The contribution of universities to their regional economy (the region's GDP) — the UK's approach to developing measures and thereby creating value

John Green (University of Cambridge, United Kingdom)

Marat Fatkhullin (Government Advisor, Russia);

1. Background

It is human nature to seek a single measure to define the state of an entity: we embrace rankings in many areas of human endeavour. But a single measure (even a set of measures) cannot successfully indicate the state of a system. A simplistic example is trying to use a single measure to define the health of a human; many metrics (blood pressure, pulse, blood counts etc) together form a picture but we need a different set of metrics to decide each particular aspect of health (heart, lung, stomach etc).

We always want as many metrics which together allow us to form a human judgement of the state of the particular aspect of the system which we are focussing on. We constantly strive to find more data and metrics to help us to draw better conclusions – there are never enough datasets and they are never perfect. But one has to start somewhere – even if one only has a few metrics and the datasets flawed, the very process of beginning to use whatever exists will drive the cultural behaviour to create better datasets and better metrics.

2. The global landscape

Over the past few years there had been increasing interest in many countries in the knowledge economy (knowledge transfer between universities and the local region). It often focusses on 3 types of transfer: (1) transferring knowledge across the university-industry (including SME) boundaries; (2) embedding continuing education into the local population; (3) societal impact. The first of these is easy to measure through metrics such as academic-corporate collaboration, licence income, patents and their citations etc; the second can be tracked by the engagement of the community in education by age profile. But the impact on society is the hardest to measure - various rough metrics are currently being suggested such as mass media exposure through altmetrics (although the UK has focussed in the Research Excellence Framework (REF, previously RAE) on providing narrative and qualitative descriptors). None of these approaches easily address the core economic question – can we demonstrate that investing more in universities will create greater regional GDP?

Many countries, UK particularly, recognise the symbiotic relationship between universities and the local economy and see the ways in which alignment and interaction across the university-industry interface can benefit the local economy. But whilst intrinsically we know this to be true we do not yet have a robust way to measure it. So what is happening? Two approaches: (1) the theorists are spending time trying to dream up ways by which a model can be created which lends itself to measurement (and there are many publications written about this); (2) others are approaching the challenge in a pragmatic way – do what one can with what is available, learn from that and work to refine the data and the model.

The UK has adopted both a theoretical and a pragmatic approach in parallel: alongside its well-established REF it has developed a Teaching Excellence Framework (TEF) and is now consulting on how to develop a Knowledge Excellence Framework (KEF) – this is in its very early stages and during 2018 is out for consultation with all the stakeholders. That is a

theoretical future modelling approach; in parallel the UK has adopted a pragmatic approach and it is this which is explained below.

3. The framework of UK regional Science and Innovation Audits (SIAs)

In 2013 the UK government embarked on a process to develop:

- A country-wide assessment of strengths & where they exist, recognising that universities are responsible for facilitating economic growth

- A regional assessment of existing strengths in research & innovation across the university-industry boundary

- A regional strategy with focussed objectives for specific investment

First the government defined a list of 17 priority scientific areas/sectors (much as Russia has recently done). Each of the UK's 5 regions then identified which sectors to analyse based upon their existing strengths. Then, working through consortia (driven by universities) each region identified mechanisms to build upon each region's strengths and build evidence-based proposals for a small number (~4) of specific sub-areas for investment (and from 2017 government funds were released to fund these).

There were some fundamental assumptions which were key to the approach:

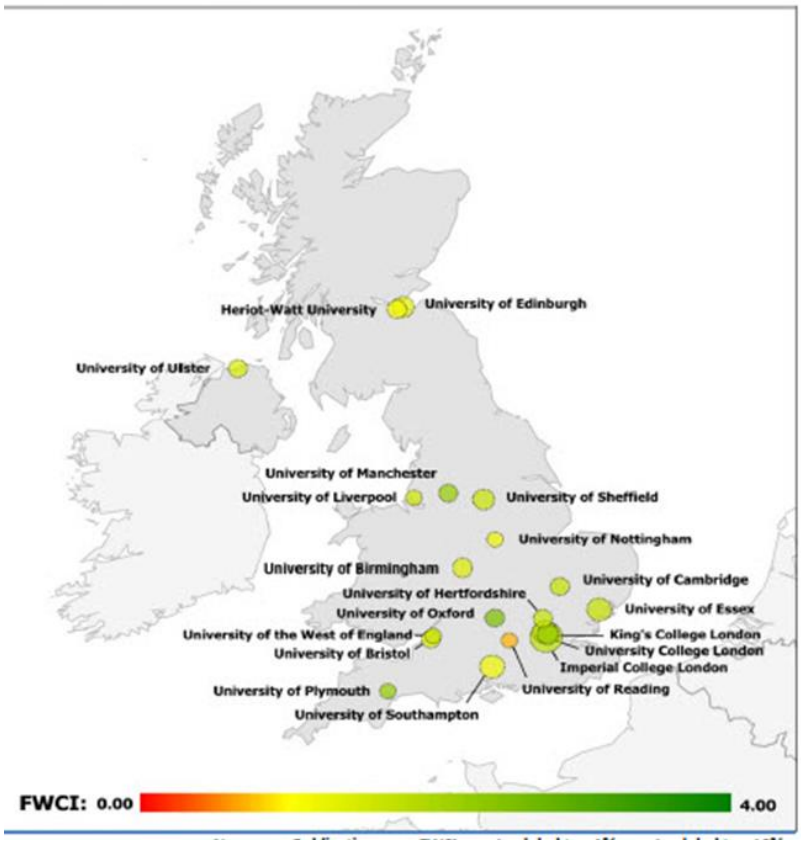
- Funding flows must be based upon the available technology and/or industry, not influenced by geographical location in order to drive greater collaboration wherever the 'ideas flow'

- Eliminate regional barriers which create domestic competition; instead organize resources to run a global race

The work started using **heat maps** to show the top universities for each of the 17 priority areas: for example the one for "Robotics" showed these areas of strength in universities:

Name	Publications	FWCI	In global top 1%	In global top 10%
University of Oxford	76	2.54	5 (6.6%)	24 (31.6%)
University College London	112	2.29	4 (3.6%)	34 (30.4%)
University of Manchester	72	2.21	2 (2.8%)	11 (15.3%)
University of Plymouth	58	2.20	0 (0.0%)	10 (17.2%)
Imperial College London	289	1.72	4 (1.4%)	60 (20.8%)
University of Cambridge	95	1.68	3 (3.2%)	27 (28.4%)
University of Essex	166	1.68	3 (1.8%)	17 (10.2%)
University of Hertfordshire	96	1.65	0 (0.0%)	9 (9.4%)
King's College London	141	1.64	8 (5.7%)	31 (22.0%)
University of Sheffield	119	1.64	3 (2.5%)	15 (12.6%)
University of the West of England*	66	1.61	0 (0.0%)	13 (19.7%)
University of Liverpool	64	1.55	0 (0.0%)	8 (12.5%)
University of Ulster	88	1.46	1 (1.1%)	13 (14.8%)
University of Bristol*	89	1.43	2 (2.2%)	10 (11.2%)
University of Birmingham	90	1.40	1 (1.1%)	12 (13.3%)
University of Edinburgh	105	1.37	0 (0.0%)	12 (11.4%)
University of Nottingham	66	1.22	1 (1.5%)	12 (18.2%)
University of Southampton	140	1.20	3 (2.1%)	31 (22.1%)
Heriot-Watt University	90	1.09	0 (0.0%)	1 (1.1%)
University of Reading	60	0.70	0 (0.0%)	4 (6.7%)

universities work jointly as the Bristol Robotics Laboratory



These revealed strengths (and weaknesses) which had not been recognised previously.

Regions then identified which sectors to analyse further based upon their region's existing strengths so as to define its potential competitive advantage and therefore its ability to attract further talent and investment based on existing strengths (an example from one region): each region assembled data on existing strengths: one region as example:

Table 1-1: Midlands Engine GVA by industrial group (2014)

	Midlands Engine GVA (£m)	Proportion of UK GVA
Agriculture, forestry and fishing	2,169	20%
Production industries	44,675	20%
… of which Manufacturing	*36,681*	*21% (of UK manufacturing)*
Construction	14,977	15%
Distribution; transport; accomm, food	49,088	17%
Information and communication	9,369	9%
Financial and insurance activities	9,465	7%
Real estate activities	25,397	14%
Business service activities	24,488	13%
Public administration; education; health	44,228	15%
Other services and household activities	10,010	14%

Source: SQW analysis of ONS Sub-Regional GVA data. Note: numbers may not add to 230bn owing to rounding

***GVA = Gross Value Added** = GDP - taxes on products + subsidies on products*

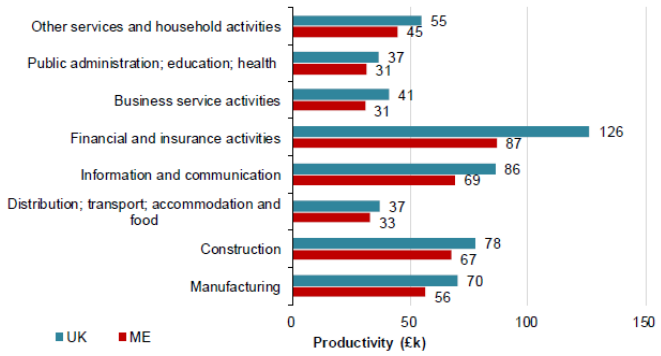
It was also critical to understand the human capital assets in a region in order to provide an evidence-based understanding of whether the region's human resources could fuel innovation & growth in the specific areas. First maps of the sectors where people were worked was developed:

Table 1-2: Midlands Engine workplace based employees by Broad Industrial Group (2014)

Broad Industrial Group	Employees in ME	Location Quotient	% GB total
Mining, quarrying & utilities	67.9	1.1	19%
Manufacturing	616.6	1.5	26%
Construction	217.3	1.0	17%
Motor trades	126.9	1.4	25%
Wholesale	251.5	1.2	22%
Retail	507.8	1.0	18%
Transport & storage (inc. postal)	260.5	1.2	21%
Accommodation & food services	290.4	0.8	15%
Information & communication	134.5	0.7	12%
Financial & insurance	106.8	0.6	10%
Property	72.3	0.9	16%
Professional, scientific & technical	328.9	0.8	15%
Business administration & support services	456.8	1.0	19%
Public administration & defence	207.5	0.9	16%
Education	488.0	1.0	19%
Health	654.7	1.0	18%
Arts, entertainment, recreation/other services	214.5	1.0	17%

Location quotient (LQ) quantifies how concentrated a particular occupation is in a region compared to UK. It can show what makes a particular region "unique" in comparison to the national average. *http://www.economicmodeling.com/wp-content/uploads/2007/10/emsi_understandinglq.pdf*

The next step for each region was to understand the skills of the workforce in order to assess what development would be needed to deliver any new strategy. For example understanding the quality of employees by measuring for example by "Productivity per employee":



This example showed that this region's workforce was less productive than the average across the UK in all sectors and was a major new finding. It resulted in the obvious outcomes – a need to improve the regional education (at technical and professional levels) in order to improve productivity – this then became the key long-term priority for the region - and one which informed the local universities' strategy in a focussed and specific way. This was maybe the first time that universities had begun to provide courses that the region needed rather than what the customers preferred.

Following these analyses (see more in the examples[1]) this region identified 6 themes of innovation to prioritise and 3 enabling competencies to underpin innovation within these

[1] 2016 Science & Innovation audits for 5 UK regions e.g. Midlands region
https://www.midlandsengine.org/wp-content/uploads/2017/04/Midlands-Engine-SIA-Volume-1-Report-01-Nov-1-2.pdf

themes. For example, in one (traditionally a manufacturing region) the enabling competencies identified were:

- Advanced Manufacturing & Engineering
- Digital Technologies & Data
- Systems Integration

and the resulting focus of the themes identified for investment were:

- Next generation transport
- Future Food processing
- Medical technologies
- Energy and low carbon

for each of which there was a careful assessment of assets and strengths to support the case for investment.

This step-by-step data driven approach resulted in the region adopting the following specific challenges:

- transport system integration
- advanced propulsion: energy & power
- optimised production & operation

4. Summary

The UK's approach to deciding how to invest in regions in order to drive economic growth was through an evidence-based, data-driven approach. First the government defined 17 priority scientific areas. Each of the UK's 5 regions then identified which sectors to analyse further based upon their existing strengths. Then each region identified mechanisms to build upon each region's strengths and built evidence-based proposals for a small number (~4) of specific sub-areas for investment (and from 2017 government funds were released to fund these).

John T. GREEN is an Emeritus Professor at the University of Cambridge.

After an academic career as a mathematician, he ran the academic side of Queens' College Cambridge. In 1993, he became Chief Executive of the Royal Society of Medicine where he was the driving force behind the creation of the UK Academy of Medical Sciences.

In 1998 he moved to Imperial College London where he merged 5 medical schools into Imperial and created the UK's first Academic Health Sciences Centre.

He was Chief Operating Officer of Imperial until 2010 where he led major projects involving research management and information technology.

John has been involved in advising governments, universities and funders on research strategies and has chaired the steering committees for many reports on research performance including
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/660855/uk-research-base-international-comparison-2016.pdf

John was the driving force of Project Snowball. Snowball Metrics are a robust framework for measuring research performance and are emerging as the standard to define key metrics across universities, funders and governments. https://www.snowballmetrics.com/ . These metrics are internationally applicable and available for benchmarking between countries.

Marat FATKHULLIN has served as Government Advisor for Russia and for other countries since 2013.

He has recently been appointed as a member of the Global Strategic Networks team at Elsevier.

Marat has advised and brokered major research collaborations within and between countries involving universities, funding bodies and industry.

He has worked with leading institutions in the UK, Europe, and Russia such as Cancer Research UK and the Russian Foundation for Basic Research.