

# Introduction to Centre for Innovative Manufacturing in Ultra Precision

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National Strategy Manager

# UK Manufacturing Background



- Manufacturing in the UK is a political “hot” topic
- Manufacturing has been an important part of the UK economy for at least 250 years
- The nature of manufacturing has and continues to change



# Manufacturing Contribution to UK Economy



- UK is 11th largest global manufacturing base
- 10% of GDP (approx. £157Bn, c.2013 World Bank)
- Significant employer; 2.6M people
- Large investment via manufacturing businesses
  - almost 75% of UK R&D investment (c.2011 ONS)
- Diversity of end industries
  - Automotive, pharmaceutical, food, aerospace, ICT, chemicals
- High proportion of SME's
  - 57% (Engineering Employers Federation)
- 54% of exports

# EPSRC Background



- The Engineering and Physical Sciences Research Council (EPSRC) is the UK's main agency for funding research in engineering and the physical sciences.
- EPSRC invests around £800 million a year in research and postgraduate training, to help the nation handle the next generation of technological change.

## KEY FACTS AND FIGURES

**9,300**

students supported

**£133 Million**

of joint investment with TSB

**44%**

of research portfolio is collaborative

**£800 Million**

annual budget

*Cranfield*  
UNIVERSITY

**EPSRC**  
Pioneering research  
and skills

 UNIVERSITY OF  
CAMBRIDGE

# Centres for Innovative Manufacturing



- The EPSRC Centres for Innovative Manufacturing are the latest in a line of EPSRC funding to support manufacturing research in UK universities.
  - Innovative Manufacturing Research Centres (IMRC)
  - Innovative Manufacturing Initiative (IMI)
  - Application of Computers to Manufacturing Engineering (ACME)
  - Integrated Knowledge Centres (IKC)
  - Centre for Innovative Manufacturing (CIM)
  - Future Manufacturing Research Hub
- 16 CIMs established by EPSRC from 2010-2013
  - All centres have similar aims
  - Each in a different technology area

# Aims of EPSRC Centres



- To create, deliver and disseminate world-leading research.
- To address major long-term manufacturing challenges/and or emergent manufacturing opportunities.
- To provide strong support for UK manufacturing industries.
- To enhance the global profile and significance of UK research.
- To create a national network of expertise in manufacturing research knowledge.
- To provide outreach to other centres and relevant research groups.





Regenerative Medicine



Ultra Precision



Laser-Based Production



Liquid Metal Engineering



Industrial Sustainability



Photonics



Intelligent Automation



Medical Devices



Advanced Metrology



Composites



Additive Manufacturing



Food



Large-Area Electronics



Through-Life Engineering



Macromolecular Therapies



CMAC

# Ultra Precision



*Next generation products will demand nanometre level tolerances on complex components*

Such products include:

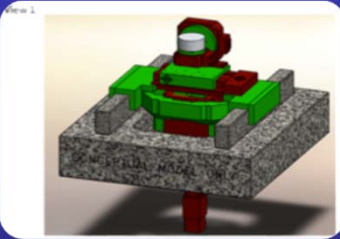
- Next generation displays
- Plastic electronic devices
- Low cost photovoltaic cells
- Medical devices
- Defence and security technologies.



*The Centre aims to create ultra high precision manufacturing processes and tools that can make products with nanoscale precision.*



# The Research Platforms



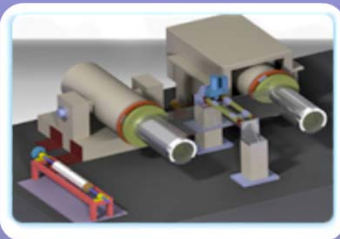
## Laser Assisted Focused Ion Beam

- Next generation hybrid ion/laser beam processing system for high throughput nano machining



## Meso-Scale Platform

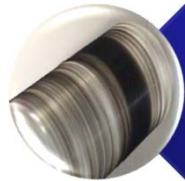
- Compact size micro factory capable of additive and subtractive technologies



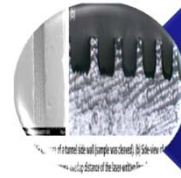
## Macro Reel-to-Reel "R2R" Platform

- Large scale facility capable of creating continuous films and film moulds

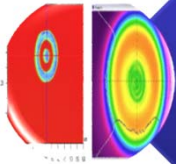
# Research Portfolio



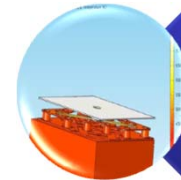
**Laser Machining of Carbon Nanotubes for Field Emission Applications**



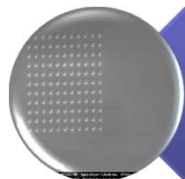
**Femtosecond Laser Irradiation and Chemical Etching**



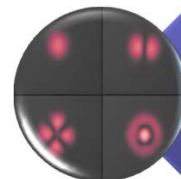
**Holographic Optical Fibre**



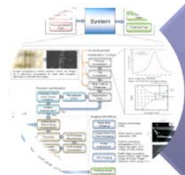
**Spatial Light Modulators for High Laser Power Applications**



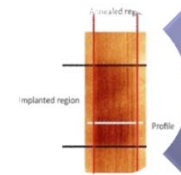
**Ultra precision light sensors**



**Holographic Enhancement of Fibre Optic Sensors**

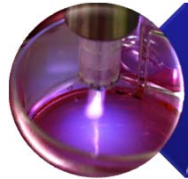


**Control System for Ultra Precision Processing**



**Ultrafast Laser Removal of Ion Beam Implanted Gallium**

# Research Portfolio



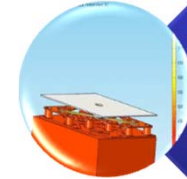
**Microwave Plasma Technologies for Advanced Surface Fabrication**



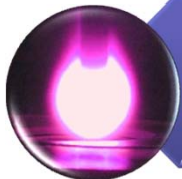
**Development of an Ultra Precision Film Steering Test Facility**



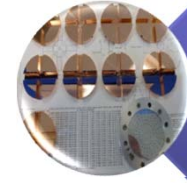
**In-Process and Post-Process Metrology for an Ultra Precision Machine**



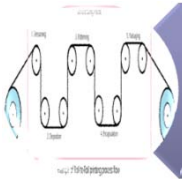
**Spatial Light Modulators for High Laser Power Applications**



**Advancement of RAP Technology to Reduce MSF Errors on Metre-Scale Optical Surfaces**



**Dimensional Deviations of CLIC Standard Discs During Machine Operations**



**Optical Alignment Control**

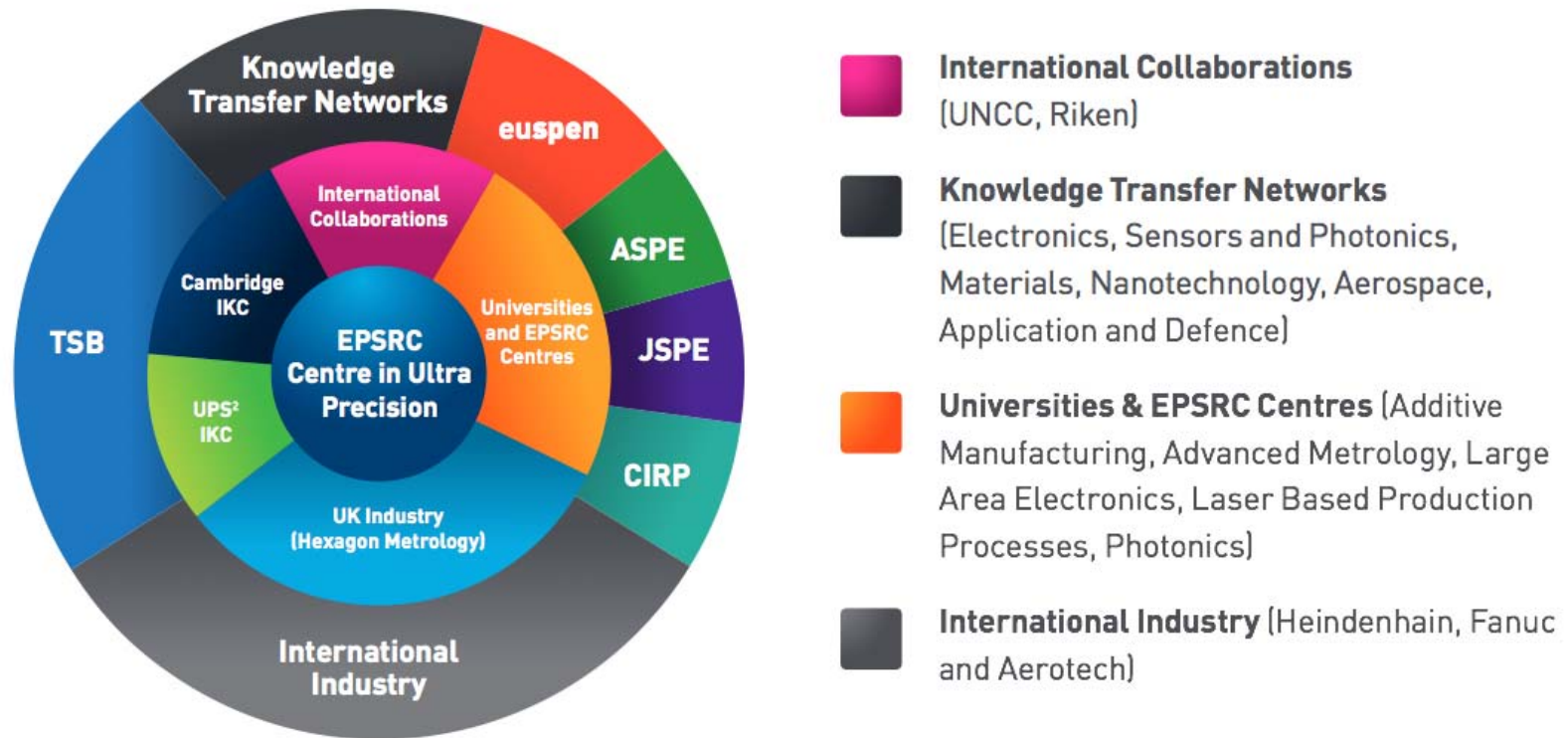


**Assessment of the Micro Four Machine Based on the Processing of Complex Features**

# National Strategy Programme for Ultra Precision



The National Strategy Programme aims to deliver a thriving and active ultra precision network community across academia and industry, supported by information services and collaboration opportunities



# Centre for Doctoral Training in Ultra Precision



UNIVERSITY OF CAMBRIDGE
Quick links ▼ Search

EPSRC Centre for Doctoral Training in Ultra Precision Log in

## EPSRC Centre for Doctoral Training in Ultra Precision

Home Masters of Research - Year 1 PhD Years 2-4 Research Platforms People Industrial Partners How to apply Contact

### APPLY NOW

**Recruiting Ultra Precision Scientists and Engineers of the Future**

We are now recruiting Postgraduate students interested in developing the next generation of ultra precision manufacturing systems and products starting in October 2014. The CDT in Ultra Precision welcomes applicants from any field of Science and Engineering who have obtained a first or upper second class honours degree (or equivalent). Full application deadline of 30th June 2014.

[Read more >](#)

Meet our newest cohort of MRes in Ultra Precision Students

We welcome our newest cohort of 7 MRes in Ultra Precision Students who began in October 2013. This cohort have a varied background of studies in Physics, Engineering and Natural Sciences.

[Read more >](#)

Cranfield and Cambridge collaboration

The collaborating team from Cambridge and Cranfield represent a world-leading Ultra Precision partnership.

[Read more >](#)

**Upcoming events**

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Plastic Electronics Fabrication Technologies  
*Feb 19, 2014*  
Sedgefield

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Future Display Technologies and Production Demand  
*Apr 01, 2014*  
Institute for Manufacturing, Cambridge

[Upcoming events >](#)

**Related Links**

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[EPSRC Centre for Innovative Manufacturing in Ultra Precision](#)

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[Centre for Industrial Photonics](#)

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[Institute for Manufacturing](#)

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[Follow our LinkedIn Group](#)

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**Applications and Enquiries**

To apply, or for more information, please contact Sophie Fuller [sg523@cam.ac.uk](mailto:sg523@cam.ac.uk).

Pioneering research and skills



# UK National Database of Facilities and Community



## UK database of ultra precision facilities, equipment and capability

Provides an openly available detailed database, listing UK companies and research establishments holding ultra precision facilities and equipment, indicating access opportunities under commercial and research agreement.



<p><b>Diamond Turning and Micromilling</b></p> <p><a href="#">View more</a></p>	<p><b>Optical Grinding and Polishing</b></p> <p><a href="#">View more</a></p>	<p><b>Plasma Ion and Beam Systems</b></p> <p><a href="#">View more</a></p>	<p><b>Surface Analysis</b></p> <p><a href="#">View more</a></p>
<p><b>Co-Ordinate Metrology</b></p> <p><a href="#">View more</a></p>	<p><b>Optical Metrology</b></p> <p><a href="#">View more</a></p>	<p><b>Lasers and Focus Ion Beam</b></p> <p><a href="#">View more</a></p>	<p><b>Surface Metrology</b></p> <p><a href="#">View more</a></p>
<p><b>Reel to Reel Processing</b></p> <p><a href="#">View more</a></p>	<p><b>Micro Injection Moulding</b></p> <p><a href="#">View more</a></p>	<p><b>UK Facilities</b></p> <p><a href="#">View more</a></p>	<p><b>All Facilities and Equipment</b></p> <p><a href="#">View more</a></p>

The Centre's Ultra Precision Community – Industrial companies and universities in the ultra precision and precision engineering community.

If you are interested in joining this community, please contact:  
 Mrs Inesa Glancuski | Centre Co-ordinator  
 Email: [inisa@ultraprecision.org](mailto:inisa@ultraprecision.org)

<p><b>PRIFYSGOL Glyndŵr UNIVERSITY</b></p> <p>Glyndŵr University</p>	<p><b>AICE</b></p> <p>Advanced Chemical Etching Limited</p>	<p><b>Nikon</b></p> <p>Nikon Metrology</p>	<p><b>AEROTECH</b></p> <p>Aerotech</p>
<p><b>OpTek SYSTEMS</b></p> <p>OpTek Systems</p>	<p><b>ALE</b></p> <p>Applied Laser Engineering Ltd</p>	<p><b>HEXAGON METROLOGY</b></p> <p>Hexagon Metrology</p>	<p><b>Reinhold Group Rexroth Bosch Group</b></p> <p>Bosch Rexroth</p>
<p><b>Innovation in Motion Milba</b></p> <p>Milba Coatings Group</p>	<p><b>queensgate</b></p> <p>Queensgate Instruments</p>	<p><b>Semitronics</b></p> <p>Semitronics Sales Ltd</p>	<p><b>QI OPTIQ</b></p> <p>QIoptiq</p>
<p><b>University of HUDDERSFIELD</b></p> <p>EPSRC Centre in Advanced Metrology – University of Huddersfield</p>	<p><b>LML</b></p> <p>Laser Micromachining Ltd</p>	<p><b>M-SOLV</b></p> <p>M-Solv Ltd</p>	<p><b>FANUC</b></p> <p>FANUC</p>

### Outreach events

- [Academic outreach](#)
- [Industrial outreach](#)
- [Ultra precision community](#)

### Latest news

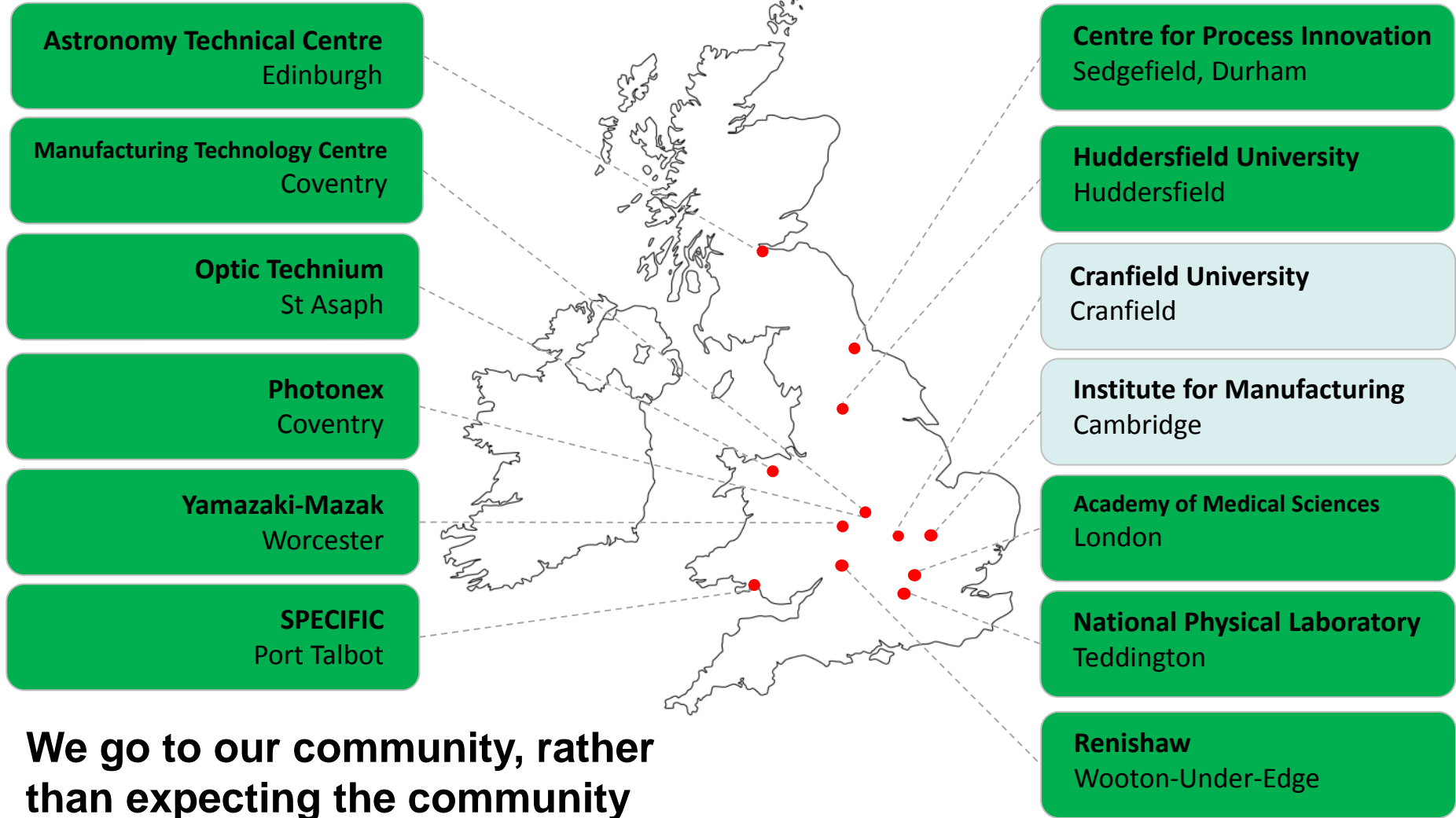
- [Watch it Made Gains Momentum](#)
- [Student Invention Takes Feet Out of Shaky Hands](#)
- [Tiang Dong Wins Roger Kelly Award for Best Young Researcher Presentation](#)
- [Register Now for the Precision Engineering Industrial Short Course](#)
- [Cranfield University Signs MOU with Beijing Institute of Space Mechanics and Electricity for Space Optics](#)
- [Jon Perkins Poster Winner at IIM Research Conference](#)
- [National Manufacturing Debate 2014](#)

# Outreach Events 2016



- Networking Events
  - Fixturing and Machining, Mazak, Worcester (17 Feb)
  - Optical Materials Day, Cranfield (14 Apr)
  - Challenges of Instrumentation and Control in UP Manufacturing, Renishaw, New Mills (18 May)
  - Laser-FIB: Industrial Applications, Cambridge IfM (23 Jun)
  - The Future of Precision Engineering, London (26 Oct)
- Other
  - Energy Beam Processing Short Course (15-18 Feb)
  - UP Manufacturing Conference (**TODAY!**)
  - Prestige Lecture: Medical Applications (28 Jun, Cranfield)
  - Precision Engineering Industrial Short Course (19-23 Sep)

# Geographic Spread



**We go to our community, rather than expecting the community to come to us.**





# Other Activities



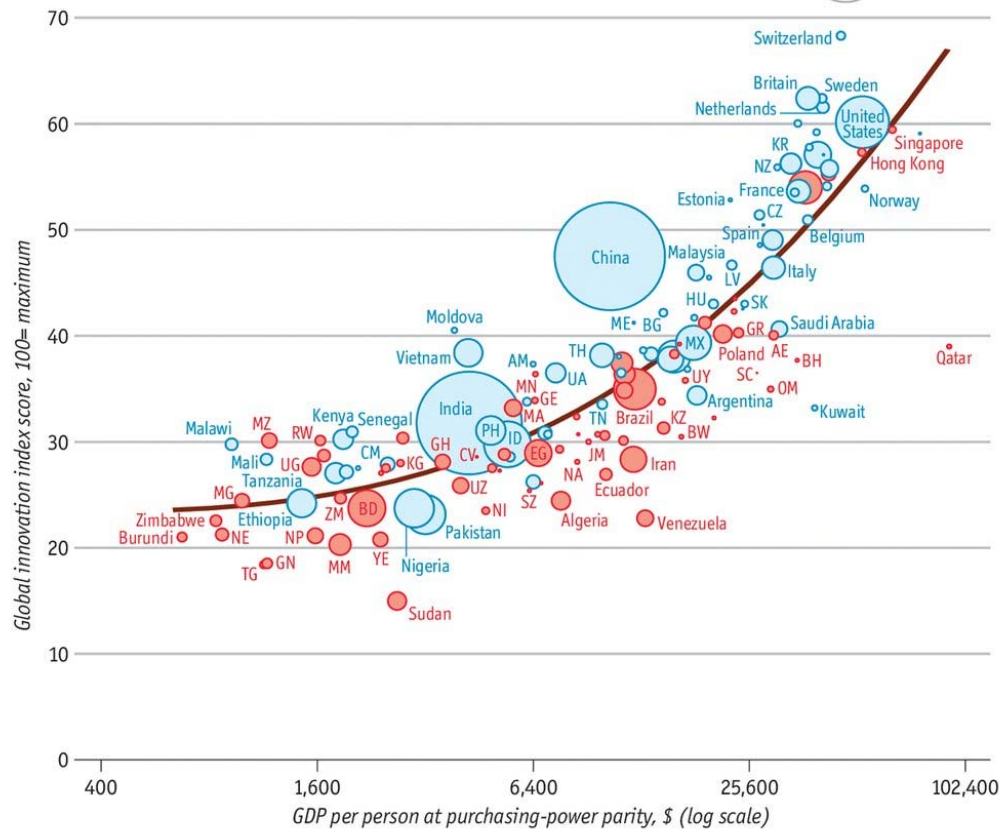
# Is It Worth It?

## Global Innovation Index

2014 or latest available year

- Efficient innovators
- Inefficient innovators

1bn Circle size = population



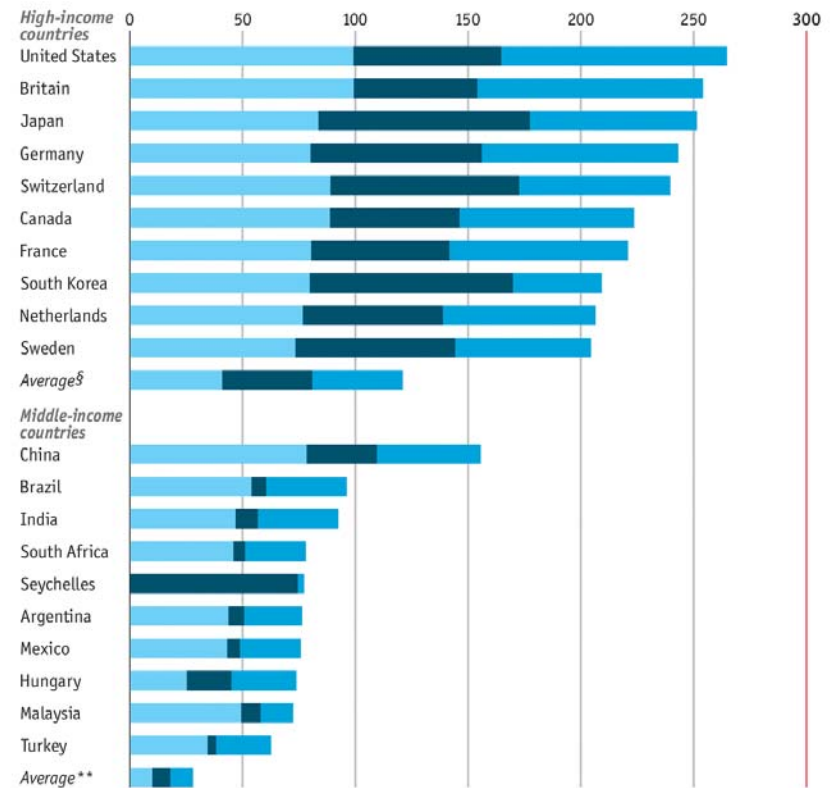
Source: Global Innovation Index, 2015

Economist.com

## Innovation quality

300=maximum quality

- Universities\*
- Patents†
- Citations‡



Source: Global Innovation Index, 2015

Economist.com

\*Average rating of top three universities †Number of patents filed per unit of GDP ‡Cited articles as % of published articles §Of 48 countries \*\*Of 72 countries



# Science and Society

## Science as an important UK cultural institution



## Science as a personal characteristic



Source: Culture Tracking Survey, King's College London.  
Data from a representative sample of 2,091 UK adults in September 2015. [www.kcl.ac.uk/culture](http://www.kcl.ac.uk/culture)

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# Contact



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