FS Club
News Events Partnerships

Global Innovation & National Interests

Professor David Bogle, Pro-Vice-Provost and Professor of Chemical Engineering, UCL

Thursday, 17 February 2022, 11:00 GMT

A Word From Today's Chairman

Professor Michael Mainelli

Executive Chairman

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Today's Agenda

- 11:00 – 11:05 Chairman's Introduction
- 11:05 – 11:25 Keynote Presentation – David Bogle
- 11:25 – 11:45 Question & Answer

FS Club

Today's Speaker

Professor David Bogle

Pro-Vice-Provost and Professor of Chemical Engineering

UCL

Global Innovation and National Interests

David Bogle

Pro-Vice-Provost and Professor of Chemical Engineering
University College London

Global Innovation and National Interests

- Context
- The BRG Institute Project
- Findings
- Threats and actions to counter
- The need for international S&T agreements amongst liberal democracies
- Some questions…

Geopolitical and Economic Context

1. The lowering of barriers to cross-border activity at end of the Cold War, the rise of the EU, and economic growth in East Asia.
2. Increasing educational levels and concomitant technical capabilities (especially engineering design & fabricate) in many nations.
3. Globalization of MNC R&D operations (including engineering design & fabricate), including substantial cross-border investments in people and facilities outside the home nation.
4. Virtual and online collaborations and knowledge exchanges among scientists, engineers, and other technical staff in research, development and commercialization settings.
5. Globalization and increasing technical sophistication of supply chains thereby globalizing many innovation ecosystems (a.k.a. creation of global “industrial commons”).

A GLOBAL LOOK AT R&D SPENDING

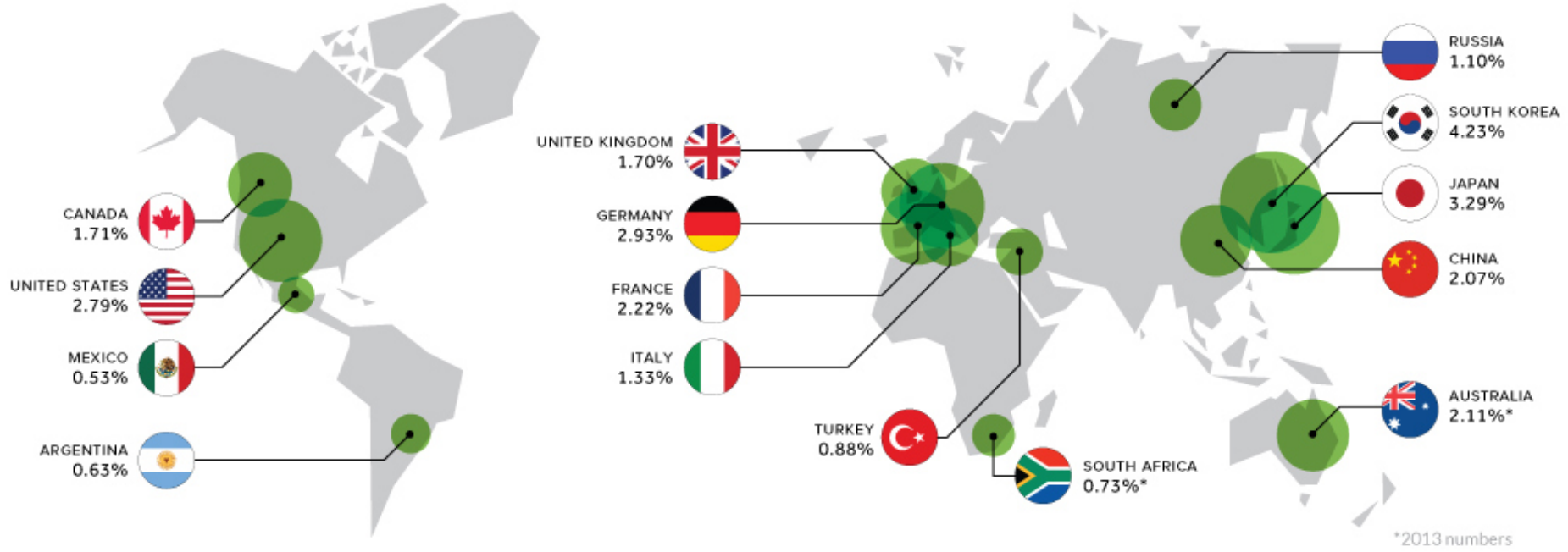
The companies and nations that are leading the way in innovation and research

The G20 accounts for **92%** of global spending on research

94% of patents granted by the US Patent and Trademark Office stem from G20 countries

R&D Expenditure as a percentage of GDP

Select G20 countries; 2015



https://www.visualcapitalist.com/global-leaders-r-d-spending/

Innovation in 2021-2022:
More + Spread Out + Connected

1. In the 1960s, US public and private R&D investment accounted for 70% of the global total. Even with increases over time, US expenditures are now less than 30% of the world's total.
2. Twenty (20) nations now regularly spend (combining public and private expenditures) in excess of 2% of GDP annually on R&D and the world's summed R&D spending has grown to almost $2 trillion per year
3. China, the EU, and the US each employ between 1.5 and 2 million total full-time equivalent S&E researchers in public, private, and academic settings (per OECD data).
4. Collaboration across national borders has become ubiquitous; global knowledge networks are now dense and tightly linked.

Oxford-AstraZeneca COVID-19 vaccine

- Collaboration between Oxford University's Jenner Institute and Vaccitech (spin off from the university)
- Financing from Oxford Sciences Innovation, Google Ventures, and Sequoia Capital, among others
- Supplied 150M doses at low cost to developing world
- With the support of the Wellcome Trust, Gilbert started work in 2007 on the design and creation of novel influenza vaccinations

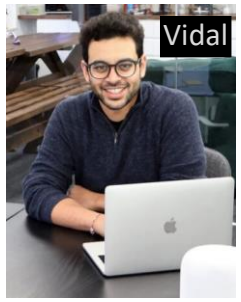
Department Spin-outs

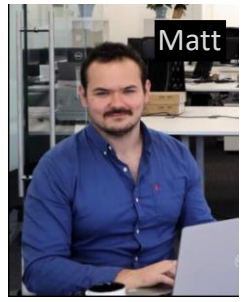
Prof. Dan Brett, Co-Founder UCL Chemical Engineering

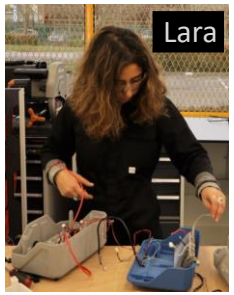
Dr Tom Mason, Co-Founder, CEO & CTO

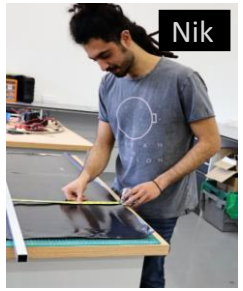
Prof. Anthony Kucernak, Imperial, Co-Founder

www.brambleenergy.com









- **Bramble Energy** is commercializing a revolutionary new platform for making electrochemical reactors, including polymer electrolyte fuel cells.
- The approach uses **printed circuit boards (PCBs)** to achieve very low cost and mass manufacturability.

EPSRC Grant Kucernak & Brett 2009 The Flexible Fuel Cell concept proven

UCL/Imperial Discovery-to-Use 2013 – first stack demo

SUPERGEN Funding

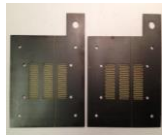
Portable power demo 2016

Vehicle Range extender 2018
APC funded

Key funding
- Portable Power Product
- Automotive

2008 2012 2016 2020

Win Carbon Trust competition 2011



Core IP filed 2014

Angel round 2016

Bramble Energy 2016 formed – revolutionary PCB fuel cell company

Dr. Tom Mason CEO 2017 Former UCL Chem Eng PhD

Institutional round 2018

Series A 2020 £5million investment, >30 employees

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Global Innovation and National Interests

Findings and Recommendations

BRGINSTITUTE.ORG

The Project on
Global Innovation
& **National Interests**
at the BRG Institute

S&T and Innovation Policies in Liberal Countries: The Shift Towards Economic Security

1. Ever-denser cross-border knowledge networks mean **no country goes it alone in S&E or innovation** and value capture from extra-national as well as national innovation is critical

2. This dramatic growth and dispersion of S&E knowledge networks and R&D intensity requires **prioritization of strategic sectors (smart specialization) is critical** for economic prosperity and national security.

3. Because no country goes it alone, **political and economic allies must collaborate, through multilateral strategic innovation and R&D agreements**, resembling – and sometimes part of – international trade, investment, and security agreements.

Exemplary International R&D Collaboration/Consortium Proposals

1. Building, testing, and standardizing **future wireless systems**
2. Multilateral approaches to **reducing and removing space debris**
3. **Digital epidemiology** to address cross-border disease and health vulnerabilities
4. Increasing **resilience of cross-border supply chains,** design and management
5. **Hardening coastal zone infrastructure** against sea level rise
6. Traditional and new approaches to **reducing biogenic methane emissions**
7. Developing and rolling out **sustainable aviation fuels and alternative propulsion systems**

Revising Domestic R&D and Innovation Policies

1. **Liberal democratic governments** need to benchmark, invest in, and align on vital areas including R&D investment, antitrust, IP, immigration, post-secondary education, and re-training to capture value from both local and global innovation.
2. **Universities** in liberal democracies, working with national governments, must update approaches to international academic collaborations to protect both openness as well as beneficial national and societal contributions.
3. **Companies operating in liberal democracies –** especially large, mid-sized and small multinational corporations – are responsible for most national and economic security value capture from innovation (jobs, profits, strategic positioning, etc.); shifts toward value capture in S&T policies will require new forms of engagement among companies, governments, and research universities.

Addressing Threats

- China's S&T policies, and the activities of the country's state-owned enterprises, are often not aligned with the principles of openness, national treatment, and reciprocity that underpin S&T knowledge exchange, trade, and investment among liberal democracies
- UK National Security and Investment Act (2021): New rules for University Research programmes involving international partners: AI, advanced robotics, synthetic biology…
- European Commission (2021) 'Tackling R&I Foreign Interference' discussion paper: academic freedom, data security and IP
- COMPETES Act just recently passed US House of Reps 'United States Innovation and Competition Act' addressing US competitiveness and China
- Guidance for U.S. Scientific Research Security That Preserves International Collaboration by President's Science Advisor (Jan 2022)
- Guidance for Implementing National Security Presidential Memorandum 33 on National Security Strategy for US Government Supported Research and Development - National Science and Technology Council (Jan 2022)

Critical Areas for New Domestic Strategies and Tactics and International Alignment

Government R&D, workforce, and regulatory policies

University roles in national S&T policy

MNC roles and responsibilities

Model international applied R&D agreements

International problem-oriented R&D collaborations

New S&T International Agreements and Collaborations

Model International Applied R&D Agreements

For liberal democracies to align economic policy and S&T policy responses to strategic competitors, and promote global security

International Problem-Oriented R&D Collaborations

For public and private testing of new R&D opportunities across borders, organizations, and sectors

Where New Cross-Border Collaboration Agreements are Critical

	Shared Knowledge and Public Goods	Market IP, Traded and Cross-Border Network Goods and Services	Military IP, Goods, and Services
Basic Research	Most existing international science agreements	Some sovereign-to-sovereign collaboration, re: standards or policy (e.g., data privacy)	Fundamental research exclusion from export control, ITAR, national security alliances
Applied or Problem-Oriented R&D	Some international R&D collaborations, e.g., ITAR, Space, Health	Some contribution from activity in all adjacent cells but mostly unaddressed	Export control regime, ITAR, national security alliances
Trade in Goods and Services	WTO/GATS	WTO/GATS	Export control regime, ITAR, national security alliances

Some questions….

- National Security – but where is the genesis of ideas?
- What other strategic areas need to be protected?
- Generating value from fundamental research – can we encourage this collaboratively while ensuring benefit for all?
- Taxpayers (voters) see ideas and value being ‘lost’ – the difference between the generation and exploitation of ideas?
- What about the movement of people?
- Working where values are very different? EC recognizes we must work with repressive regimes but there are challenges.
- Are there particular challenges for the UK?

Acknowledgements:

Bruce Guile, Eion Lys, BRG Institute Advisory Board
Dan Brett and Paul Shearing UCL Chemical Engineering

My email: d.bogle@ucl.ac.uk

Further reading

- Guile and Wagner, A New S&T Policy for a New Global Reality https://issues.org/global-science-technology-policy-guile-wagner/
- Tyson and Guile, Innovation Based Economic Security https://issues.org/innovation-based-economic-security-tyson-guile/
- McLaughlin and Guile, Greatness Thrust Upon Them: US Research Universities and the National Interest https://issues.org/us-research-universities-national-interest-mclaughlin-guile/
- Science-Business Article (quoting Delpy past UK EPSRC CEO) https://sciencebusiness.net/news/new-years-resolution-research-group-aims-fix-way-world-collaborates-technology
- BRG Institute https://www.brginstitute.org/working-papers

Findings 1: From the Cold War to Today

1. Over last 30 years, research-capable personnel, public and private R&D capability, and advanced industrial competence ("lab to fab" or "code to download") have grown rapidly and become dispersed around the world.

2. Largely open public R&D investment, immigration/emigration, and cross-border knowledge exchanges have underpinned this dispersion and propelled rapid advances in science, engineering, and commercial innovation.

3. Trade and investment agreements among sovereign nations have supported openness by generally adhering to principles of (i) reciprocity and (ii) national treatment and by allowing private sector actors to avail themselves of (iii) enforcement mechanisms.

4. Capitalizing on these three foundations, businesses originating in liberal democracies were able to benefit from from cross-border openness in trade and investment transactions, paving the way for rapid growth of tech-based and other multinational corporations of all sizes.

Background detail

Findings 2: Where The World is Today

5. The globalization of science and engineering knowledge, and of innovation, means that no nation “goes it alone” in research, or in commercial or national security applications of S&T.

6. The post-Cold War global importance of China – now the second largest R&D investor – in commercial and national security S&T has been fueled by state-dominated investment in basic, applied, and industrial R&D and by integrated, outward-facing S&T policies.

7. China’s S&T policies, and the activities of the country’s state-owned enterprises, are often not aligned with the principles of openness, national treatment, and reciprocity that underpin S&T knowledge exchange, trade, and investment among liberal democracies.

8. Liberal democracies need revised S&T strategies, tactics, and cross-border collaborations to adjust to both dispersed global innovation processes and the increasingly important role of China in global S&T.

Background detail

Findings 3: Shifting the Policies of Liberal Democracies

9. Policy and practice shifts in liberal democracies need to protect openness while simultaneously improving the ability of a nation (and its political and economic allies) to capture economic and national security value from ever-denser cross-border knowledge networks.

10. Prioritization of strategic sectors (smart specialization) is critical for economic prosperity and national security of even the most technologically robust liberal democracies.

11. Liberal democracies need new types of competition-supporting sovereign-to-sovereign agreements on applied and industrial R&D, new cross-border R&D collaborations, and new international public-private R&D consortia all aligned with principles of national treatment, reciprocity, and with enforcement mechanisms to ensure adherence to these principles.

Comments, Questions & Answers

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Forthcoming Events

- Mon, 21 Feb (15:00-15:45) Financial Services & UK Competition Law: Evolving Business Models & The Competition Law Landscape
- Wed, 23 Feb (16:00-16:45) The New Political Capitalism
- Thu, 24 Feb (08:00-09:15) BizTech Huìhuà Chat: Realising The Renewable Energy Internet - The Financial Interconnectors
- Tue, 01 Mar (15:00-15:45) The Discount Process Is The Problem!

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