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Practical Systems Thinking: the challenge of tackling complex problems in day to day government

Nick Mabey, E3G

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Outline

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- Introduction
- Systems Thinking in Day to Day Government
- Examples from UK Prime Ministers Strategy Unit
  - Fisheries strategy
  - Correctional Services
  - Countries at Risk of Instability
  - Energy and Climate Security
- Some critical systems issues in the climate and energy debate?
- Implementing systems thinking in real decision making

Background

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- Non-profit, public interest European organisation with a global scope
- Founded in 2005 with mission to “accelerate the transition to sustainable development”
- Focus on informal diplomacy working across energy, environment, security, diplomatic and economic sectors

My Background (abridged)

- UK Prime Ministers Strategy Unit
- FCO: Environment Policy Department
- Climate and energy research at London Business School and MIT

The Prime Minister's Strategy Unit

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What is the PMSU?

- A unit of Cabinet Office formed in 1997 as the Performance and Innovation Unit

What does PMSU do?

- Provide a central capacity for strategic, long term and cross-cutting thinking
- Promote strategic thinking and better policy making across HMG

How does PMSU work?

- Work in small project teams
- Undertake specific commissioned projects which take 3-9 months
- Bring together civil servants and secondees from private sector, voluntary sector, academia, public sector and other governments

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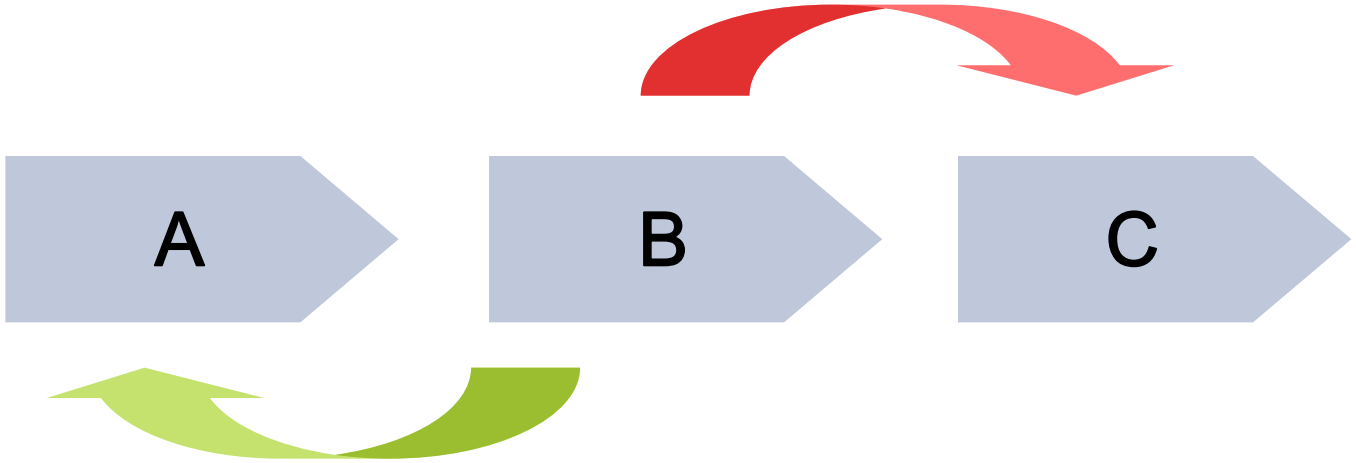
The Reality of Decision Making?

'There is nothing a government hates more than to be well-informed; for it makes the process of arriving at decisions much more complicated and difficult'

John Maynard Keynes

What is Systems Thinking?



- Systems show non-intuitive behaviour
- Systems are prone to boom and bust cycles
- Systems “control” must include all elements

At a trivial level everything is a system. But when are system characteristics material for policy making?

Systems Thinking in Day to Day Government

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Governments' interest in systems thinking is to deliver:

- **better decisions**;
- map **unintended consequences** of actions;
- counter tendencies to **silo/departmental thinking**
- Communicate assumptions to **stakeholders**

Speed of policy cycle and complexity of issues means that a broad understanding of systems concepts is often as useful as full models

Systems thinking works best in the knowable domain; complexity requires different tools

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Complex Cause and effect only coherent in retrospect and do not repeat	**Knowable** Cause and effect separated in space and time
Chaos No cause and effect relationships perceivable	**Known** Cause and effect relationships are clear, repeat and can be predicted

(Source: IBM Cynefin Framework, 2004)

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PMSU Examples

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1. **Fisheries Policy**: modernising regulatory practice inside context of complex biological, economic, political and social systems.

2. **Correctional Services**: addressing cost implications of growing use of correctional services inside a broad approach to crime reduction

3. **Countries at Risk of Instability**: using systems approaches in long term foreign policy to drive more effective preventative approaches

4. **Climate and Energy Security**: shaping long run private sector investment decisions in new under conditions of high uncertainty

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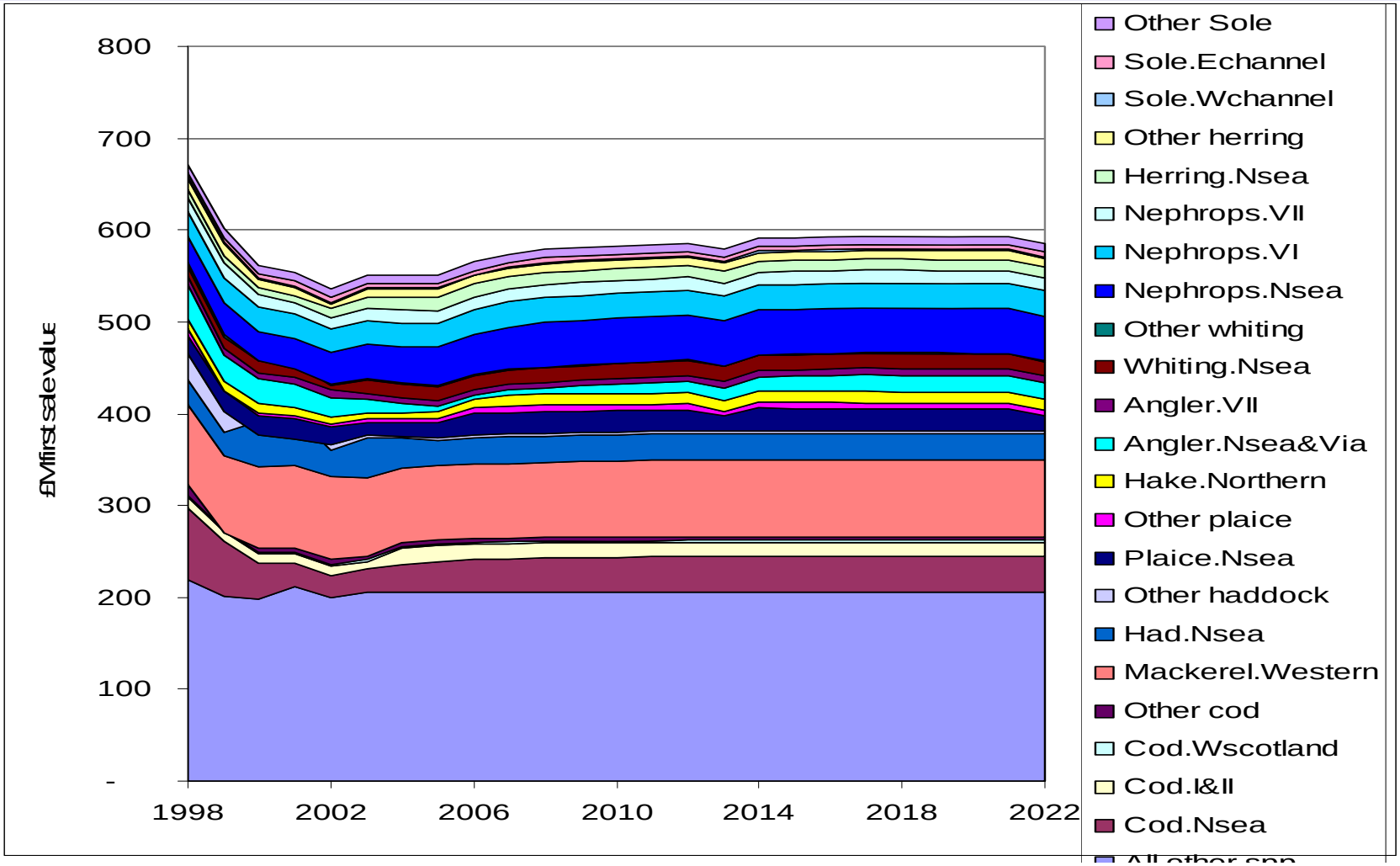
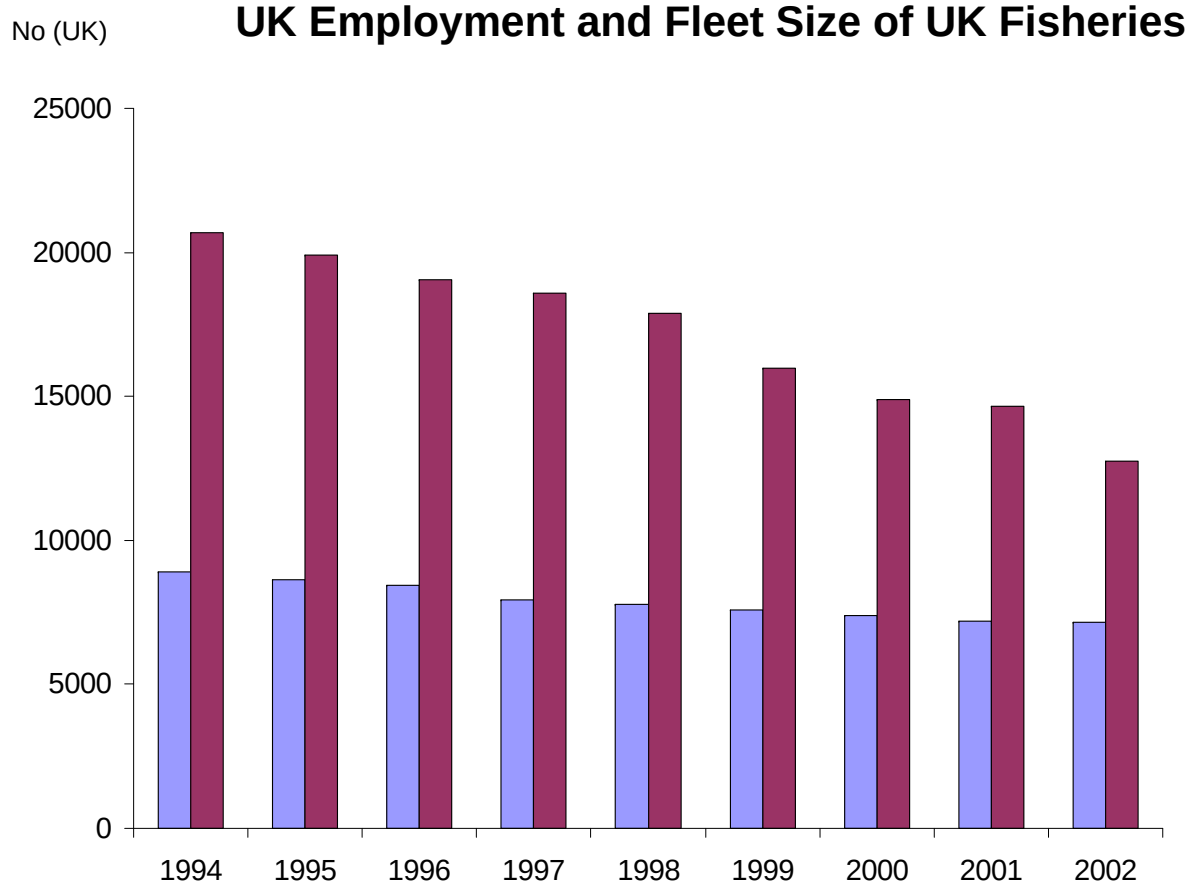
UK Fisheries

- Commissioned by Tony Blair after meeting fishing industry in 2003 post large scale quota cuts
- Report March 2004:”Net Benefits: A sustainable and profitable future for UK fishing”
- Implemented (partially!) 2004/5.

Large number of valuable UK fish stocks – over 80 commercial species



Both vessel numbers and employment have been falling over the past 8 years



CAGR 1994 - 2002

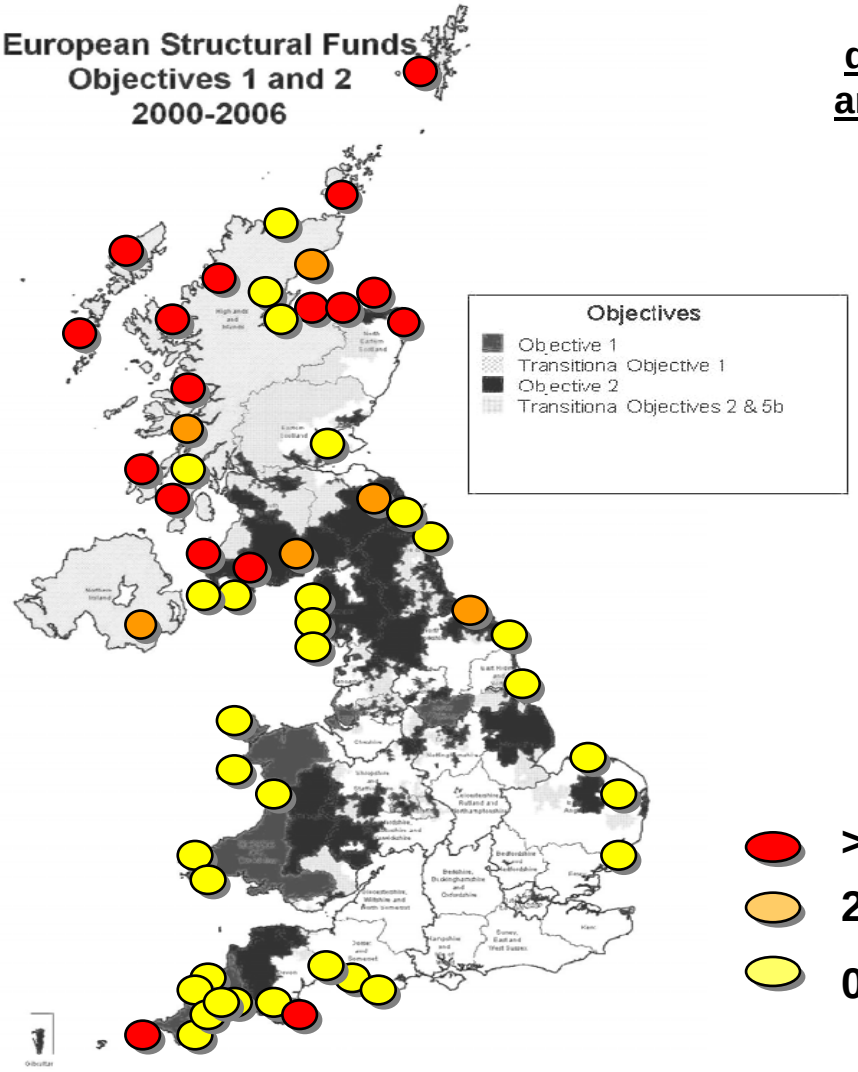
Employees -6%

Vessels -3%

Source: Defra 2002

Fishing Communities are dispersed, rural and often poor....

- **15 UK areas have over 5% dependency on fisheries employment;**
- **5 over 15% dependency**
- **More Members of Parliament per job than any other industry**



Total Fisheries dependency by TTWA and map of availability of structural funds 2000-2006

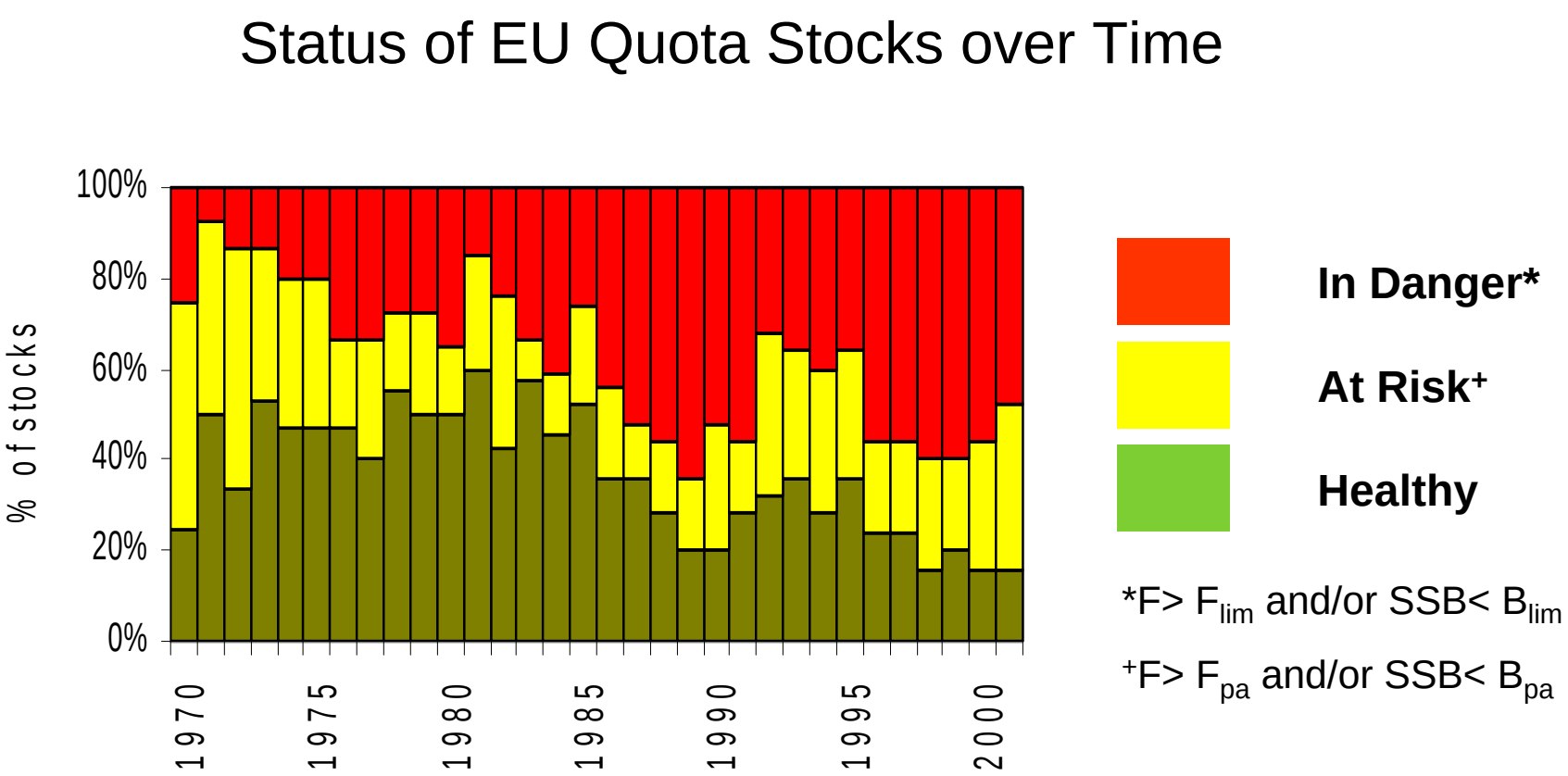
>4%

2-3.9%

0.6-1.9%

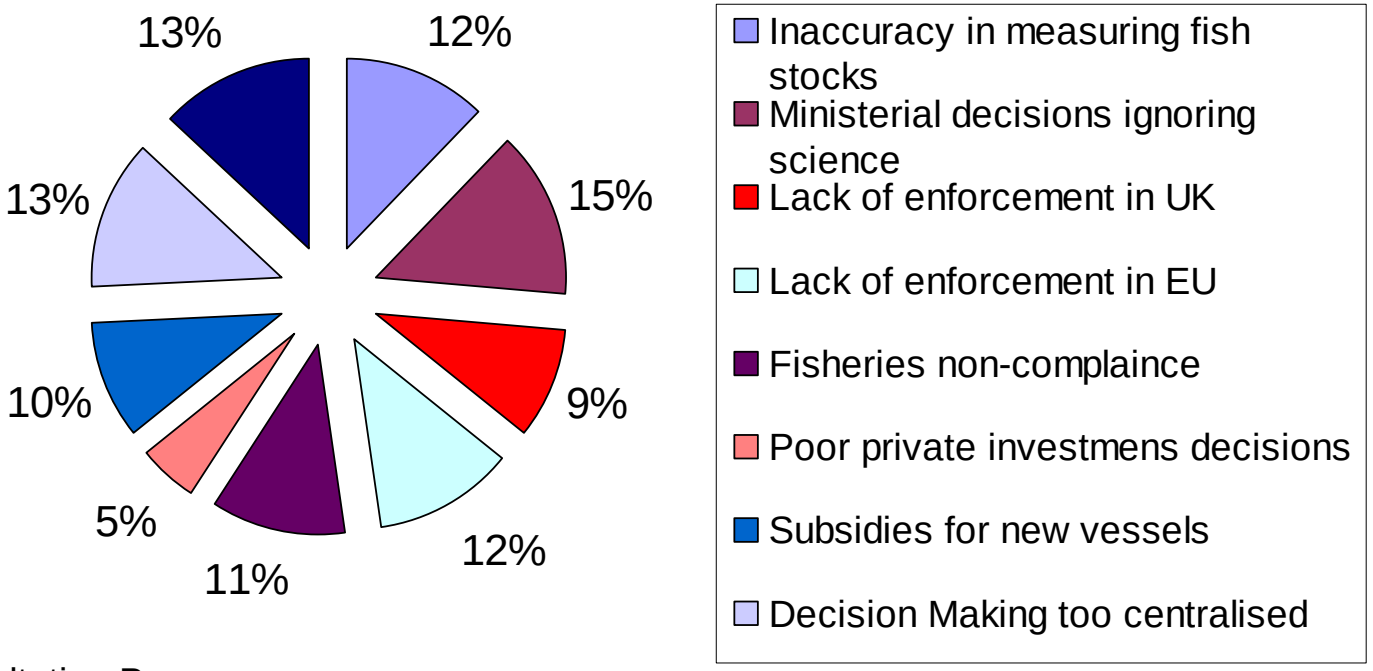
Source: DTI, SU analysis using DEFRA and ABI data

Health of fish stocks has been declining over time



Fisheries policy seen as suffering from systemic failure by stakeholders

- All parts of the CFP system have significant problems
- This system failure is recognised by stakeholders
- Lack of faith in system leads to widespread non-compliance



Source: SU Consultation Paper

Analysis asked a few simple questions

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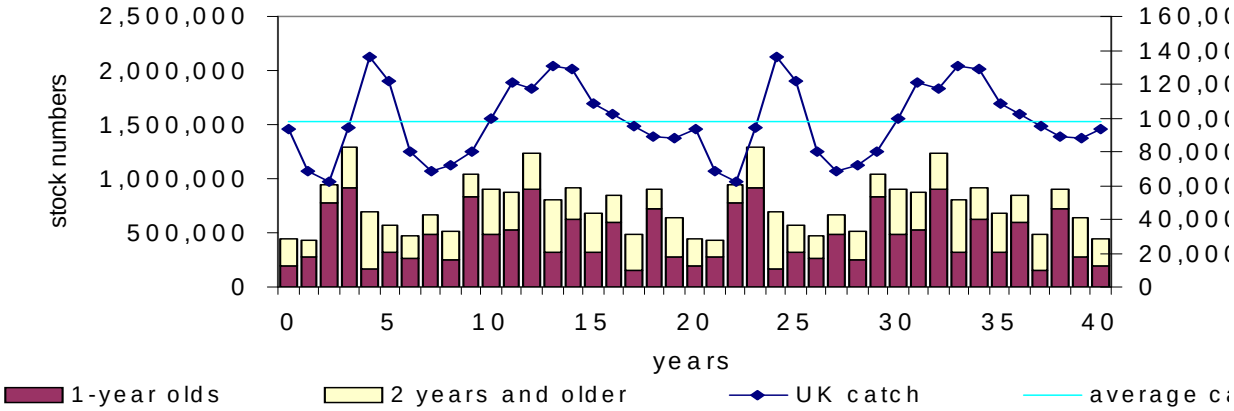
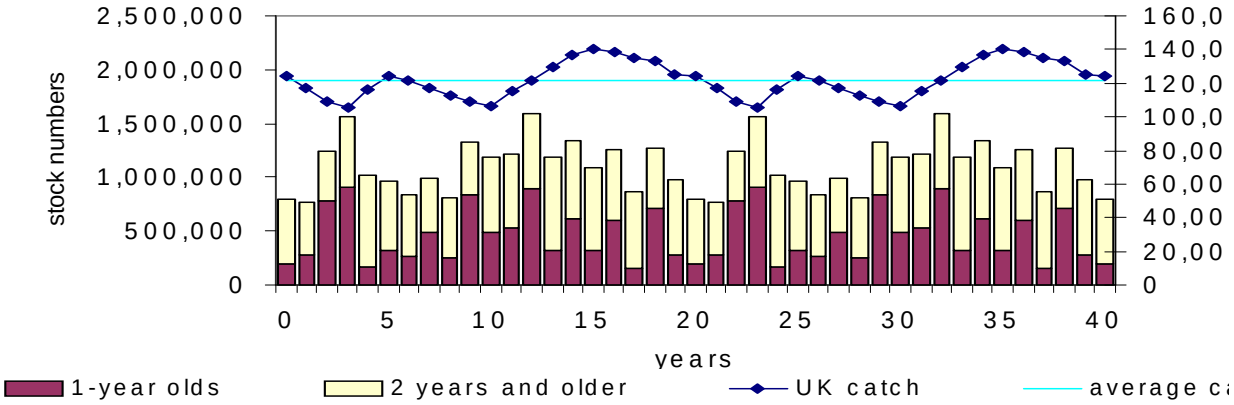
- What are the causes of fisheries management failures?
- If fisheries were well managed what would a sustainable fleet size be?
- What would a reformed management system look like at UK and EU level?
- How could this new system be developed over 10 years?

Work took 12 months; 5 systems models; over 100 stakeholder meetings; and agreement with 4 national jurisdictions!

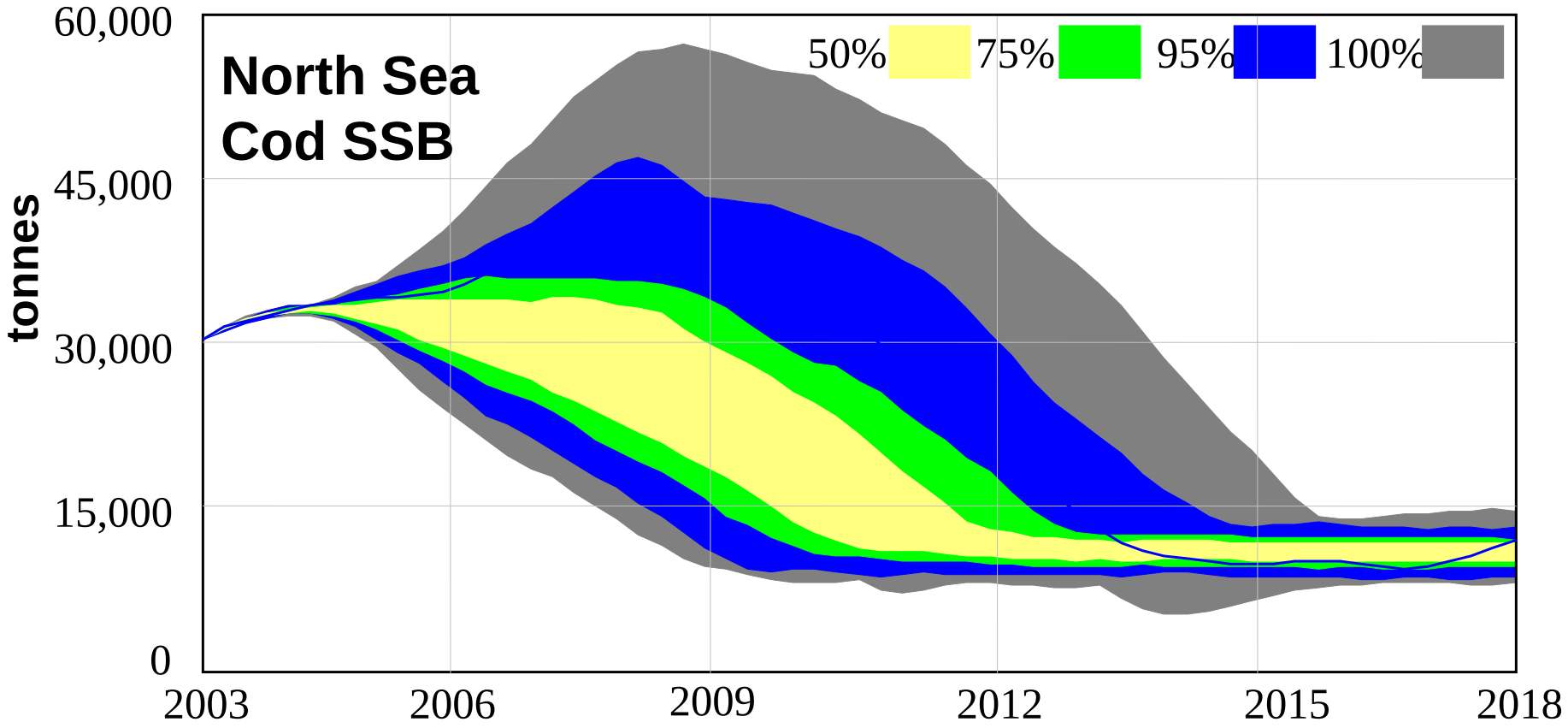
Modelling stochastic stock stability under different regimes....



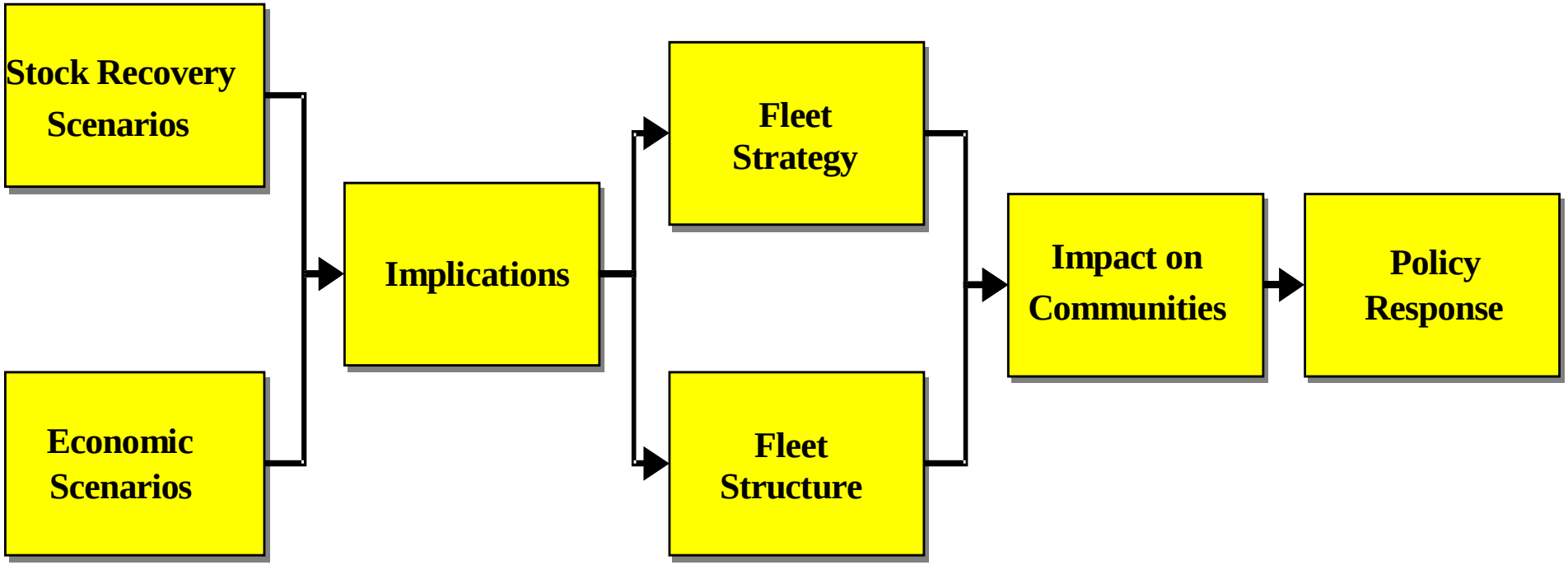


And systems models of related investment dynamics

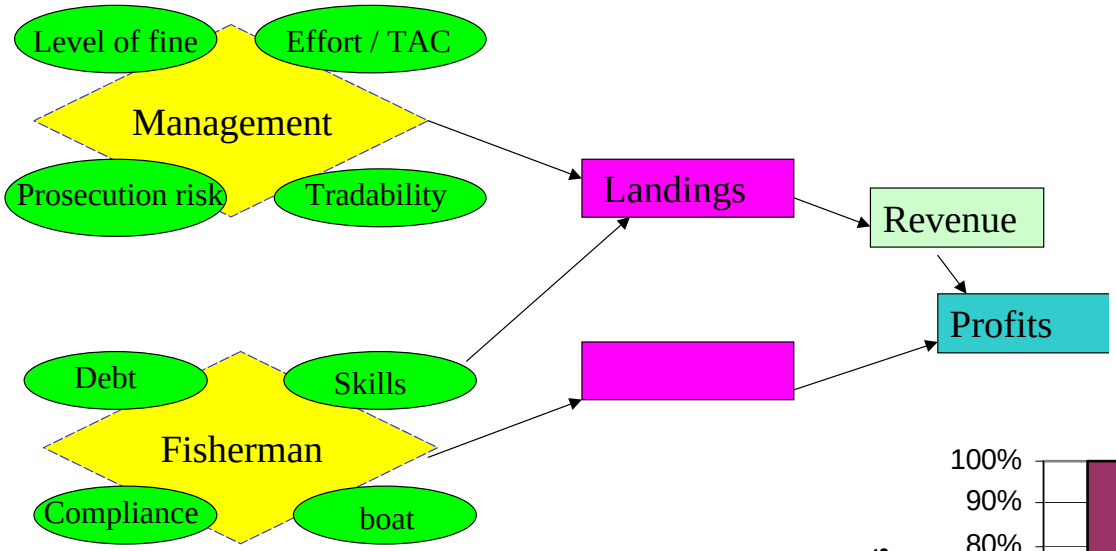
If no intervention North Sea Cod may rise short-term, but then crash

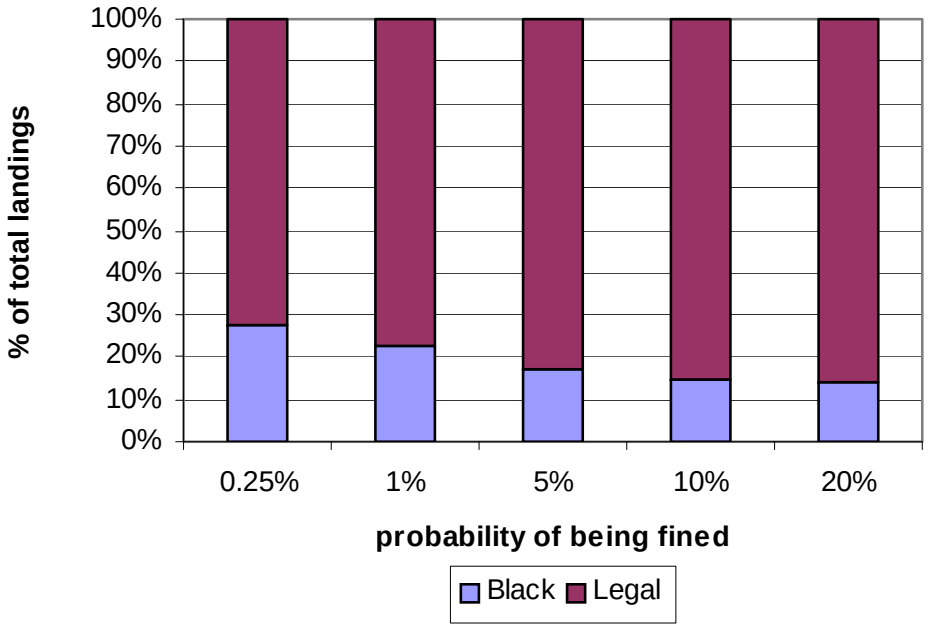


Linking this to modelling of potential economic scenarios for the UK fleet



And modelling of compliance and enforcement





Systems analysis revealed multiple cycles of “hard” and “soft” failure

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- **Cycle of misreporting**: misreporting of catches led to scientists increasing risk margins on catch limits reducing catch sizes and encouraging further misreporting.
- **Cycle of mistrust**: reluctance of scientists to admit errors in stock estimates and hostility from fishermen to engage with scientists led to divergence between reality and stock modelling.
- **Cycle of over-investment**: subsidies to reduce fleet size led to modernisation of fleet and an increase in total catching capacity. Use of house as collateral to buy new boats encourages inefficient over fishing.
- **Cycle of non-compliance**: introduction of higher fines led to more honest fishermen being driven out of business as cheats better able to afford fines

Perception by all stakeholders that EU and UK fisheries authorities were not competent or interested in the industry or environment

In return bureaucratic views on lack of compliance were “hard line”

- Fishermen not obeying the rules is a criminal offence
- It undermines fish stocks and their livelihoods therefore they must be irrational, irresponsible and at the extreme congenitally dishonest/different (“fishermen are hunters”)
- Fishermen cannot be trusted to co-manage fish stocks (except UK has done this in overseas aid programmes for 30 years)
- Any systemic discussion of incentives for non-compliance is giving fishers “excuses” for breaking the law

Need stronger enforcement / better science / better fishermen – government must exert more control

But this approach is not economically feasible.....

UK Sea Fishing Industry – Balance Sheet 2002

Industry Revenue	£546m
Estimated Operating Profits in Industry*	£125m
Government Expenditure	£120M

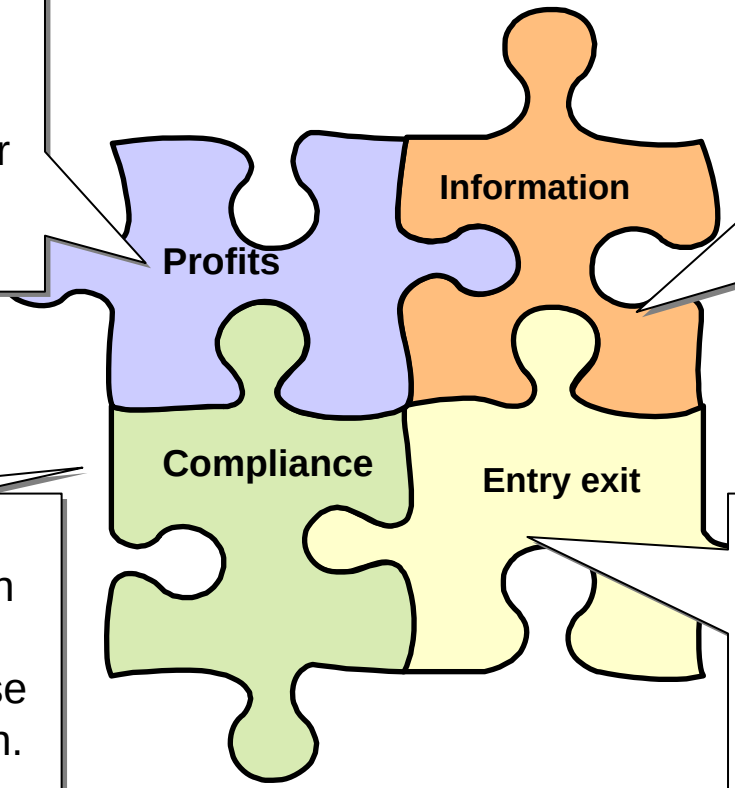
Government spending all value added on regulation. Fisheries too complex and expensive for more control.

** includes costs of administration, stock estimation, enforcement, price support and grant support

Source: DEFRA, SEERAD, Seafish cost and Earnings, Strategy Unit Analysis

What would an ideal system look like?

Sufficient profits to allow investment in new technology and savings for the bad years.



Information should be unbiased and relevant. Information not just on stock assessment but also effort, technical creep and socio-economics

The majority of fishermen should comply with the rules. If this is not the case then the system is broken.

Fixed capital in the fleet should be broadly aligned to the long term state of fish stocks. Effort should be reduced with technical progress

Create a culture where compliance is the norm and the need for enforcement the exception

Lessons: Uncertainty addressed by building systems that can learn

- Building the strategy required a large number of systems models based in different disciplines: biology; economics; game theory; business analysis.
- Key parameter was the impossibility of controlling activity in such a dispersed and fragmented industry – transaction costs too high.
- Limits of biological understanding – especially of impact of climate change – gives high future uncertainty to stock predictions. Need high trust system to have any chance of managing these future uncertainties cooperatively.
- Need to motivate further investment in continual innovation of scientific and regulatory systems to meet future environmental and economic challenges.

Limits of measurement, modelling, control and understanding motivated investment in a high trust system that can learn

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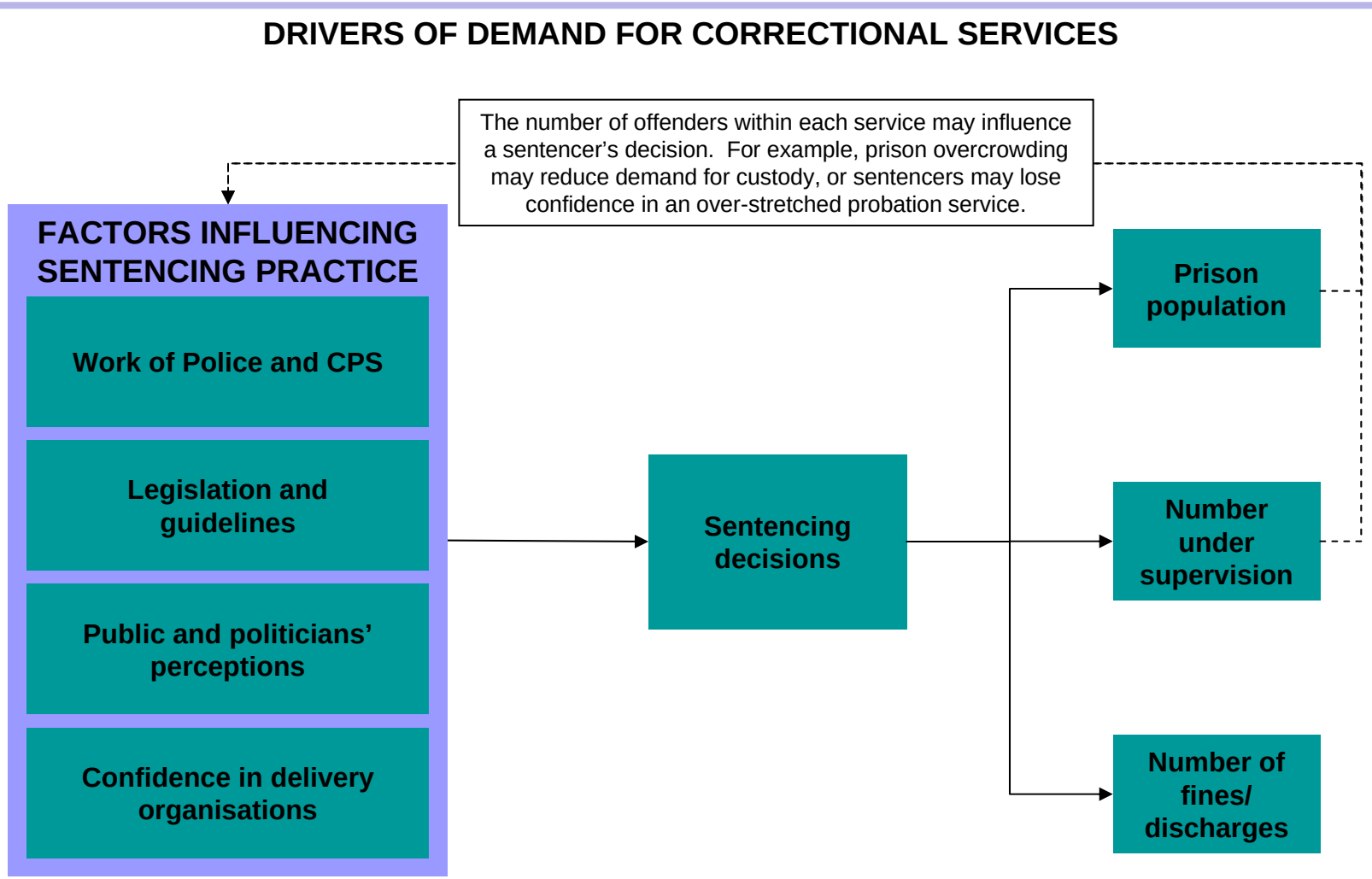
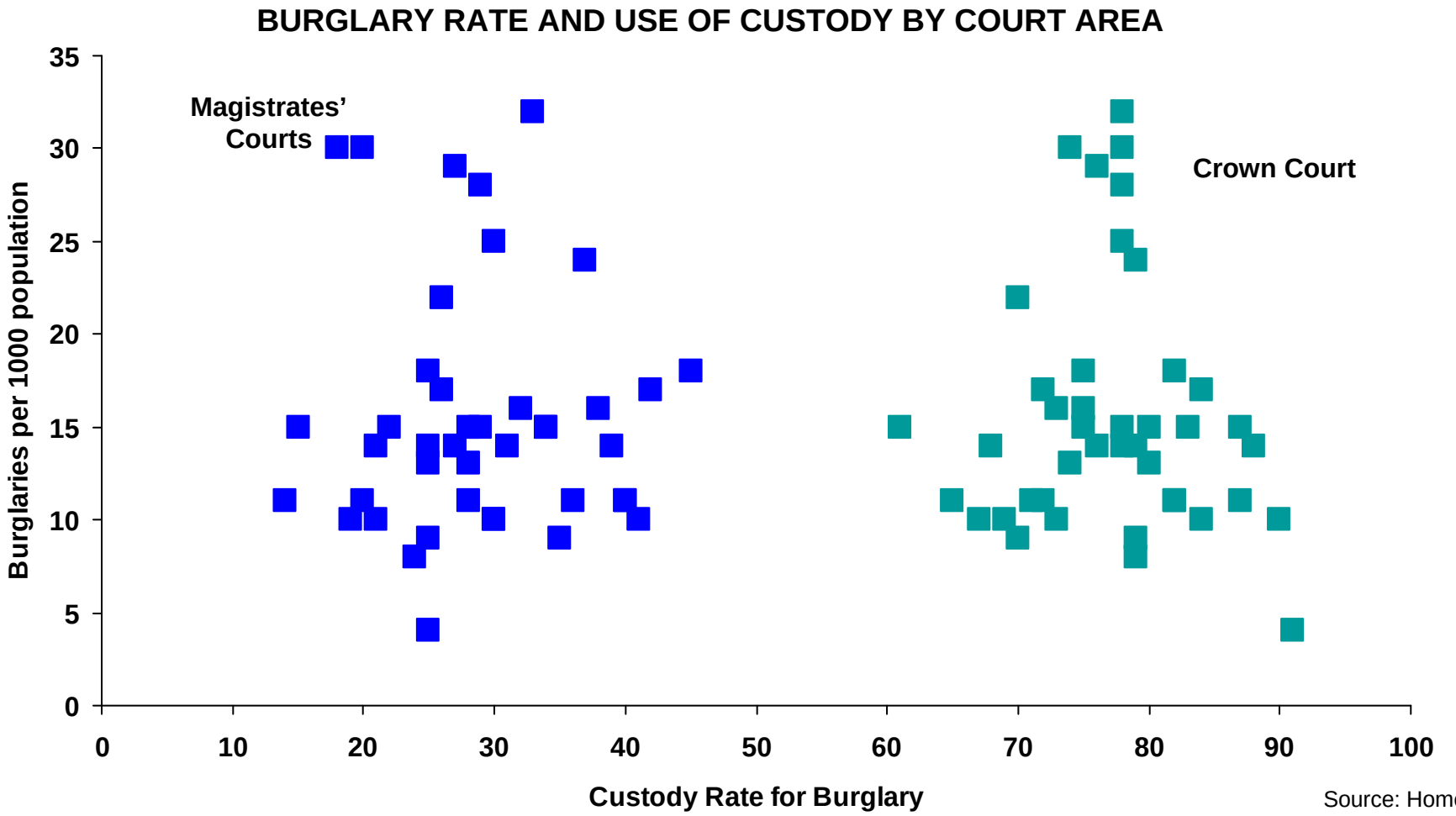
Courts are the key demand drivers for correctional services



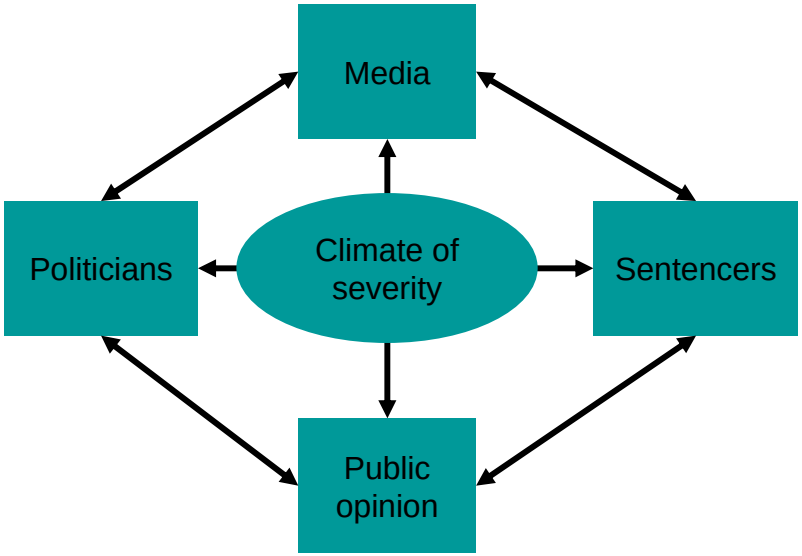
However, the behaviour of sentencers varies widely and does not reflect local crime rates



Source: Home Office

There is strong pressure on sentencers to increase their use of custody and community sentences

KEY INFLUENCES ON SENTENCERS



- the behaviour of sentencers has become more severe over time. crime has fallen over this period, but it is hard to prove the link between increased severity of sentencing and crime reduction
- what is clear is that the increase in severity has been driven by the interaction between politicians, public opinion and the media and not by the most effective way to reduce crime
- the judiciary is highly receptive to information on what different sentences achieve, yet there remains a lack of credible evidence on what works or on current practice in relation to peers

However, no cost feedback to courts to drive incentives to consider the most effective use of scarce resources

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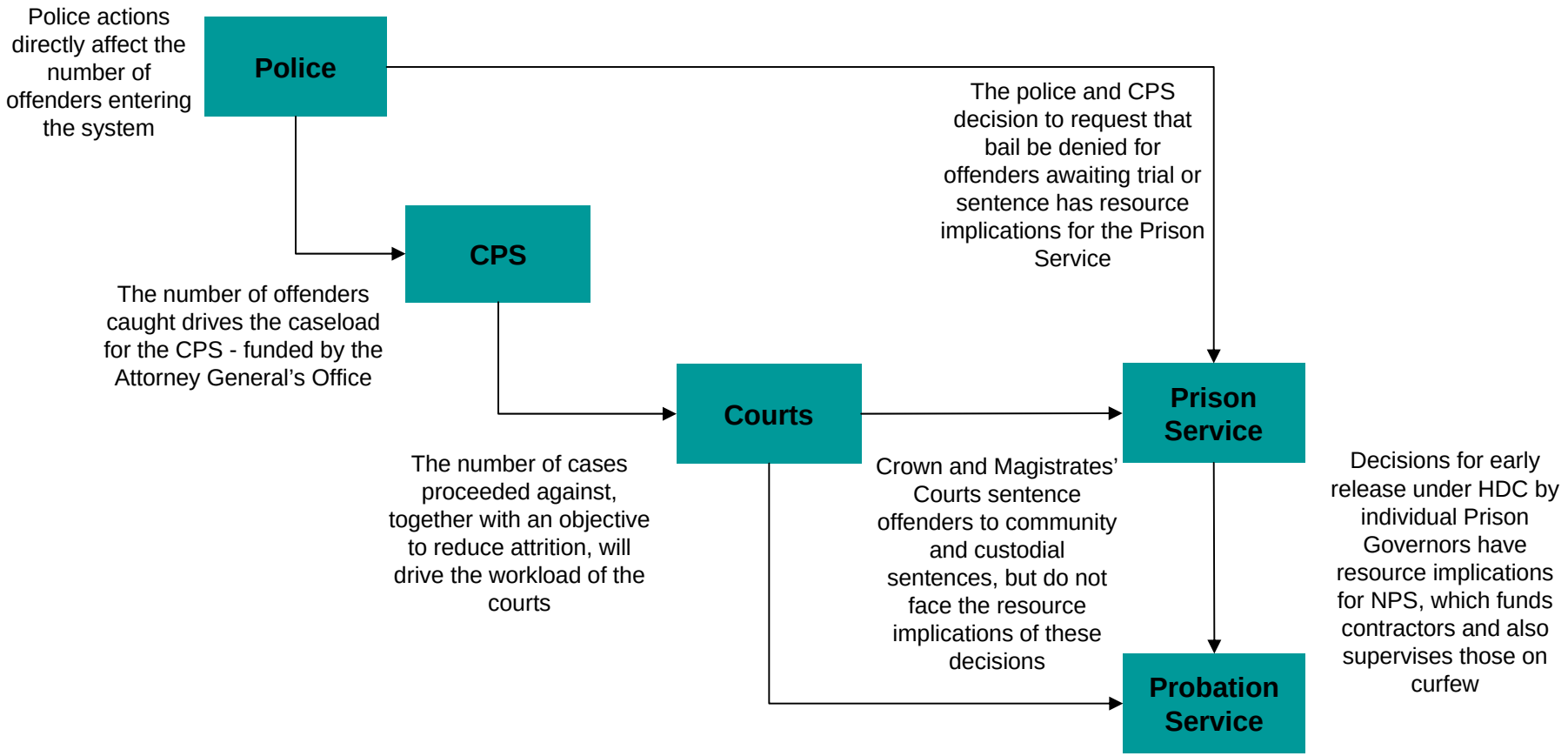
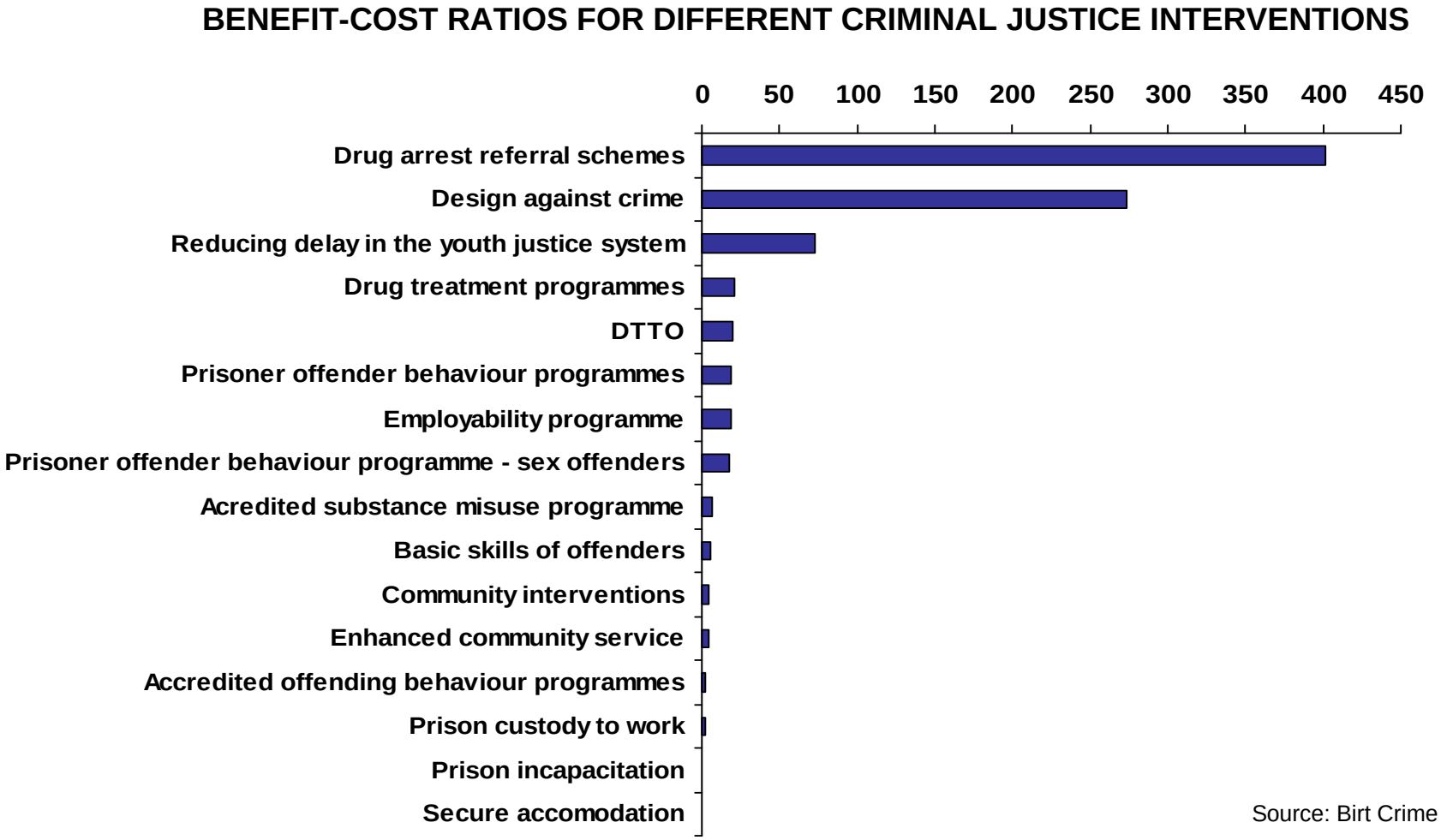
COST DRIVERS IN THE CRIMINAL JUSTICE SYSTEM



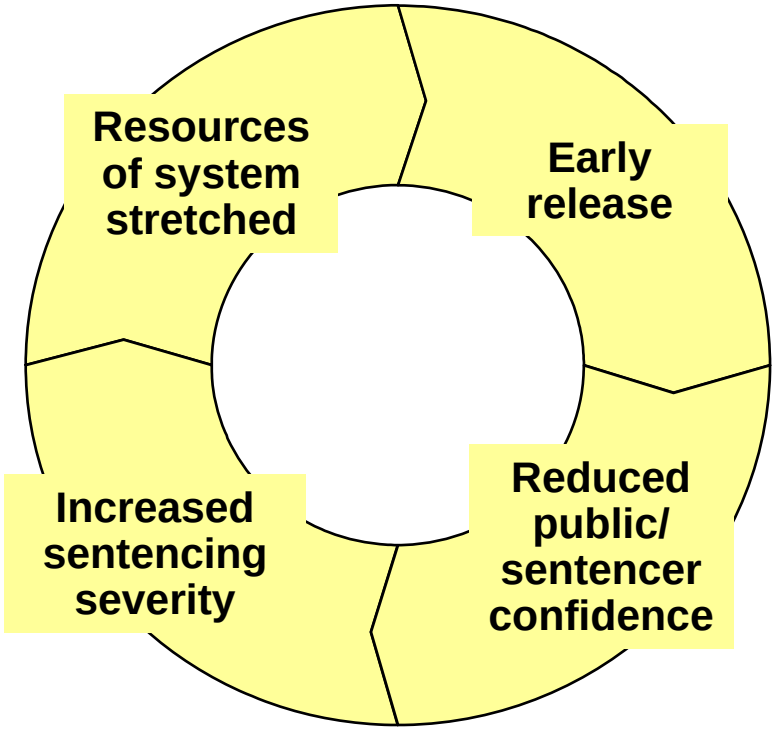
The cost-effectiveness of different interventions varies dramatically



Source: Birt Crime Report (2000)

Demand for correctional services outstripping supply which results in vicious circle of crisis

VICIOUS CIRCLE OF INCREASING SENTENCING SEVERITY



SHORT TERM "FIRE FIGHTING" PREVENTS LONG TERM PLANNING

- UK spending £1bn more on correctional services than ten years ago, but there is no evidence that this is the best way to reduce crime
- If demand for services continues to outstrip supply, there will continue to be a disjoint between policy and practice
- Similarly, there will be a reduction in the effectiveness of any interventions

Lessons: insights from combining quantitative modelling and qualitative analysis

- Impossible to understand dynamics without looking at connections between systems: media, sentencing behaviour, formal rules

- Impossible to quantify all these linkages - though parts of the system could be modelled, including some of the feedback loops from prison and rehabilitation to crime

- Mapping of the system linkages vital for helping the key decision-makers and actors to agree to reform, and breaking free from assumptions

Careful blend of qualitative and quantitative modelling helped break existing pre-conceptions

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Countries at Risk of Instability

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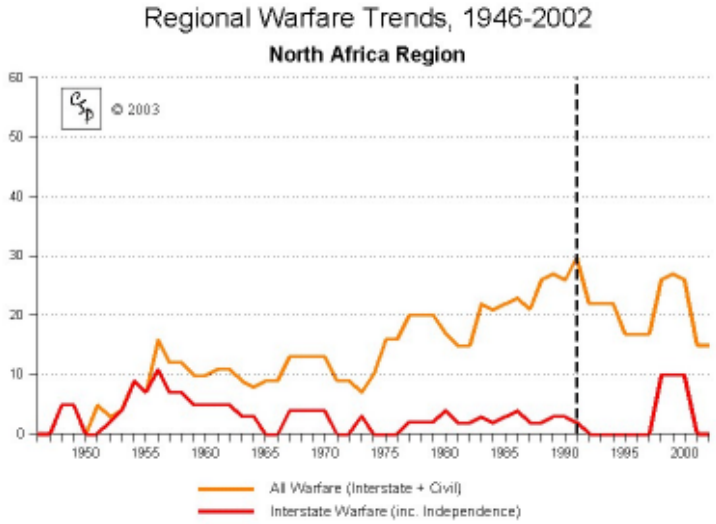
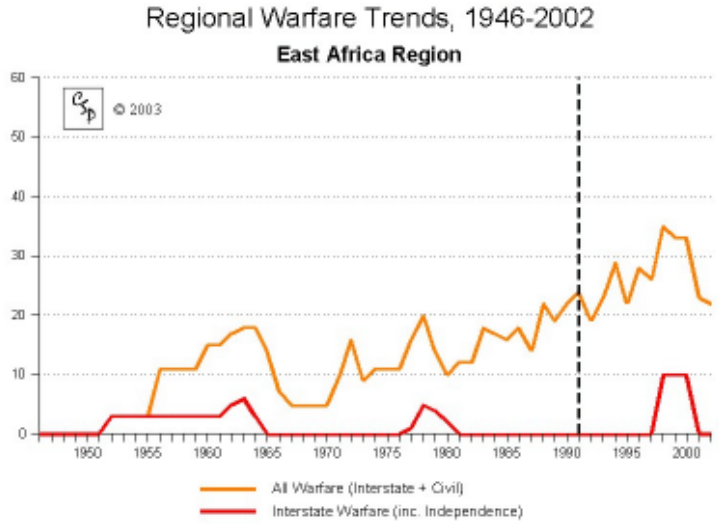
- Challenge identified in Strategic Audit of UK Policy in 2003.
- Report "Investing in Prevention" published February 2005;
- Countries with significant risk of instability make up 40-60% of all UK priority counties across all foreign policy: from WMD and terrorism to poverty reduction;
- "*The biggest source of inefficiency in our collective security institutions has simply been an unwillingness to get serious about preventing deadly violence."* UN High Level Panel on Threats, Challenges and Change 2005.

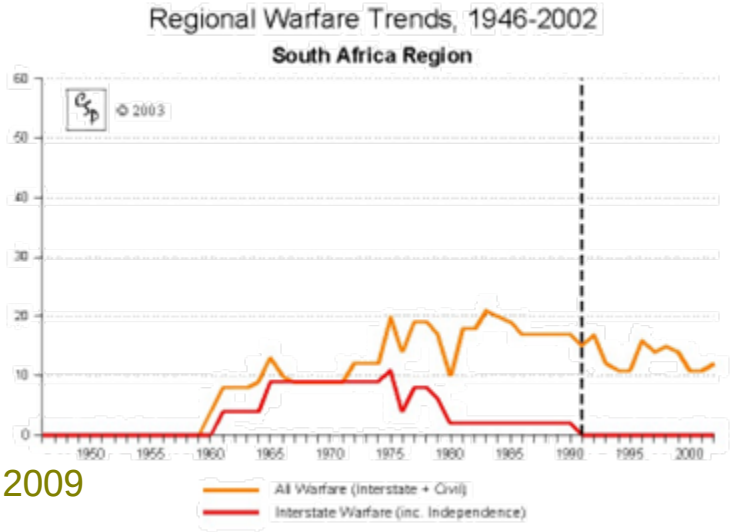
Failure to present decision makers with credible options was the major source of inaction

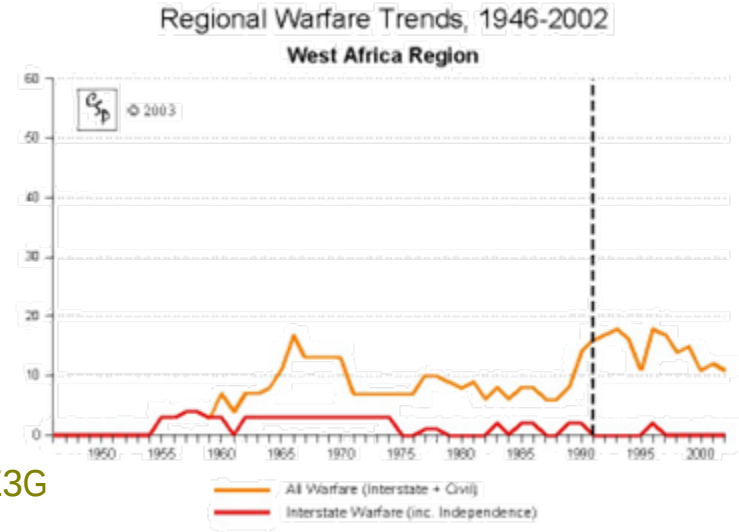
- "Received wisdom" focuses on a lack of political will as the primary cause of underinvestment in prevention and slow response to early warning signals;
- Political will to act is deterred by a number of factors: clashes of country interests; costs and benefits of action don't add-up; perceived lack of public support for action;
- CRI Project looked the needs of decision makers using structured interviews and in-depth analysis of system performance;
- Analysis showed that official decision support machinery was not presenting timely and well-constructed options for action to decision makers - resulting in inaction in response to raised risks.

Drivers of conflict trends very hard to understand from policy standpoint









Statistical evidence partial, contested and hard to use with policy makers:

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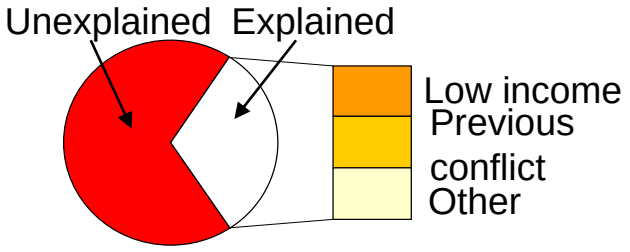
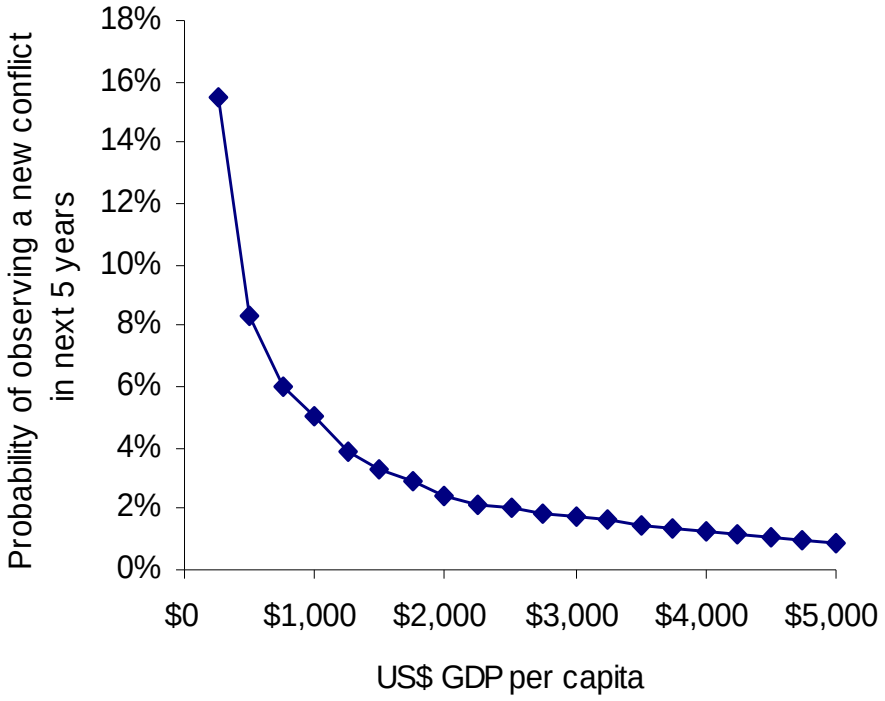
	Ethnic fractionalisation - ELF	Ethnic dominance	Ethnic fractionalisation - larger	Ethnic polarisation	Ethnic heterogeneity	Language discrimination	Linguistic fragmentation	Linguistic diversity	Religious fractionalisation	Animist diversity	Religious polarisation	Religious discrimination	Islam	Level of GDP per capita	Development (proxy energy	Income growth	Trade as % of GDP	Income inequality	Land inequality	Proxy for natural resources	Oil exporter	Primary commodity exports	Mountainous territory	Size	Population size	Young males	Population dispersion	Diaspora size	Population growth within a	Political inclusiveness	Democracy	Civil liberties	Democracy (lagged)	Newness of state	Regime change	Proximity to independence	Level of education	Male secondary school rates	Previous civil war	Civil wars in region	International war	End cold war
Fearon-Laitin (Onset of civil war)	NS	NS	↓	NS	.	NS	.	NS	NS	.	.	NS	NS	↓↓	.		NS	NS	.	.	↑↑	NS	↑↑	↑↑	.	NS	.	.	NS	.	NS	NS	.	↑↑	.	.	.	NS	.	.	.	.
Collier-Hoeffler (Onset of civil war)	↓	↑	.	NS	.	.	.	.	NS	.	.	.	.	↓	.	↓	.	NS	NS	.	.	↑ ⌒	NS	.	↑	.	NS	↑	.	.	NS	.		.		.	.	↓	↑		.	NS
Reynal-Querol (Prevalence of ethnic wars)	.	.	.		.	.	NS	.	↓ ✍	↑	↑	.	.	↓	.	.	.	.	.	NS	.	.	.	.		.	.	.	.	↓	↓	.	.	.	.	.	↓	.		.	.	.
Hegre et al (Prevalence of civil war)	.	.		.	↑	.	.	.	.	.	.	.	.	.	⌒	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	⌒	.	.	.	↑	↑	.		↑	NS	NS	.
Elbadawi-Sambanis (Prevalence of civil war)	⌒	↑?	.	.		.	.			.	.	.	.	↓↓	.	.	.		.	.	.	NS	.	.	↑↑	.	.	.	.	.	.	.	↓	.			.		↑↑	.		.

- Research explains only 25-50% of causes of conflict. Other factors, e.g. leadership, are important
- Therefore any structural assessment must be twinned with specific country analysis / intelligence



Example: Low incomes are associated with poor governance and violent conflict



Findings:

- Low GDP per capita is associated with conflict through two mechanisms:
  - reduced state capacity to settle societal conflicts via political and judicial means rather than violence
  - lower opportunity costs for potential rebels who have fewer stakes in society (employment, investments) to deter them from using violence
- Economic development is usually a necessary but not sufficient condition for democracy to take root. However, economic growth does not necessarily lead to democratisation or improvements in other aspects of governance.

Therefore policy makers should think about:

- In the long run inclusive, broad-based economic development is the best conflict prevention policy.
- In the short term external donors can help to build state capacity.
- Employment, esp. of young men, is important - as is the "R" (reintegration) in DDR programmes.

Effective policy needs critical decisions to be made over many departments and timeframes

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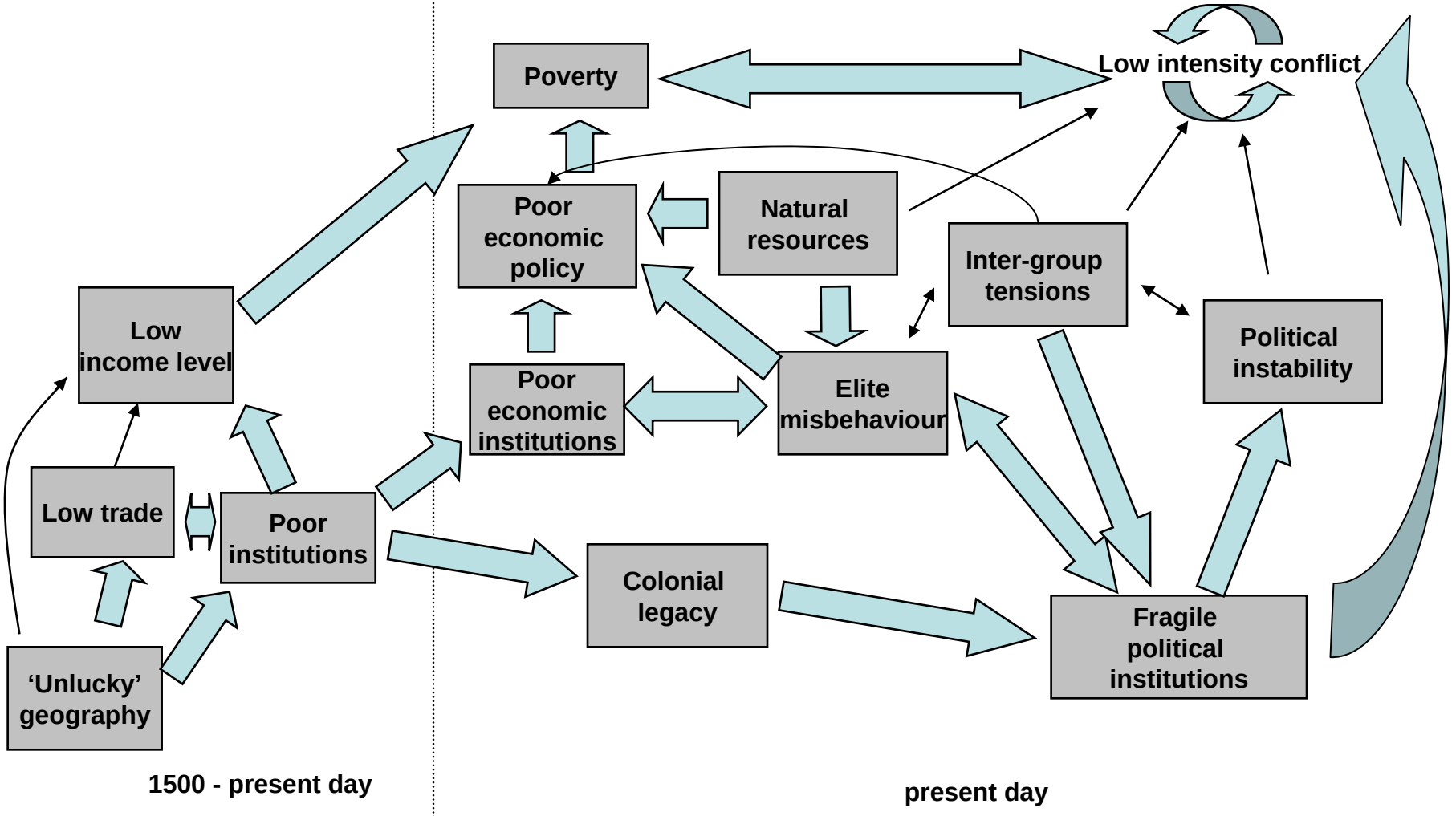
10-15 years	2-6 years	.5-2 years	0-.5 years
• Broad International system change	• Focused international system change	• Military Contingency planning	•Military intervention/strengthening
•Broad Regional system change	•Force reorganisation	•Disaster/aid Contingency planning	•Diplomatic intervention
• National institution building	• National governance strengthening	• Policing operations	•Humanitarian support
•UK military capability investment	•Aid programmes	•Preventive diplomacy	• Macroeconomic crisis support
• Economic investment	• Regional military strengthening		

Standard systems models were not useable in real policy making processes!



Analytic Approach

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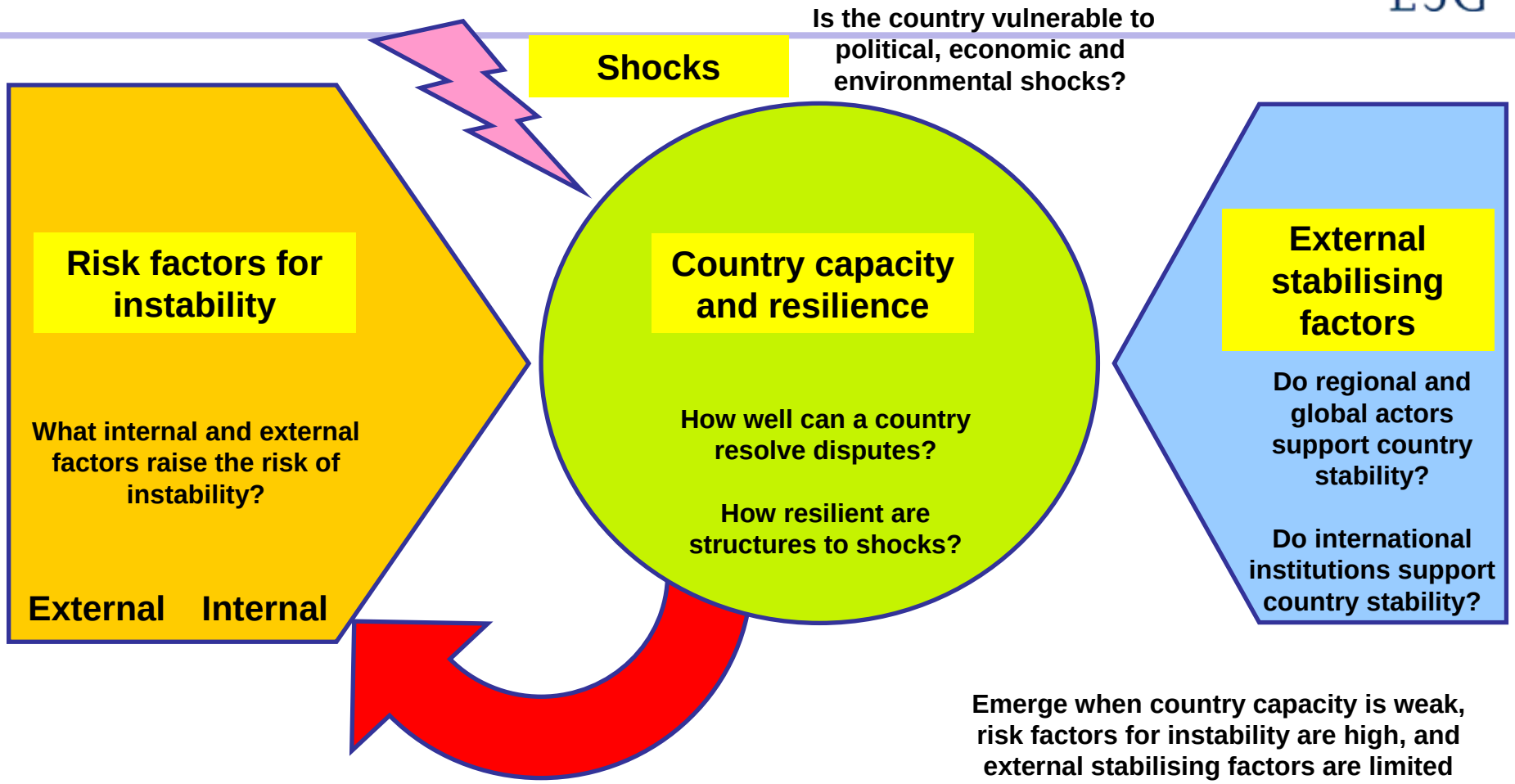
- Analysis of key trends, threats and response associated with failing states
- Analysis of UK decision making systems and comparison with key allies (US, Germany, EU)
- Piloting of three real life country strategy processes through UK system
- Development of system recommendations and tools/manual for cross-departmental strategy process

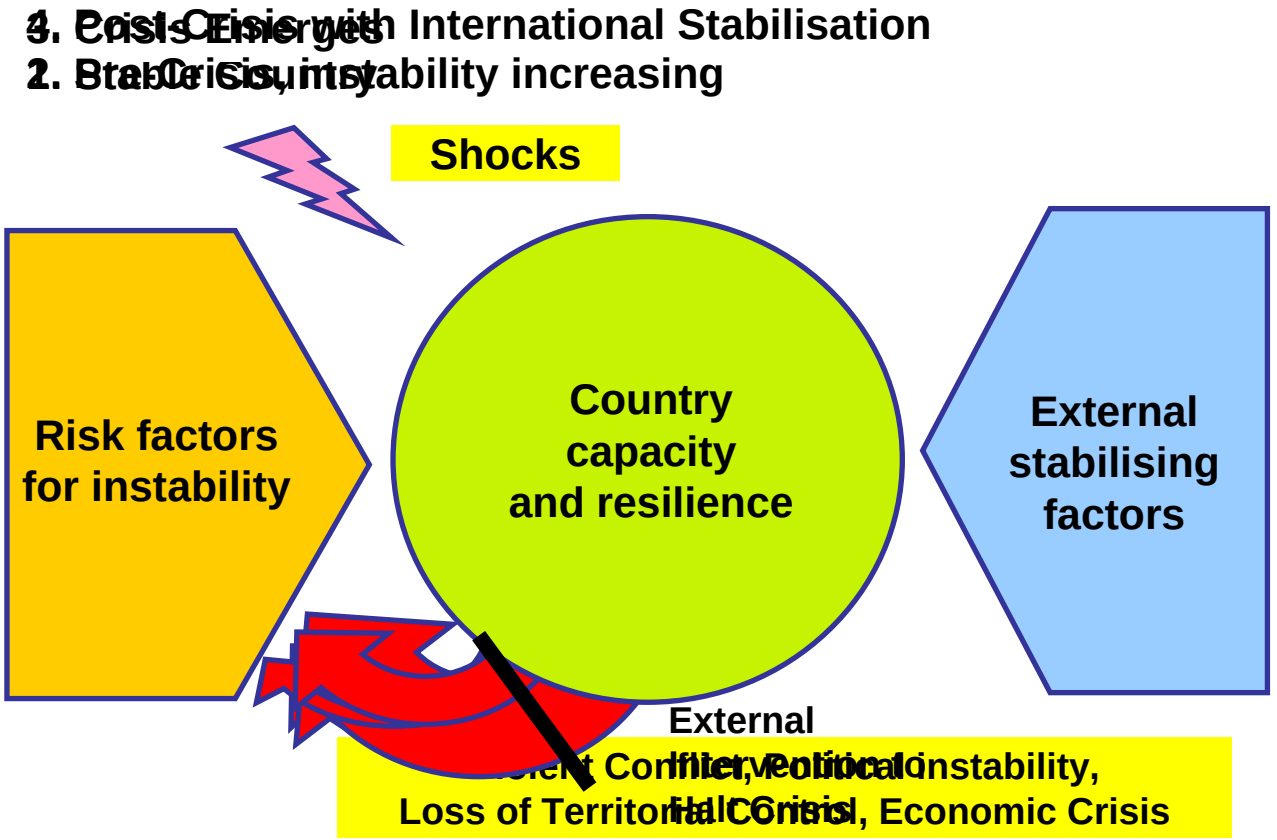
Building alignment through the Instability Framework: Instability arises from in balance between country capacity, internal and external risk factors and external stabilisers



Emerge when country capacity is weak, risk factors for instability are high, and external stabilising factors are limited

Instability feeds back and strengthens risk factors of instability, creating a vicious circle

Balance of factors changes over time as country risks change, crises emerge and are resolved



CRI Annotated Instability Framework : Core factors to consider in country specific analysis

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Shocks

- natural disasters
- global/regional financial crisis
- commodity price shocks
- assassinations

Risk factors for instability

External

Generic
- Bad regional neighbour-hood
- International terrorism
- Geopolitical competition
- Conflict financing
- Off-shore financial havens
- Low quality MNCs

Internal

Generic factors
- Low GDP/
- Economic decline
- Previous conflict
- Natural resource dependence
- Horizontal inequality
- Organised Crime

Future factors
- HIV/Aids
- Resource scarcity
- Climate change
- Demographics

Country capacity and resilience

State Capacity
- Security
- Macroeconomic fundamentals
- Public good provision

Civil Society
- Civil society orgs
- Traditional systems

Rules of the Game
- Political Institutions
- Legal/economic institutions
- Executive checks & balances

Social Contract
- Leadership
- Legitimacy
- Expectations vs delivery

External stabilising factors

Political/Institutional
- Bilateral relationships
- Regional groupings
- Standards in regional /global institutions

Economic
- Open external markets
- Good quality FDI

Security
- Security guarantees

Violent Conflict, Political instability, Loss of Territorial Control, Economic Crisis

Emerge when country capacity is weak, large risk factors of instability exist, and external stabilising factors are limited

Feedback of instability into risk factors creating vicious circle

Lessons: New tools and institutions can help overcome “political” failures

- Instability and conflict issues are highly complex and not amenable to simple one size fits all policy solutions.
- Project developed a robust strategic approach and proposals for strengthening decision support and implementation systems to deliver it. Including piloting new approaches and tools with practitioners
- Credibility with stakeholders required the political realities constraining action to be kept in mind – but also needed to strongly challenge whether these were the only or main barrier to better responses
- System needs to invest in both preventive and reactive strategies for managing instability risks. This is a long term task which the project has formed one part.

Tackling new security challenges requires major public sector reform and change – not just new policies

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The Energy White Paper 2003

Four objectives for UK energy policy:

- **security**: maintaining secure supplies at stable prices in the long term
- **environment**: primarily climate change
- **competitiveness**: industrial energy costs comparable to key competitors
- **social**: eliminating UK fuel poverty

UK energy policy has been driven by **economic imperatives** for 20 years

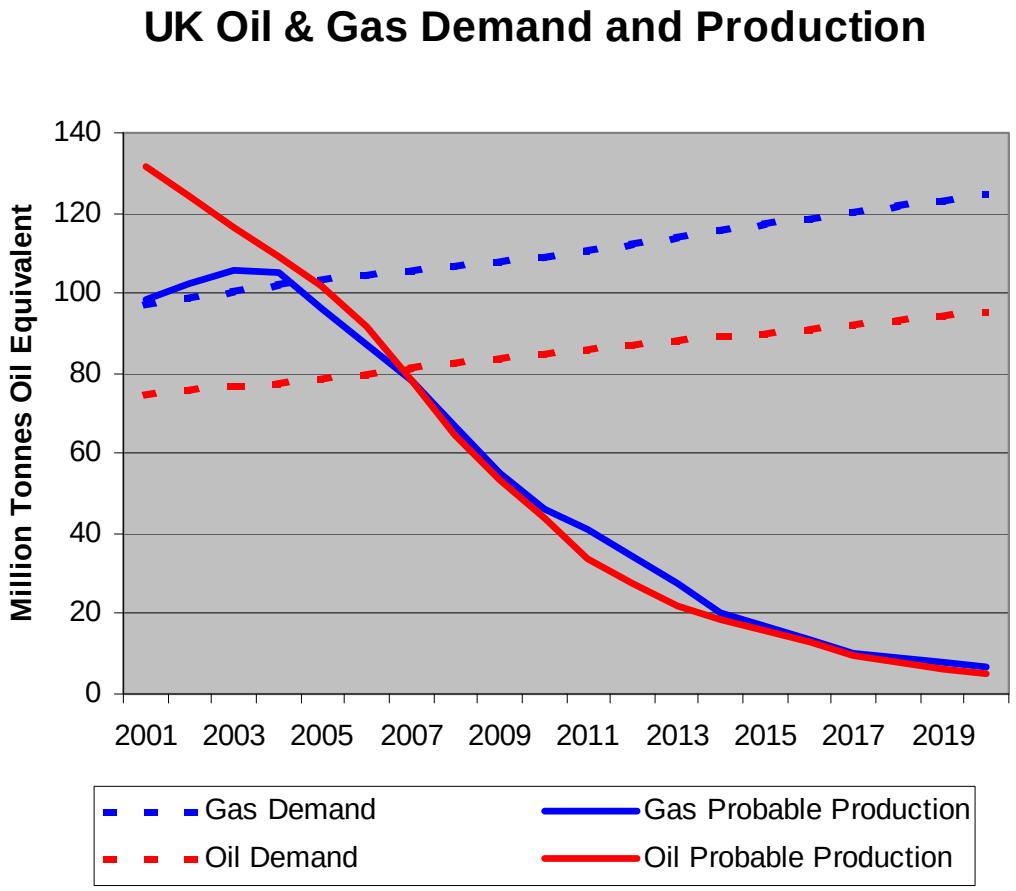
Energy self-sufficiency meant UK energy policy has been **nationally focused**

UK Hydrocarbon Production Falling

The UK is currently a net exporter of both oil & gas

Demand for oil and gas is widely projected to rise by 2020

Domestic production is projected to fall leading to rising import dependency



Source: DTI 2002

Based on high level analysis UK took strong strategic decision to lead on climate change

- Set a domestic goal of 60% reductions from 1990 levels by 2050
- This target seen explicitly in the context of moving forward international consensus on tackling climate change
- Decision to undertake short to medium term polices to put UK emissions on a trajectory consistent with the 2050 goal:
  - 20% reductions by 2010
  - Around 30% by 2020

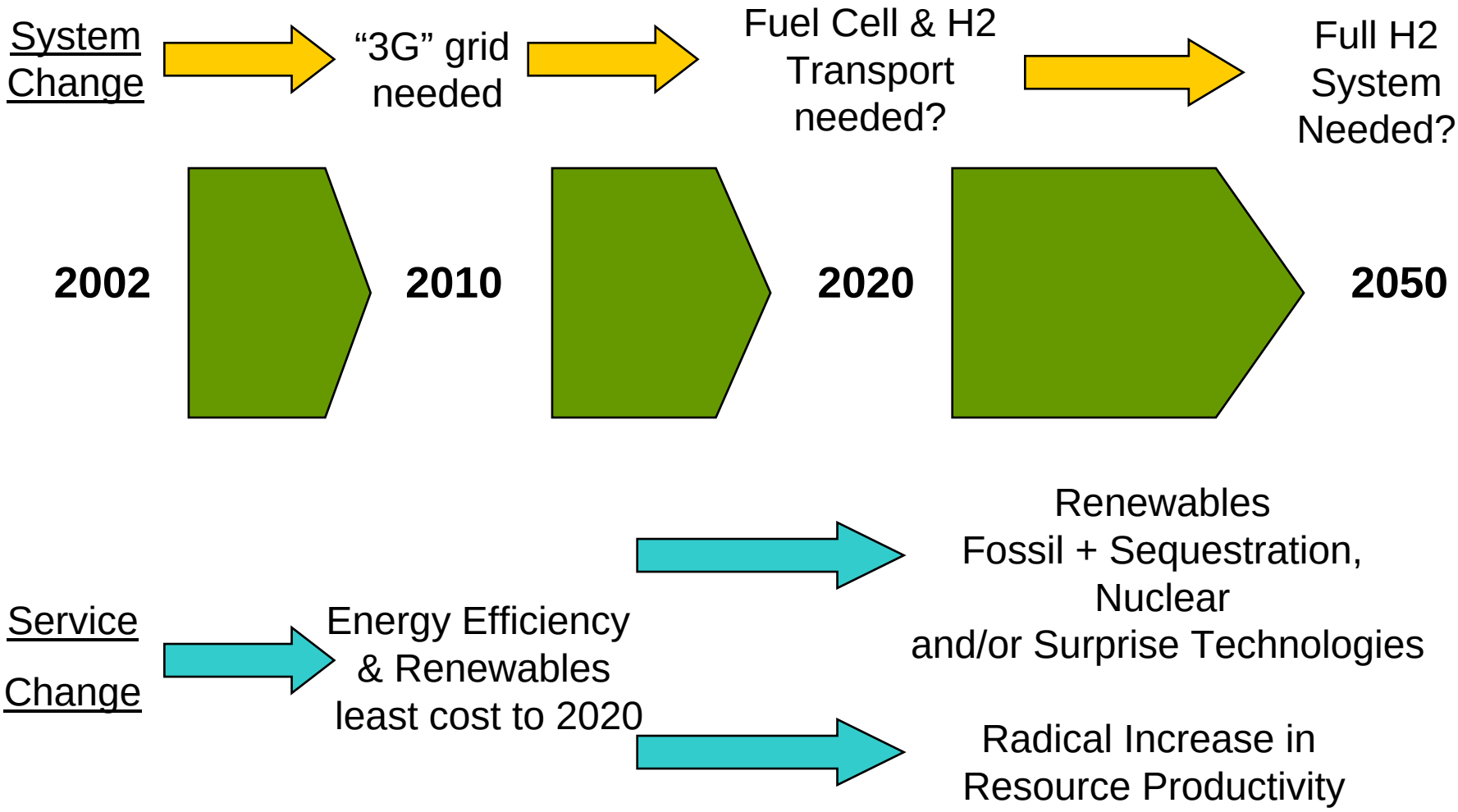
Challenge was to build a credible package of measures to support the 2050 target without over-committing or over-investing - taking into account UK is just one player in key international markets

2005 Review: Off target due to implementation failure

- 5-6%age points off 2010 target – mixture of baseline increases and policy implementation failures.
- Renewable energy targets will be met in most scenarios – very rapid growth from low base
- Investment and strategic focus on innovation increasing:
  - Renewables innovation review 2004
  - Energy efficiency innovation review 2005
  - Hydrogen innovation review 2005

Challenge of managing national carbon budget is far harder than anticipated. Need to develop practical risk management system.

Simplified Low Carbon Routemap for UK



Not All Futures are Equal

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The future might be uncertain - but some scenarios are more likely:

- some technologies will penetrate less quickly than expected

- new scientific evidence is likely to show climate change will be more damaging

- this will probably imply the need for steeper and quicker emissions cuts

- but unexpected new technologies will lower the cost of reaching these targets - these will be determined mainly by activity in global markets - not UK R&D

- emissions growth in developing countries may jump with personal car use

Hedging strategies should take into account the likely need for stronger CO2 reductions

The Carbon Catch 22

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- Decision makers are uncertain about the economic and technical feasibility of meeting ambitious cuts in CO2, so set “fuzzy” carbon reduction goals;
- Many technologies will only be developed with immediate market pull rather than technology push. Companies will only invest if future markets are certain enough;
- Some options require investment in radical system transformation but new innovations could appear which make these redundant;
- Fear of being seen to “pick technological winners” and desire to put risk onto private sector is stalling more radical technological options.

Need to create a virtuous circle of demonstrating feasibility of emissions cuts so decision makers commit to credible targets for market pull

Lessons: delivering the public goods of climate and energy security needs Govt. to manage major risks

E3G

- Energy policy requires long term investment decisions which impact multiple objectives – giving investor certainty is key which means a strong focus on generating credible investor expectations from policy.

- Decisions must be made under conditions of high uncertainty over prices and availability of fuels and technologies – primarily driven by global forces – so flexibility and resilience is also vital.

- Imperative of delivering energy and climate security goals means government must cover some strategic investment and technology risks

- Quantitative systematic analysis and modelling key to guide long-term policy making and risk management – especially the interface of international security of supply, economics and climate change

Failures in UK policy led to 2008 Climate Change Act and independent Climate Change Committee with functions analogous to a Central Bank

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Climate change will not be solved by "muddling through"

E3G

- Delivering climate security requires changes in technological, economic and regulatory systems inside a specific timeframe
- The need to drive "intentional change" requires explicit understanding of drivers, constraints, blockages, uncertainties
- The need to build new institutions between different policy communities means creating common frames of analysis and shared objectives

Biggest challenges for tackling climate and energy security will not be technological or financial but institutional

Key policy community integration challenges

- **Energy and climate security**: lack of common objectives, divergent world views and professional cultures is hampering construction of integrated policies
- **Finance**: better joint understanding of how investment and climate risk are perceived by finance community and method for accurately quantifying domestic "carbon liability"
- **Innovation Policy**: stronger understanding of national and global innovation systems; how key climate and energy technologies will be delivered; and explicit trade-offs between fast low carbon technology diffusion and narrow national competitiveness goals
- **Security, development and climate change**: joint tools for analysing impact of climate change on country stability and conflict in order to shift development investment and diplomacy towards preventive resilience building and risk reduction strategies

Key Systemic Policy Challenges

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- **Low Carbon Infrastructure Investment**: route map for building power grid (and CO2 grid) capable of delivering zero emission power sector by 2030-2035
- **Regional Transport Planning**: developing flexible urban and regional transport infrastructure systems economic under high energy and carbon price scenarios
- **Technology Policy and Competition**: balance of centralised and decentralised programmes to drive near to market technologies owned by incumbents to commercialisation while providing incentives for disruptive and new entrant solutions
- **Resilience Planning**: smart planning for infrastructure investments, information systems and management systems to prepare for increased climate variability

Public/Private Market Creation

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- High efficiency building supply and innovation chains
- Retrofit energy efficiency markets in liberalised electricity markets
- Active/smart grid business models in liberalised electricity systems
- Scalable CCS business models
- Low carbon infrastructure and construction materials

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What counts as success?

Predictability and control will always be elusive. The business of government is inherently unpredictable, messy and shaped by events. But better use of systems models should mean …

...better informed crises!

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"..chance only favours the prepared mind"
Louis Pasteur

- Fewer shocks
- More holistic understanding and actions
- Making explicit underlying assumptions
- Richer narratives to understand and explain processes of change
- Capturing knowledge and understanding which otherwise would dissipate with staff turnover

Use of systems approaches is hampered by lack of demand from decision makers, and a lack of familiarity and training in civil service

There will always be politics - but this should be addressed in defining the systemic context

- Most decisions are surrounded by complex political contexts
- These often capture harder to define issues which are not amenable to modelling (e.g. societal norms; ethical issues etc)
- The raw political issues of resources, power and constituencies
- Factoring politics into systemic thinking - explicitly defining links and impacts helps separate the truly political from poor analysis

Investment in mapping formal and informal decision making processes key to designing useful system tools

Simplicity not Simplistic

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"I would not give a fig for the simplicity this side of complexity. However, I would give my life for the simplicity on the other side of complexity"

Oliver Wendall Holmes

Further Information

All Strategy Unit reports and background papers can be found at www.strategy.gov.uk

Information on policy making methods can be found at www.policyhub.gov.uk

I can be contacted at *nick.mabey@e3g.org*

E3G can be found at www.e3g.org