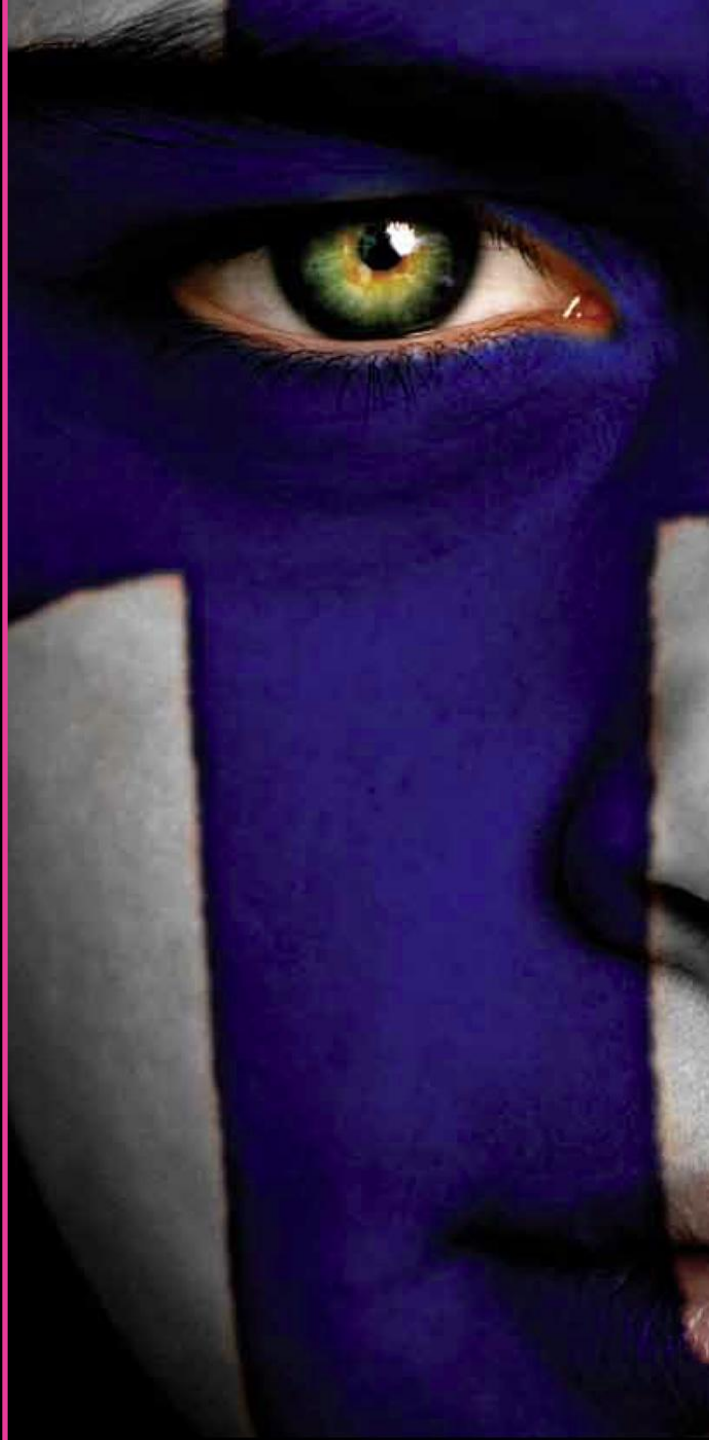
Thanks for your attention

markku.wilenius@tse.fi

Extreme Events

Game Changers & Surprises (Xevents)

Senior Research Scholar
John **Casti**
IIASA



Game Changers and Surprises (Xevents)

John L. Casti

Helsinki, June 15, 2011

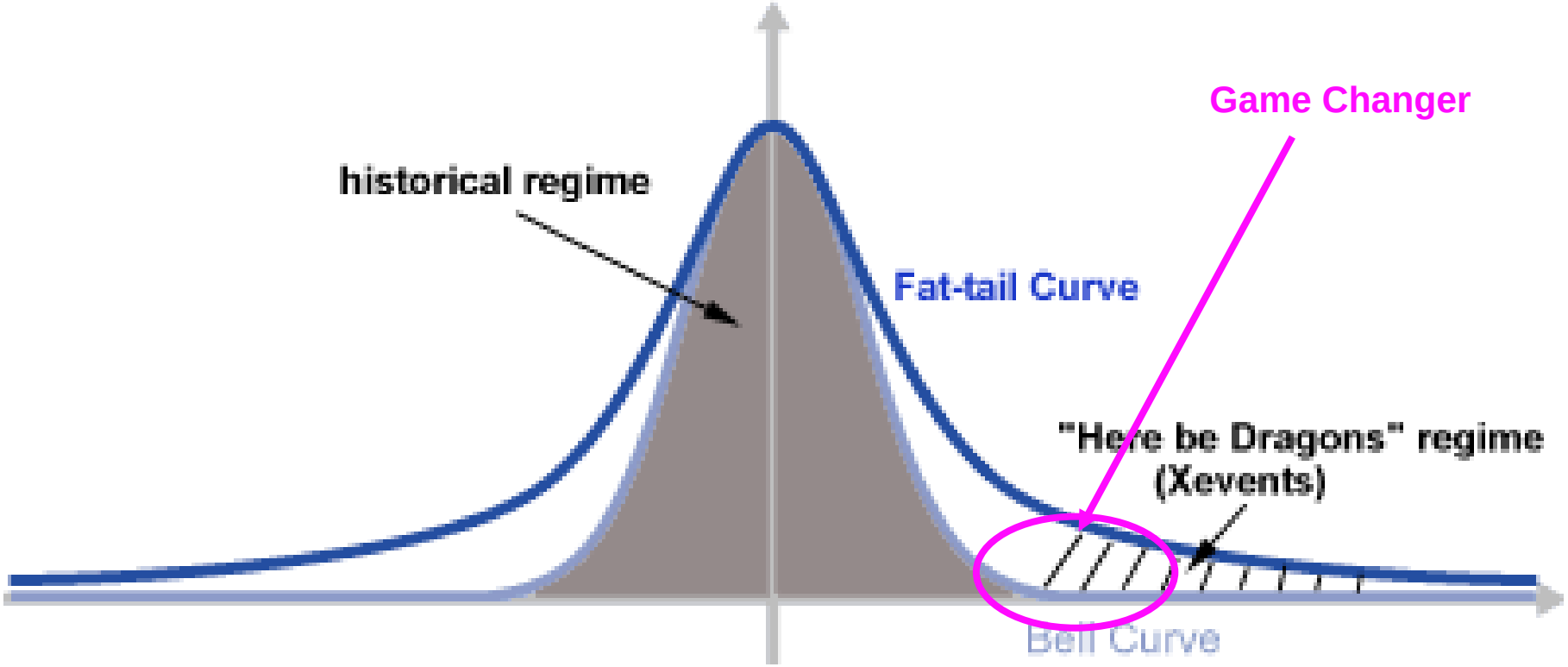
Some "Ex-Xevents"

- Financial system crash September 2008
- Fall of the Berlin Wall 1989
- A virulent strain of a new virus jumps to humans in Hong Kong, sweeps across Asia, and ends up killing more than fifty million people
- 9/11 attack on the World Trade Center
- Bees around the world begin dying off in massive numbers, interfering with pollination of plants worldwide and precipitating a global food shortage
- An Ice Age
- Japan's devastation by a magnitude 9.0 earthquake in March 2011

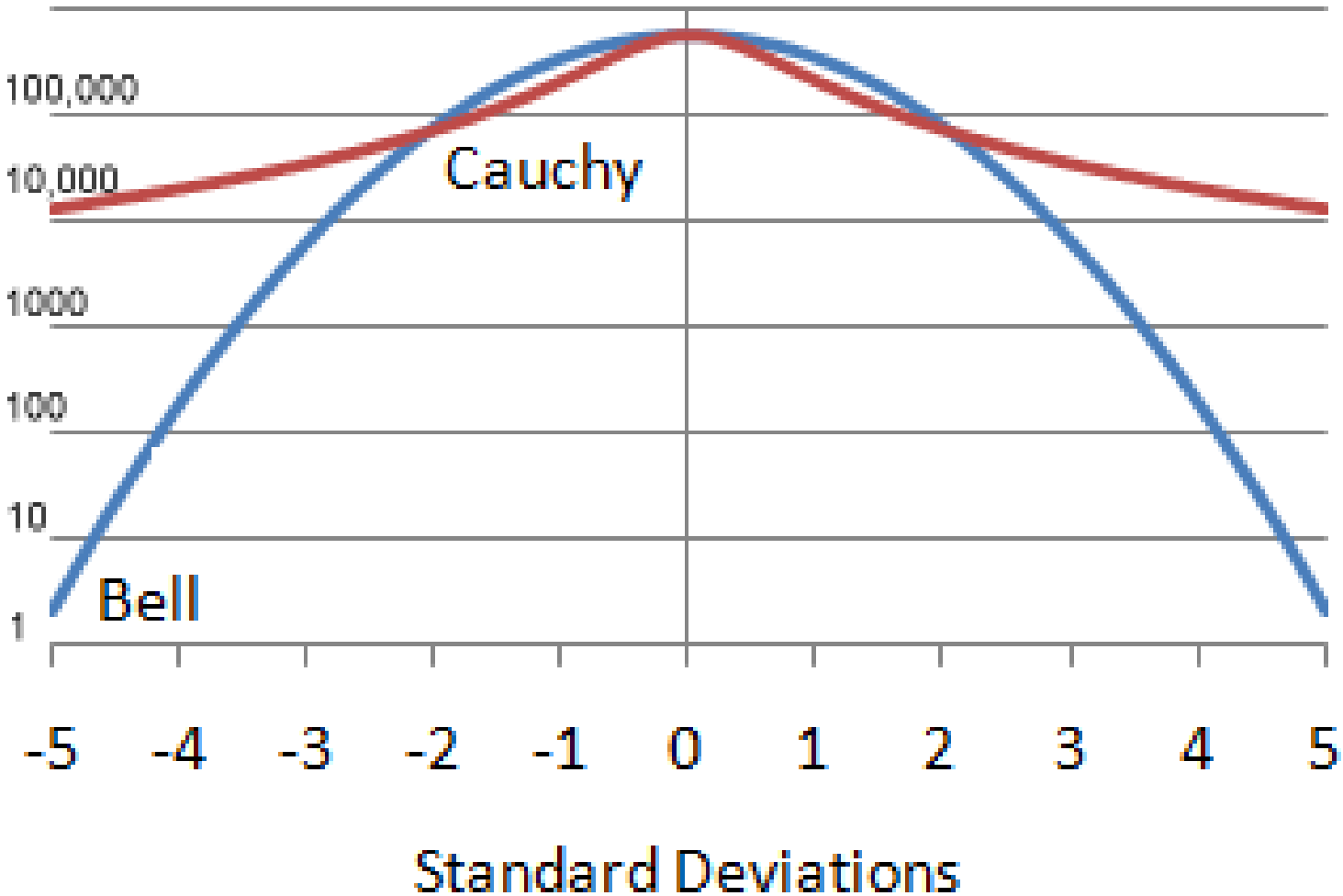
A Xevent is

- Rare
- ***Surprising***
- High impact on human society
- Caused by nature or ***humans***

The Tale of the Fat Tail-I



The Tale of the Fat Tail-II



The Ugly Swan Paradox

- Surprises ***always*** happen
- No ***specific*** surprise ever happens

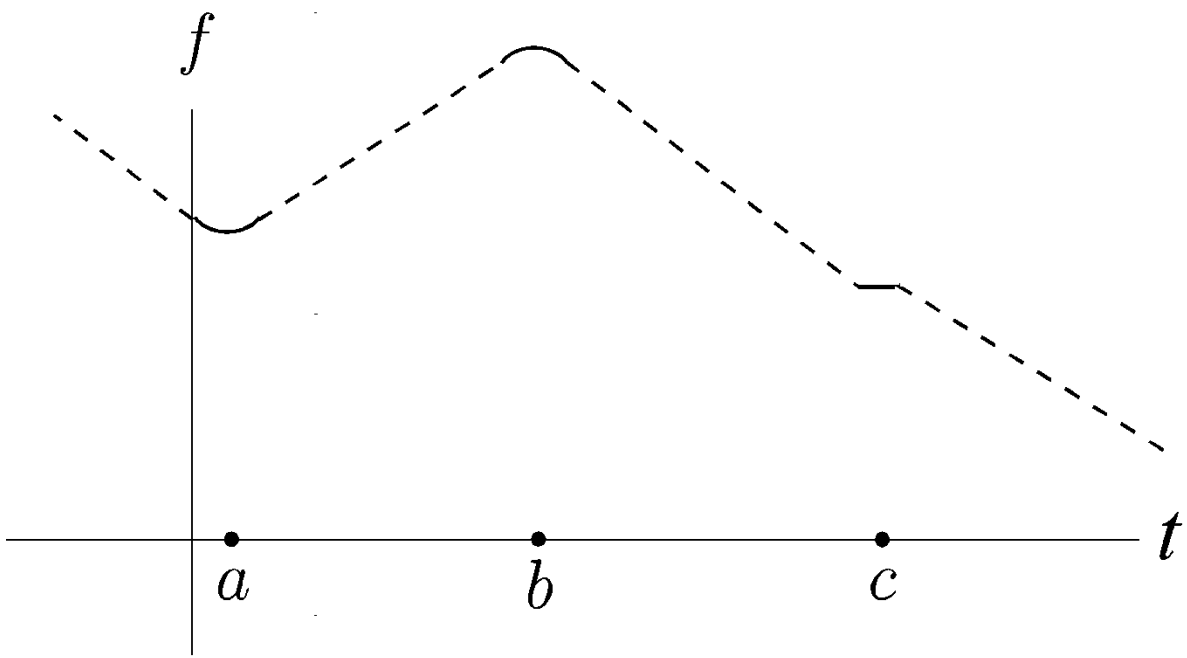
Why Xevents are important

- dramatic, unexpected change ("flip") or discontinuity ("jump") in trend
- a problem or an opportunity

> wild cards of strategic planning (Game Changers)

Xevents and Turning Points

Xevent ≈ "sharp" turning point ⇒ surprise ⇒ risk (or opportunity)!



XEvents in Human Society

Dynamics of shocks and their impact on human systems

- How can we anticipate the turning points of trends, and when these turns will trigger system shocks?
- How are we able to identify early-warning signals for the “danger zone” of Unknown Unknowns?

Conceptual Areas

Early-Warning Signals
- Horizon scanning

Anticipation
- Signal verification

Forecasting
- Likelihood of unlikely events
- Theory of surprise

Trends

Extreme Risk Analysis
- How to find "turning points"
- How social mood biases events
- New forms of insurance

Modeling
- New Scenario Methods
- Agent-based simulation to generate "missing" data

DISCUSSION

WHAT IS RELEVANT FOR FINLAND?

Big Questions

Are we already seeing weak signals of a paradigm shift in the world economy that are increasing social tensions? What if they intensify?

Are we facing another period of turmoil preceded by an economic depression or "great recession"?

Are we too comfortable today in the belief that the global economy will soon wake up from its recent nightmare and things will return to "normal"?

What are potential sources of economic growth in a volatile environment? Where do we find the sources of well being for the future?

We know the trend, but when it will (re)turn to strong growth?

Climate change will cause imbalances into economy, financial system and social system – are we able to better understand these changes?

We know that the transition will mean changes in the power structure – what are the alternatives?

Public support/subsidies are needed for regional development, but will this only delay the creative destruction required for reconfiguration of economies?

Which alternative is a more efficient structure for growth– few clusters or a wide diversity of small enterprises?

How can we identify key uncertainties and collect the weak signs of change in the investment market?

Turning Points and Methods

Turning points

How to identify key uncertainties and collect the weak signs of change in the investment market?

Are we already seeing weak signals of a paradigm shift in the world economy that is increasing social tensions? What if they intensify?

We know the trend, but we do not when it will turn to strong growth.

We are now in the turning point (of globalization) - what is typical for the future?

Are we in for another period of turmoil that was preceded by an economic depression or "great recession" as they nowadays call them?

We know that the transition will mean also change in the power structure – what are the alternatives?

Early-Warning Signals
Horizon scanning

Anticipation
Signal verification

Forecasting
Likelihood of unlikely events
Theory of surprise

Trends
How to find "turning points"

Extreme Risk Analysis
How social mood biases events
New forms of insurance

Modeling
New scenario methods. Agent-based simulation to generate "missing" data

Complexity and Methods

The nature of complexity

What are the potential sources of the growth in a volatile environment?

Where do we find the sources of well being for the future?

Climate change will cause imbalancies into economy, financial system and social system – are we able to understand these better?

Are we too comfortable today in our common belief that the global economy will soon wake up from its recent nightmare and things will be as usual again?

Public support/subsidies are needed for regional development, but will this only delay the creative destruction required?

Early-warning signals
Horizon scanning

Anticipation
Signal verification

Forecasting
Likelihood of unlikely events
Theory of surprise

Trends
How to find "turning points"

Extreme Risk Analysis
How social mood biases events
New forms of insurance

Modeling
Agent-based simulation to generate "missing" data
New scenario methods

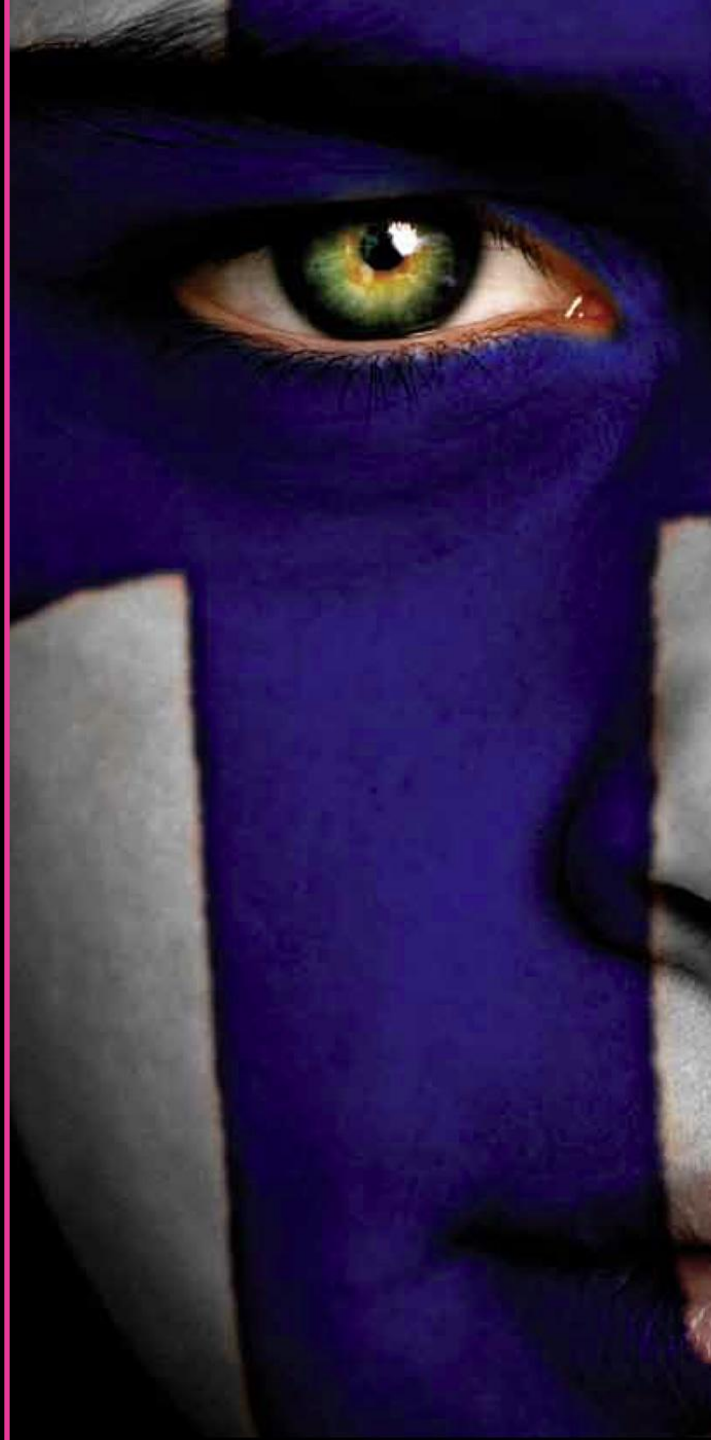
Extreme Events

Lessons from another small national economy: Scotland

Policy Manager
Richard **Rollison**

Policy Adviser
Katriona **Carmichael**

Scottish Government
Strategy & Economic Policy Division



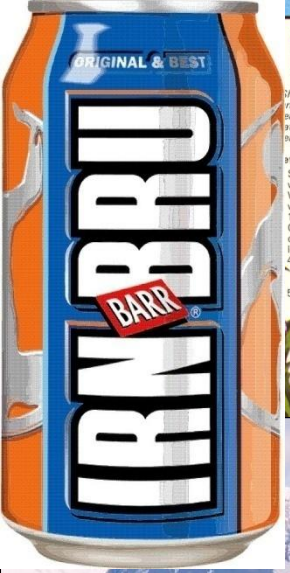
GAME CHANGERS AND SCOTLAND

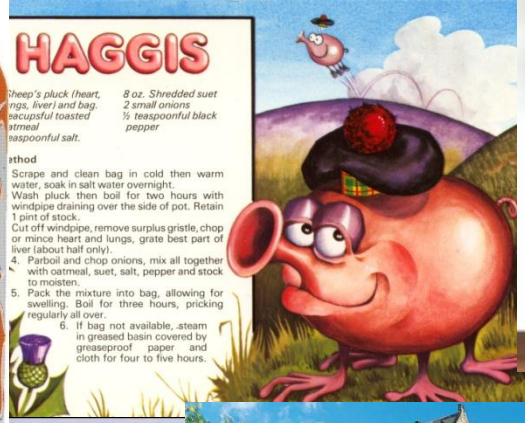
Richard Rollison & Katriona Carmichael

Strategy and Economic Policy Division

Scottish Government

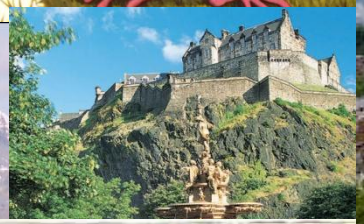
June 2011


ORIGINAL & BEST
IRN BRU
BARR


HAGGIS
Sheep's pluck (heart, lungs, liver) and bag.
Teacupsful toasted oatmeal
Teaspoonful salt.
8 oz. Shredded suet
2 small onions
½ teaspoonful black pepper
Method
Scrape and clean bag in cold then warm water, soak in salt water overnight.
Wash pluck then boil for two hours with windpipe draining over the side of pot. Retain 1 pint of stock.
Cut off windpipe, remove surplus gristle, chop or mince heart and lungs, grate best part of liver (about half only).
4. Parboil and chop onions, mix all together with oatmeal, suet, salt, pepper and stock to moisten.
5. Pack the mixture into bag, allowing for swelling. Boil for three hours, pricking regularly all over.
6. If bag not available, steam in greased basin covered by greaseproof paper and cloth for four to five hours.


CAOL ILA
OBAN
TALISKER


TIGER MOUNTAIN TIGER TOPS JUNGLE LODGE
ANOTHER CHIVAS LIFE EXPERIENCE
CHIVAS




GLASGOW2014
RYDER CUP
1927 2014


205536
The Royal Bank of Scotland plc
ONE POUND
STERLING
£1


MENU

Scottish Parliament - 1999

Reserved and Devolved Powers

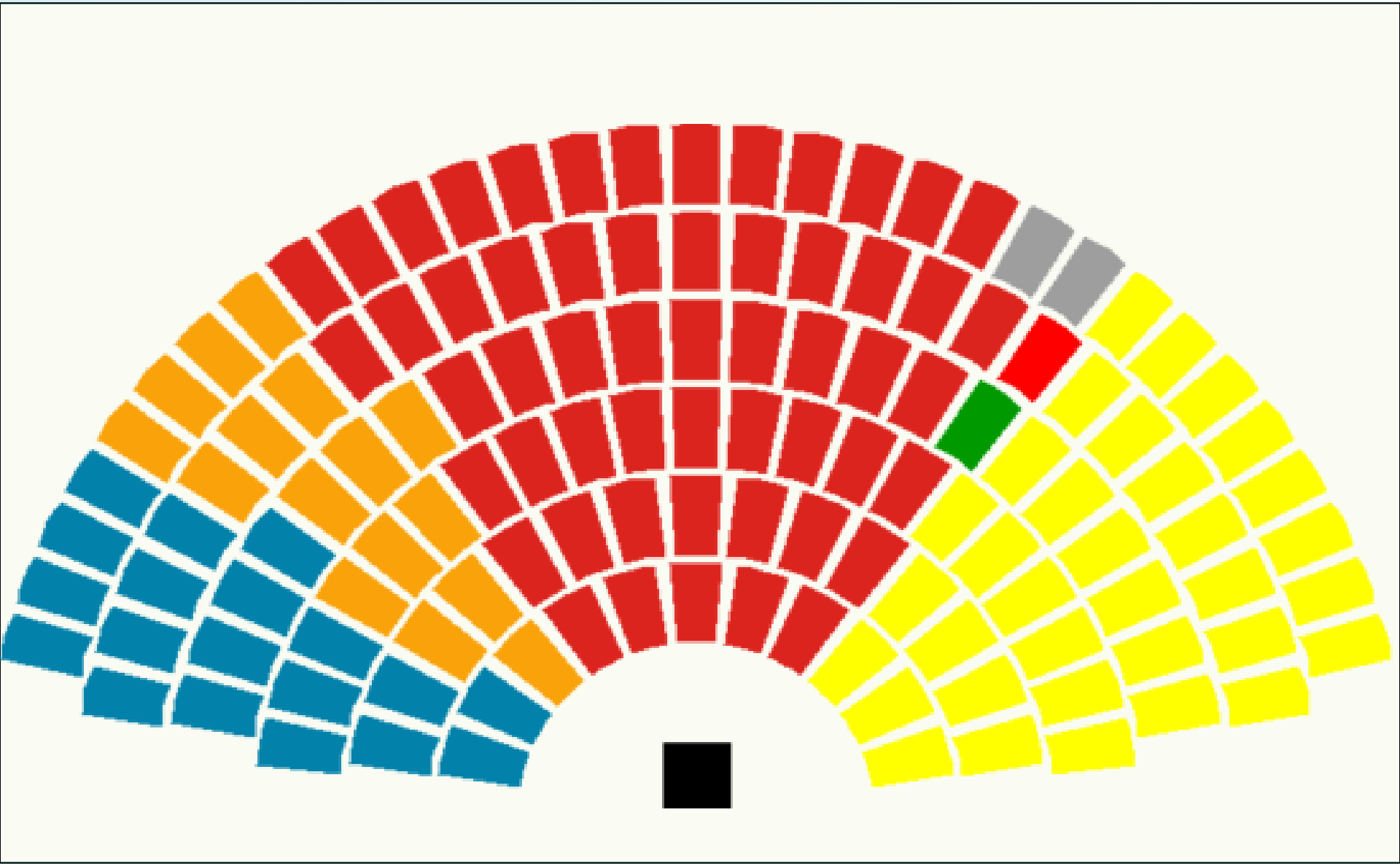
Reserved to the UK Parliament

- The Constitution
- Foreign affairs, defence and national security
- Macro-economic, fiscal, monetary policy
- Energy policy
- Transport safety and regulation
- Social Security

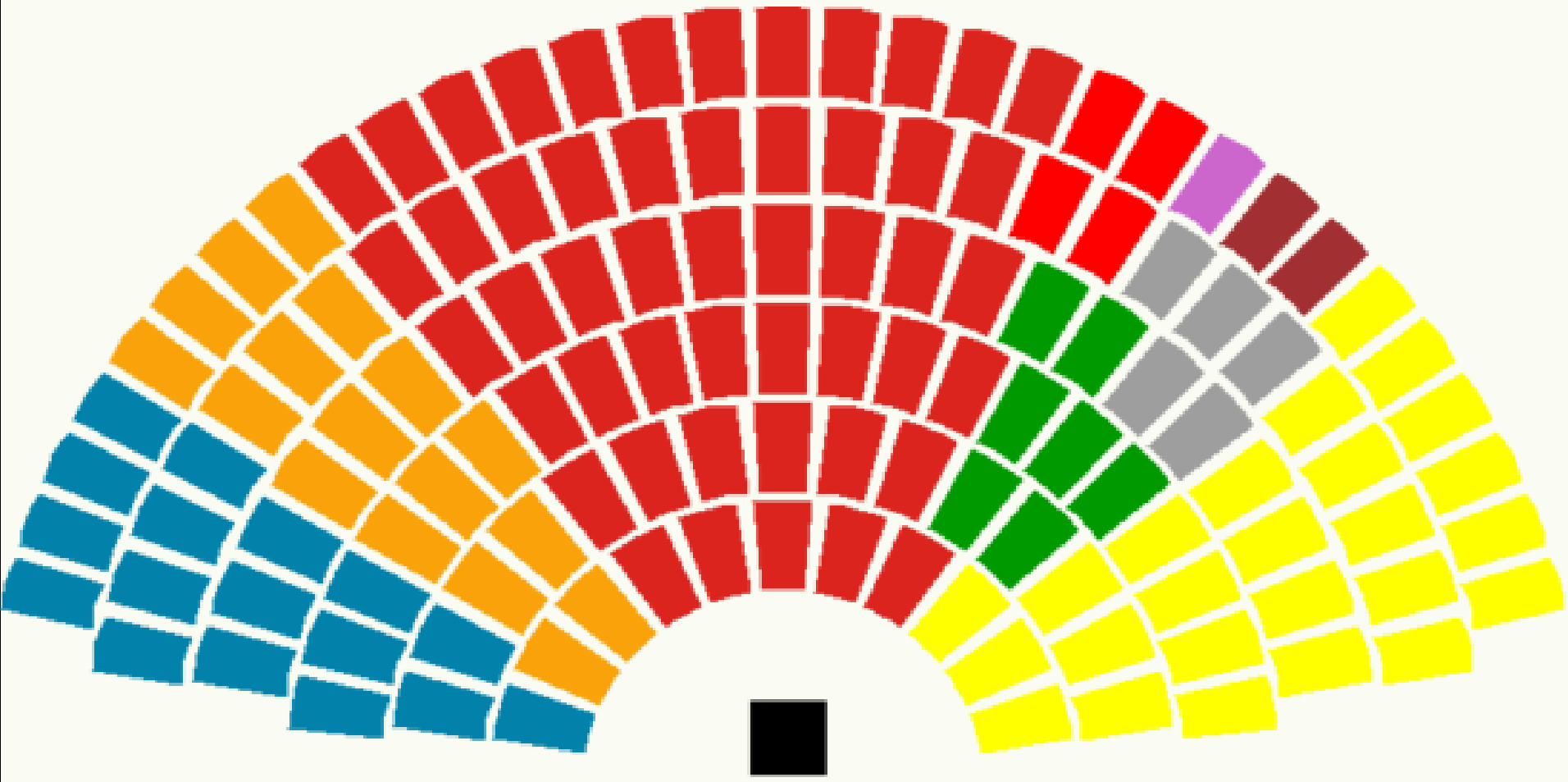
Devolved to the Scottish Parliament

- Health
- Housing and Social Care
- Justice and Social Inclusion
- Education, Skills and Vocational training
- Agriculture and Transport
- "Executive devolution"

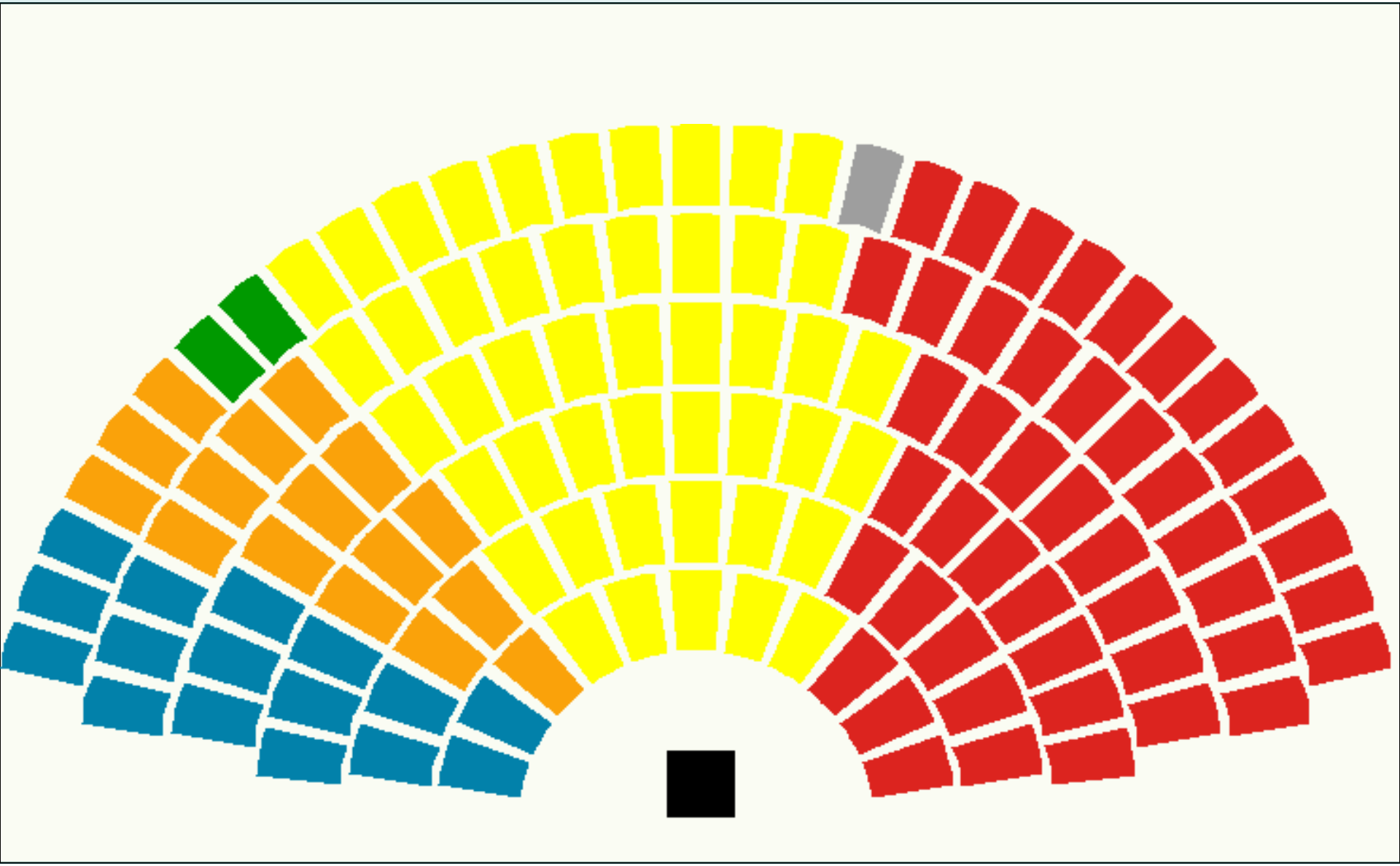
1st Scottish Parliament Election 1999



2nd Scottish Parliament Election 2003

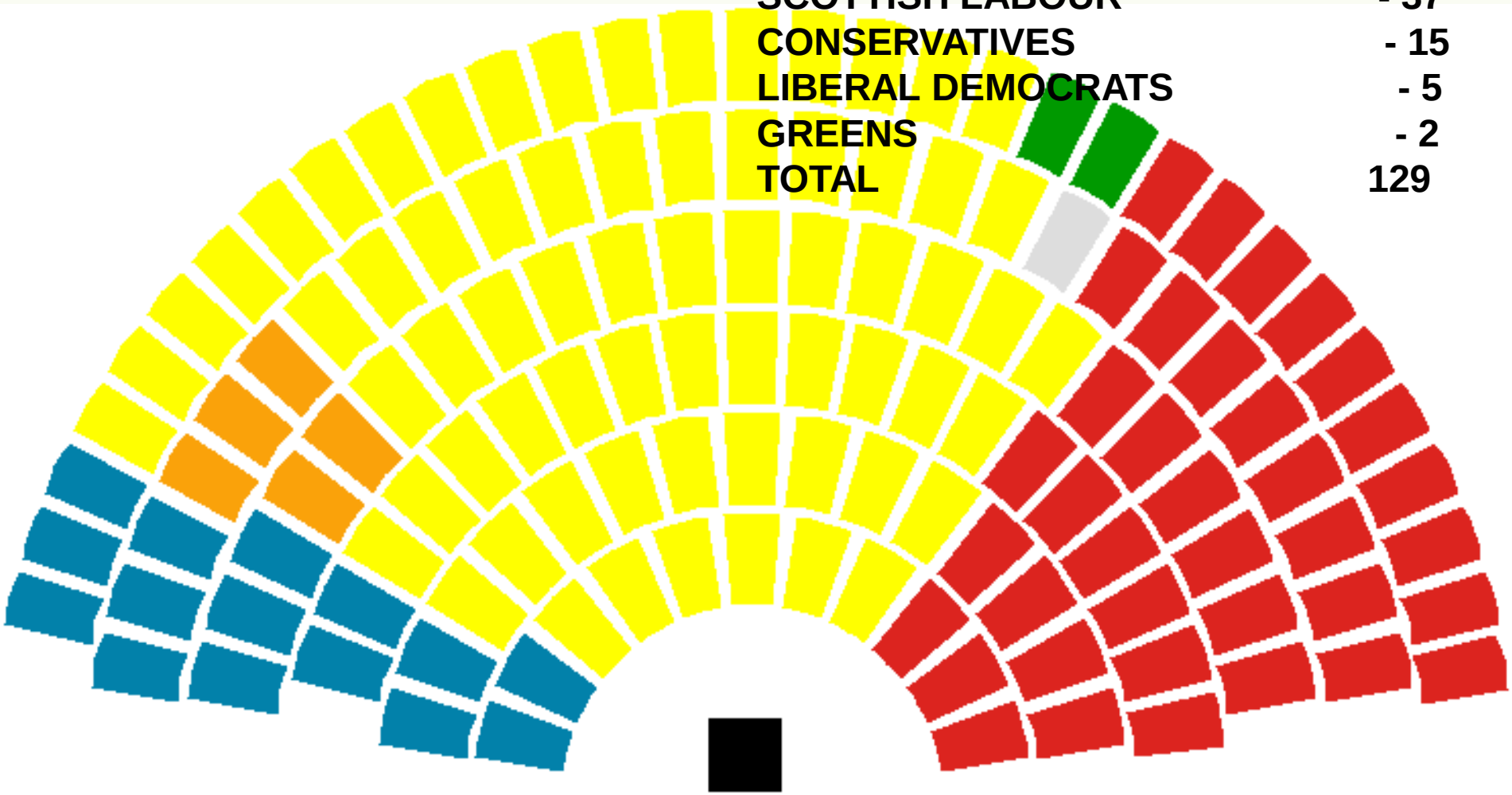


3rd Scottish Parliament Election 2007



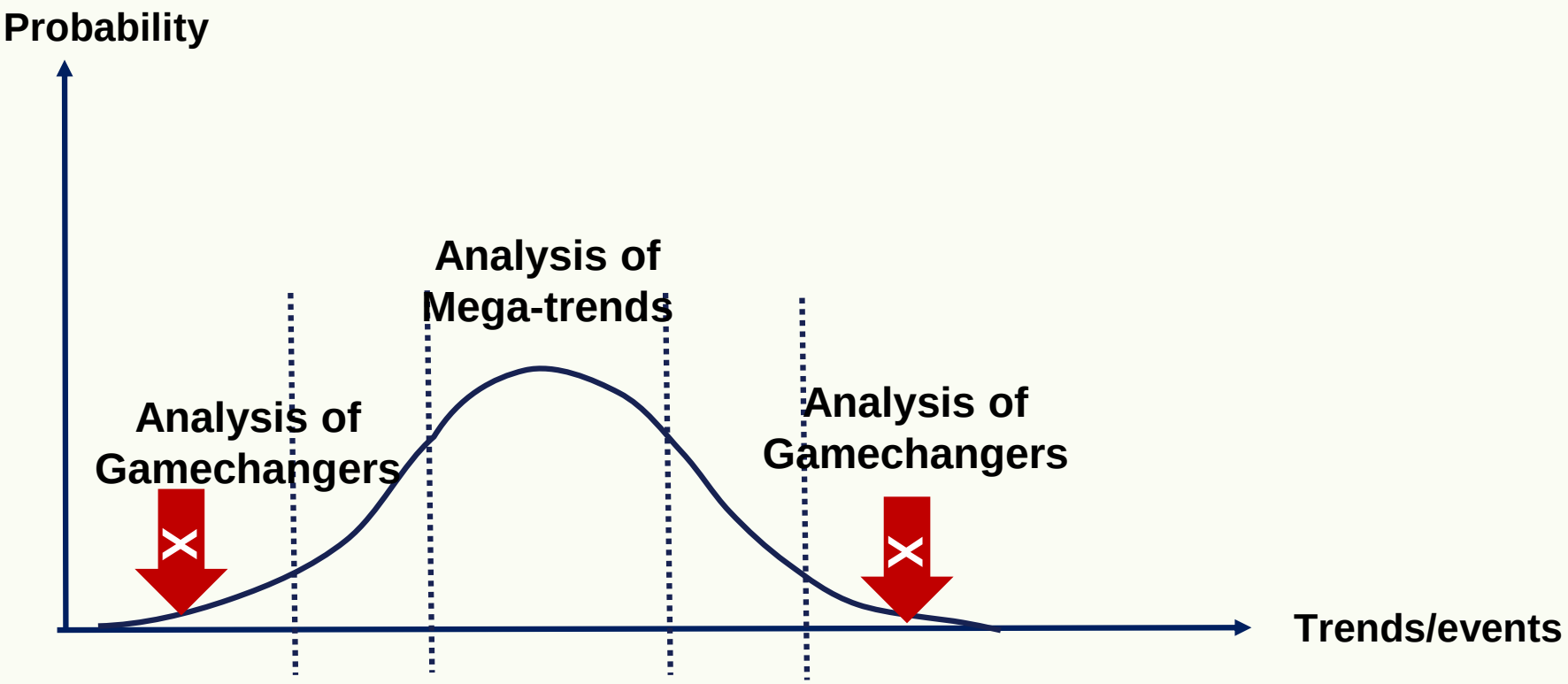
4th Scottish Parliament Election 2011

SCOTTISH NATIONAL PARTY	- 69
SCOTTISH LABOUR	- 37
CONSERVATIVES	- 15
LIBERAL DEMOCRATS	- 5
GREENS	- 2
TOTAL	129



Alex Salmond – First Minister

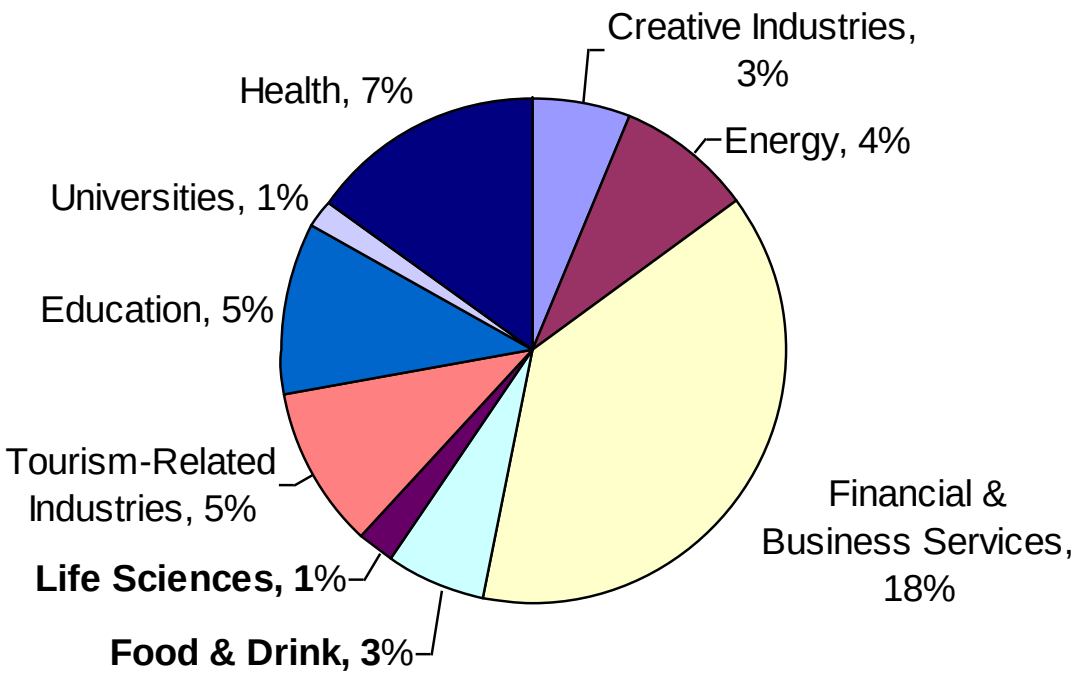
Planning for uncertainty



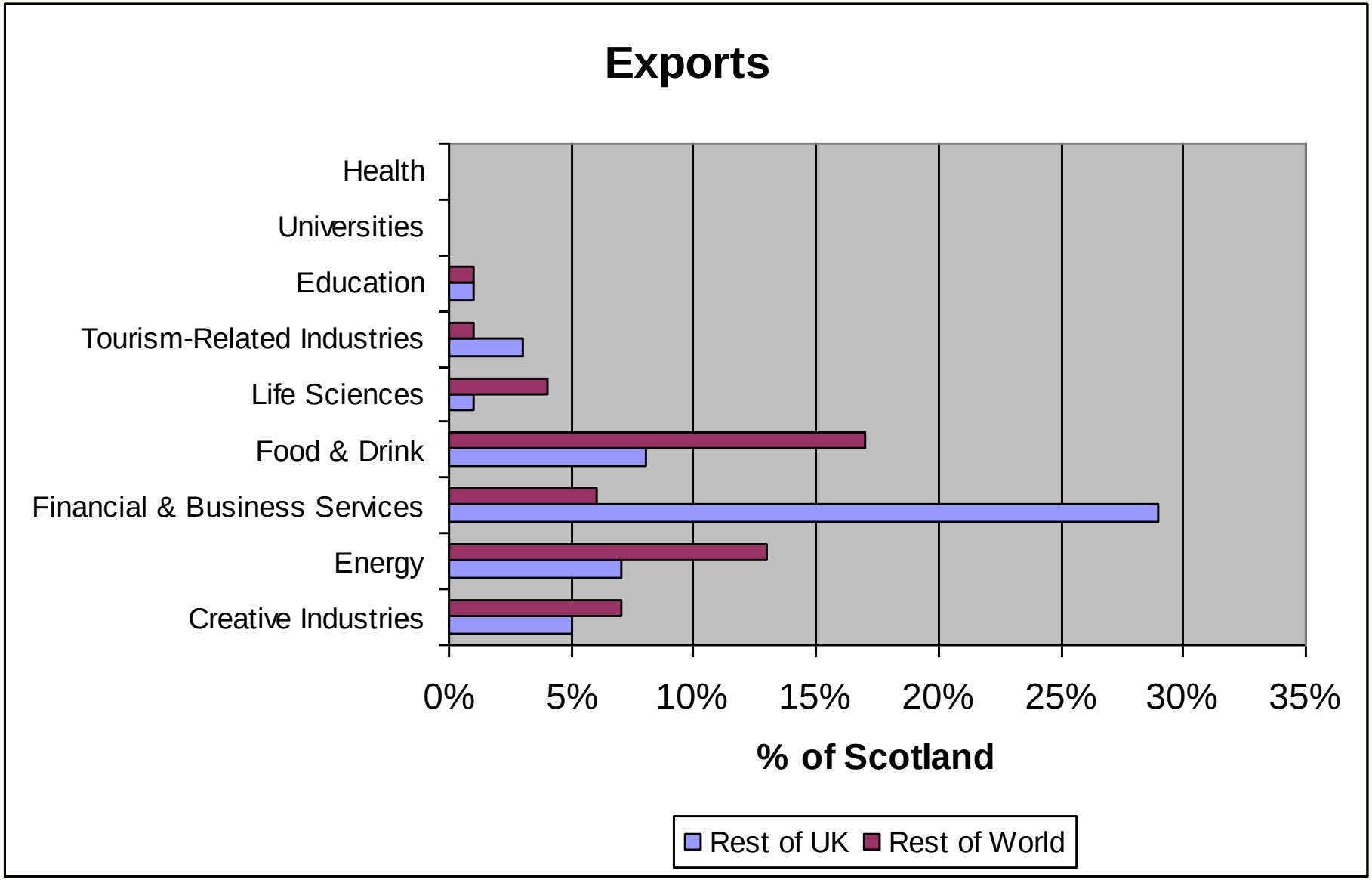
Why are Game Changers important to Scotland?

- Systems are increasingly connected and intertwined – shocks from change can be felt widely and quickly
- Small countries are more susceptible and exposed to these rapid changes
- But are also potentially agile and adaptable in response

Key Sectors – GDP (2007)



Key Sectors – Exports to UK and Rest of World (2007)



Life Sciences Sector

- **Small but growing sector – fragmented subsectors:** biotechnology and pharmaceutical companies, contract research organisations, medical device and diagnostic companies, specialist suppliers and support organisations.

- **Strong (but unconnected) assets – R&D, population, skilled workforce**

- **Key issues – rates of commercialisation, lack of production, low levels of venture capital investment**

Life Sciences: Game Changers

GLOBAL INTELLECTUAL PROPERTY RIGHTS (IPR)SYSTEM

Strong IPR: Patent regulation is very strong. Large corporations gather IPR, especially by acquiring innovative start-ups. New products require high investment inputs. Large corporations set the rules of the global market, others operate as subcontractors. Markets are divided among few brands, prices are stable and market behaviour is easy to predict.

Weak IPR" Open source rules. Plenty of small players and some coalitions. Technology emerges all around but there are not as many strong investors. No standards, but a position as a dominating technology is gained by fast development. Products are highly diversified with many small and radical innovations that compete with each other. Players are entering/exiting the market with a high frequency.

REGULATION

Large similarly regulated areas: Global and EU level regulation is strong with the same rules for all of the players in the homogenous market. It takes time and money for new innovations to be accepted by the regulatory authorities. Large corporations are the strongest players. Lobbying and collaboration with the public sector is essential. Global products and brands for specific market segments.

We set our own rules: Country level regulation generates small markets that differ from each other. Local companies/agents are the strongest players. Technology is customized according to market needs. Less investment in technology because the market potential is limited.

.

Life Sciences: Game Changers

ATTITUDES TO SCIENCE AND TECHNOLOGY

Trust: Technology solves many resource scarcity, aging and health problems. Consumers trust and believe in science and technology for general and niche needs. Large players are technology companies that invest heavily in research and innovation. Technology investments are increasingly attractive.

Mistrust: The shared opinion of science and technology is that it has failed and cannot be trusted. There have been some drug and medical scares and the internet is perceived as unreliable and unsafe. Players in this market are traditional companies; alternative health is strong; quality of life is important. Few investors. Small, low-tech innovations emerge.

GLOBAL COMPETITORS

Diversified: Many small, innovative Life Science companies all over the world. Technology development focused on small customer segments. Plenty of Venture Capital investment available. Different approaches, local products, radically different technologies applied. Low and high tech side by side. Dynamic structure with something happening all the time. Development and consolidation of new networks as well as new start-ups and specialization emerging.

Few power centres: Countries such as India, China and Brazil are investing heavily in Life Sciences through new large corporations funded/supported by government. There is fierce competition and strong political support for subsidies. A few dominant investment intensive technologies emerge. There are global brands and other players are subcontractors to the few leading companies. Markets are global not local.

Life Sciences: Game Changers

CLIMATE CHANGE

Catastrophes: Climate change is not managed and there are many small crises all over the world. Fulfilment of basic needs is the first priority; food, clean water, vaccinations for sick people. Resources are used for the clear-up of catastrophes. Governments and governmental health care are the leading agents. Focus on existing technologies, low tech drugs etc. with limited possibilities for developing radically new innovative products.

Relative advantage: Governments invest in the mitigation of the climate change. Climate change related technologies attract investors. Scotland benefits from climate change as water is a key asset for Life Sciences. New radical technologies emerge. Environmental and life science technology closely linked. Life Science plays major role in solving climate change related social, economical, health etc. problems.

Life Sciences: Efficient Portfolios

Game Changers and Life Sciences – Some Conclusions

- Advantage from uncertainty
- Success through collaboration
- Pioneer Scotland
- Uniqueness counts
- Hybrid solutions

Food and Drink Sector

- *Land of Food and Drink* - built on 3 key market opportunities (Premium, Health & Provenance)
- Diverse (and fragmented) – few large employers (e.g. Whisky), but mainly SMEs
- Competing priorities – exports vs. health vs. Local
- Influence of EU/UK regulation and subsidy

Food and Drink: Game Changers

Most likely

#3 "Rise of the consumer society in Asia": In China and India, middle classes grow considerably and their consumer spending power exceeds that of Europe and the US combined….

More likely

#1 "Healthy food only": Markets for unhealthy food and drink products diminish due to consumer preferences, production regulation or taxation...

#4 "Local food only": Environmental regulation, high energy prices, trade wars or consumers preferring local food make it infeasible to transport products to foreign markets...

#5 "Sustainability through new technology": Technological change significantly increases the yield and quality of production, without damaging reputation for sustainable, ethical production...

#7 "Ruined reputation": Scotland's reputation as a 'Land of Food & Drink' is ruined because of a health scare. Food and drink sales and, in particular, exports suffer massively...

Least likely

#2 "Basic needs": The share of income that consumers globally can afford to spend on Food and Drink decreases due to global economic depression (c.f. 1930s)…

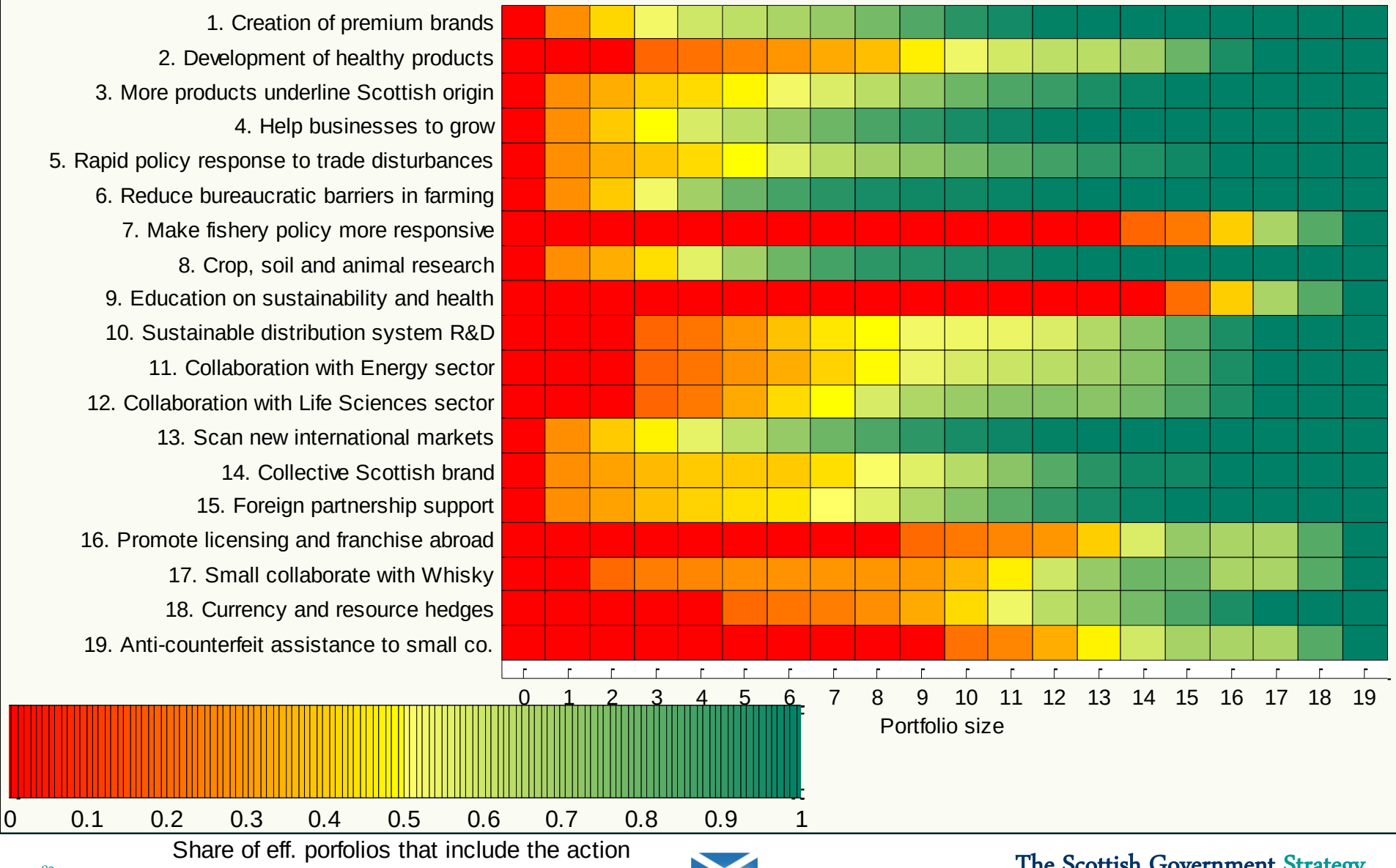
#6 "Sustainability through revolution in consumption": Sustainability is achieved through transformational change of consumption habits in western countries (grain to humans not animals)...

#8 "Decreased natural wealth": Effects of climate change substantially decrease the advantages that Scottish land and sea offer for the Food and Drink sector...

#9 "Increased natural wealth": Effects of climate change increase the advantage that Scottish land and sea offers for the Food and Drink sector...

#10 "Liberalisation": Scotland's Food and Drink sector opens up to market forces. Subsidies, such as the single farm payment, are eliminated, CAP collapses and tariff barriers are removed…

Food and Drink: Efficient Portfolios



Game Changers and Food and Drink – Some Conclusions

- The current strategy is broadly right
- Breadth builds strength
- Success through collaboration
- Speed up reaction times
- Portfolio approach

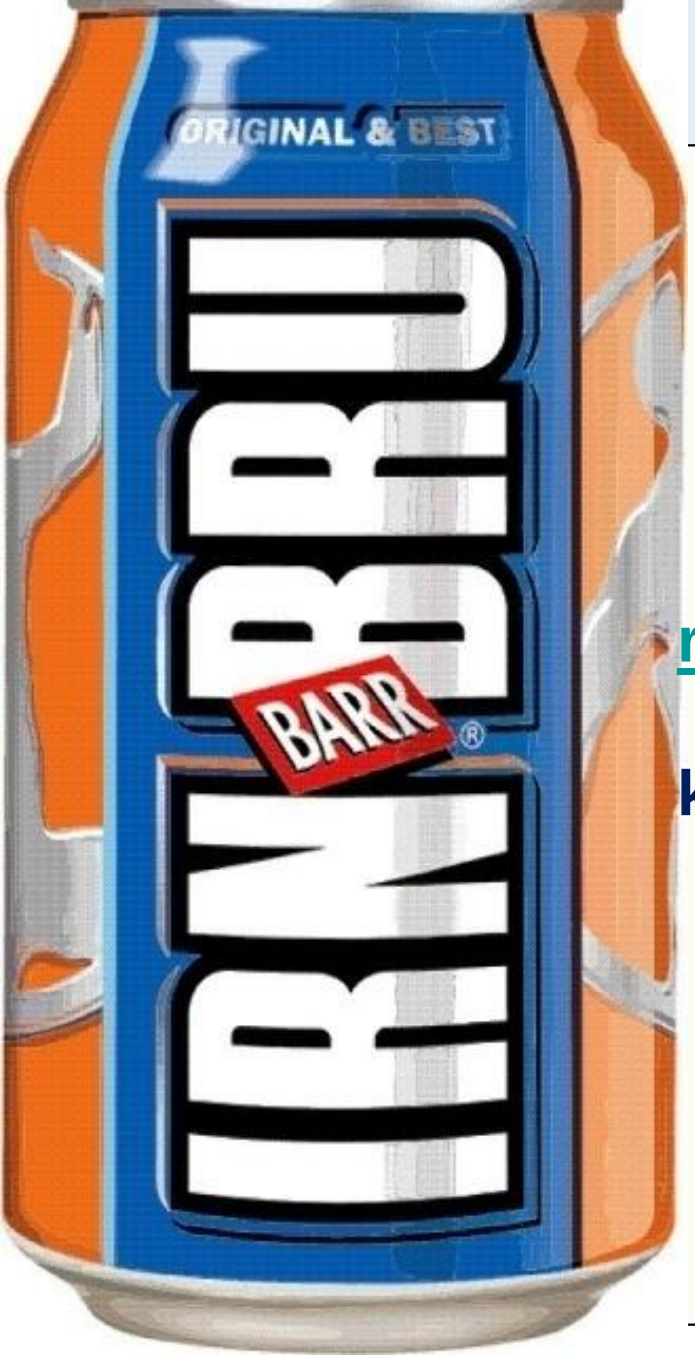
Game Changers & Economic Growth: Key messages

- Balancing growth and resilience
- Cross-sectoral growth
- Responding to rapid change

Game Changers & Economic Growth: Key messages

What should Government do?

- Shape the economic portfolio to promote growth **and** resilience.
- Identify and communicate signals of change – collect data on the future as well as the past.
- Act corporately – developing deep relationships with other Governments and companies to help develop joint or complementary products and services and access new markets.
- Make the most of the downturn – responding quickly and creatively to promote the redistribution of knowledge, skills and resources.



Questions

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Extreme Events

Conclusions

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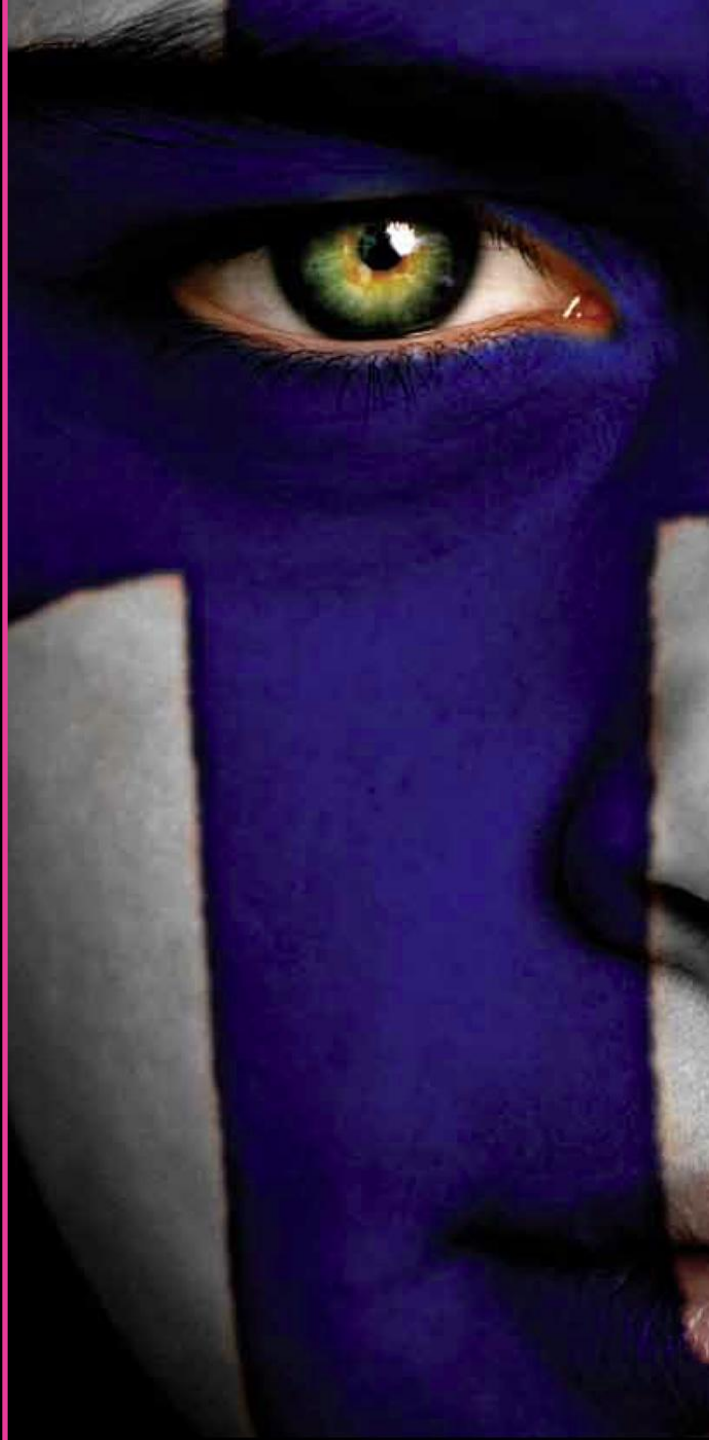

Conclusions

L. Ilmola, P. Rouvinen
Helsinki June 15, 2011


NOW


GAME CHANGERS