

The Spending Review - Submission from *Engineering the Future*

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Introduction

EtF welcomes the opportunity to contribute to the thinking around the 2015 Spending Review. In representing the engineering profession, EtF is well placed to highlight the contribution which engineering and related disciplines make to the economic well-being of the UK as a whole. In the following document, we will describe how engineering will help the government meet its targets and spending priorities. We hope that this will give Treasury the necessary background to support the engineering sector, and engineers, in the coming years.

Engineering contributes directly to the financial health of the country, particularly through export and revenue generation. It provides employment for millions, both in prime companies and supply chains. Engineering is also an underpinning ‘enabler’ for economic recovery. It touches on almost every aspect of the economy, from exports to the health of the population, from local economic development to transport.

The Government rightly funds and encourages science, but without engineering, society would not benefit from any of those scientific advances. If we accept that engineering is the means to benefit from new ideas and discoveries, then it follows that there is no part of the economy that doesn’t benefit from engineering. Engineering ‘makes science useful’.

When support for the engineering sector and profession is sustained and ‘protected’, it enables resilience to volatility, the development of sustainable solutions, the deployment of effective predictions and anticipation to maximise funding impact, as well as leveraging long term

private investment. The result of this is more (and more effective) spending across government and the private sector.

Protected spending

The National Health Service

Engineering in healthcare is a key but often overlooked element. EtF is finalising a report on this very subject, which covers the contribution of engineering to an extraordinarily wide range of healthcare provision, including:

- Systems thinking in community healthcare
- E-health and m-health, using technology to manage health and behaviour
- Engineering and construction in healthcare estates, and how it contributes to positive outcomes

Engineering reaches far beyond the most obvious applications of engineering in healthcare – such as monitoring technology and prosthetic implants. It underpins the success of a national health service and system in every way.

Defence spending

Without engineering, the UK defence priorities would be moot. The work of the Armed Forces, whether acting during a specific conflict, supporting disaster relief, or providing peacekeeping reinforcement, relies on engineering technology and engineering 'ways of thinking'. From communications systems to protective armour, engineering technology demonstrably reduces the risk to life and the length of conflict. Engineering thinking and behaviours also support the deployment of defence spending through modelling outcomes from crises, avoiding costly field mistakes, etc. It also potentially reduces the future need for defence spending, thanks to the technologies used in surveillance and threat reduction/prevention.

Official development assistance

Engineering makes overseas development and aid effective far beyond an immediate crisis. For the UK to get the maximum benefit from its international development work, it will need engineering and engineers to continue to play its part. As with defence, it is the combination of engineering technology and engineering 'ways of thinking' which make the difference between a short term 'fix' and a long term, cost-effective solution.

Per pupil spending in schools

The previous Coalition government, and governments before this, made great strides in improving the provision of subjects core to engineering in schools – science, technology, engineering and mathematics. EtF will continue to work with government to ensure that schools spending appropriately and effectively supports these subjects, whether it be in terms of capital expenditure (on great science facilities, digital connectivity, etc) or revenue (STEM teacher supply, etc).

Spending priorities

Engineering thinking is fundamental to improving the impact and efficiency of public spending. The Royal Academy of Engineering's *Thinking Like An Engineer* identified the following 'habits of mind' which engineers use: systems thinking, adapting, problem finding, creative problem solving, visualising, and improving. These are bound within wider learning habits of mind: open-mindedness, resilience, resourcefulness, collaboration, reflection, ethical consideration, and curiosity. We mention these here because these approaches, processes, and 'ways of thinking' provide a perfect blueprint for the behaviour change necessary to achieve the government's planned spending priorities.

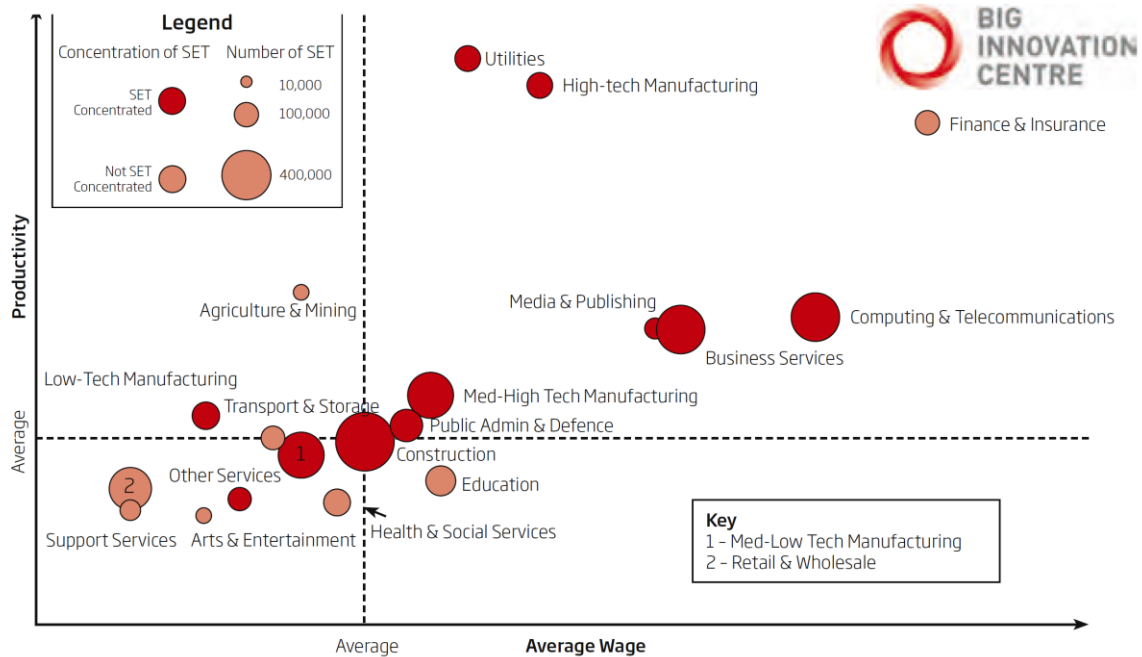
Promoting innovation and greater collaboration in public services

Engineering thinking in public services

Innovative thinking is at the heart of engineering. It is those with an engineering 'mindset' who are able to move outside the traditional way of doing things, and come up with new and better processes. Engineering is also a highly collaborative profession, and increasingly multi-disciplinary in its approach. As a result, engineering provides the model, as well as the means to achieve greater innovation and collaboration in public services.

Engineers as public servants

Engineers and others in STEM roles are to be found across public services, as this graphic developed for the Royal Academy of Engineering's publication *Job and Growth* attests:



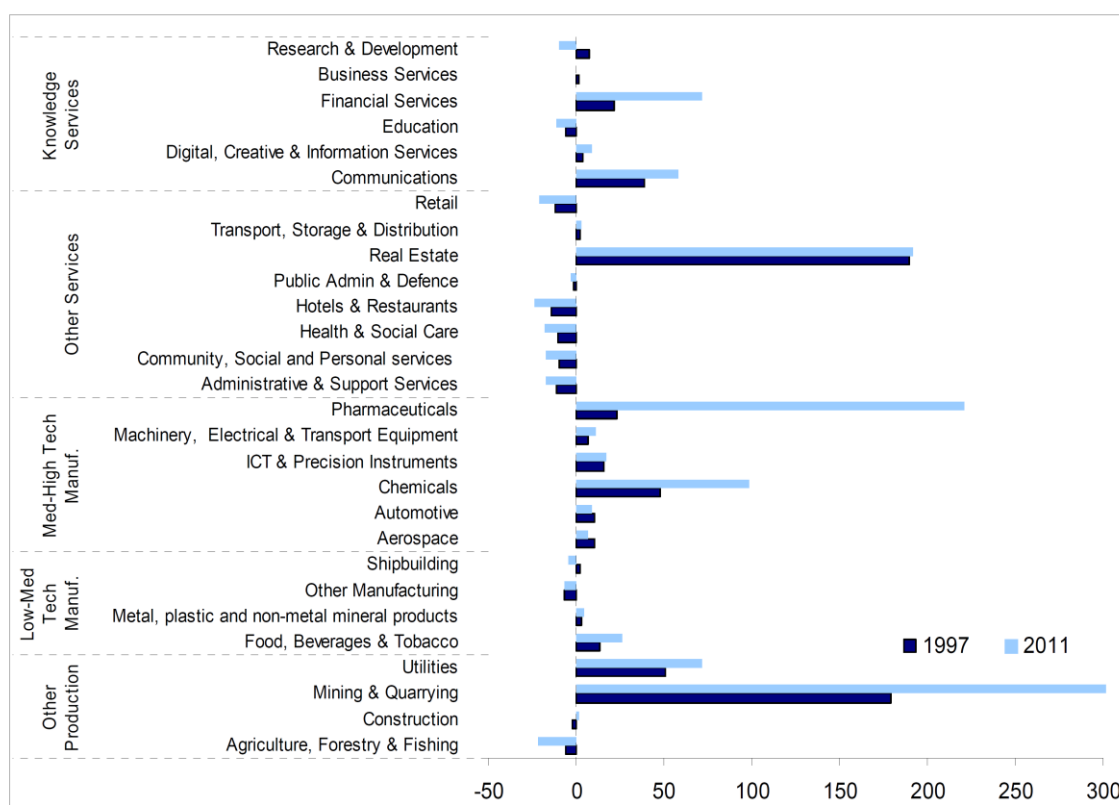
Engineers will be central to the successful deployment of funding for public services over the next five years. See also under the heading "Delivering high quality public services, such as the NHS"

Promoting growth and productivity, including through radical devolution of powers to local areas in England

The contribution of engineering to the UK's productivity is well-documented and evidenced. EngineeringUK's most recent analysis of the engineering sector and profession makes the simple headline calculation that "Engineering enterprises have the potential to generate an additional £27 billion per year from 2022". This is caveated with the presumption that engineering companies will be able to recruit the right people and skills.

BIS's own analysis of ONS data, published in BIS Economics Paper No. 18, *Industrial Strategy: UK Sector Analysis*, September 2012, shows that mid-high tech manufacturing is the only high level sector with a consistent positive contribution to UK GVA.

Figure 2.3: UK GVA per worker relative to whole economy (1997, 2011)



Source: BIS Analysis of ONS Data.

A more recent analysis as part of *Working Futures: 2012-2022*, suggests that in 2017, Primary Sector & Utilities and Manufacturing will be the two sectors contributing the highest levels of GVA per employee.

	GVA Levels 2017 (£000)	Employment levels (000s) 2017	GVA per employee
Primary sector & utilities	64012	789	£81,130.54
Manufacturing	146584	2542	£57,664.83
Construction	95848	2151	£44,559.74
Trade, accom, & transport	259276	8651	£29,970.64
Business and other services	509526	10327	£49,339.21
Public admin, health, education	263291	8350	£31,531.86
Total	1404076	32788	£42,822.86

Source: Table 3.1 and Table 3.2, *Working Futures 2012-2022*

Engineering also plays its part in the UK’s relative global position, boosting our competitiveness and attracting overseas investment to the UK. We must be ambitious, not just to secure our place in international rankings, but to improve and outstrip our competitors. This is recognised by organisations such as the CBI, which details the contribution of Science, Technology, Engineering, and Mathematics in their publication *Engineering our future: Stepping up the urgency on STEM* (2014). The recent *Ingenious Resilience* briefing from the Engineering Professors’ Council and Cambridge University Science and Policy Exchange quotes a number of key statistics, not least that: “engineering contributed 27% of GDP in 2014 and employed 20% of all working people”.

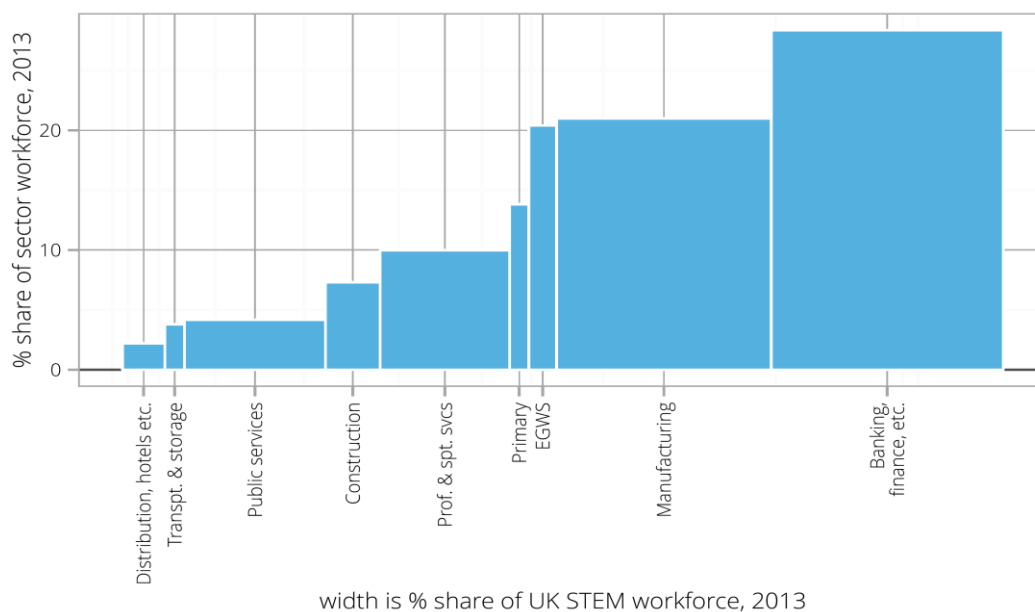
Specifically in support of the localism agenda, engineering is essential to city systems. These require data management, behaviour analysis, systems thinking, etc, to make investment go further, and to make infrastructure functional.

In addition to all of these ways in which engineering supports growth and productivity, the sector also has a positive multiplier effect on the rest of the UK; for every new engineering vacancy that is filled, 2 new jobs can be expected to be created throughout the UK economy (according to *The contribution of engineering to the UK economy – the multiplier impacts – A report for EngineeringUK*, CEBR, January 2015 <http://www.engineeringuk.com/Research/>)

Delivering high quality public services, such as the NHS

As discussed under the Protected Spending section on the NHS, engineering and engineering thinking underpins the success and effectiveness of the national health service. Engineering is also to be found in all other public services, from transport to open government.

The following table, taken from *Reviewing the requirement for high level STEM skills*, UKCES 2015, shows the distribution of the STEM workforce by LFS industry sector, 2013. Although manufacturing accounts for the largest share, public services take quite a share of the overall STEM workforce.



Source: UKCES analysis of Labour Force Survey. In Figure 7, sectors are from INDE07M. Width is share of UK workforce, height is share of sector workforce.

Promoting choice and competition

Engineers are central to systems which allow comparison and informed choice. Engineering “thinking” ensures that there are innovative and effective solutions, and that decisions can be made between competing approaches based on the best evidence of efficacy.

Driving efficiency and value for money across the public sector

A central tenet of engineers and engineering companies is the pursuit of ‘more for less’. In engineering, more means:

- More product
- Higher productivity
- Higher profitability
- Greater impact
- More outputs

while less means:

- Less waste
- Lower resource usage
- Less system slack

This approach is clearly also the focus for government spending, which needs to get the maximum possible public benefit for the minimum public spend.

Keeping the UK on track

We are also very aware that there are many more calls on government funding, which cannot be avoided over the next five years. This is for a number of reasons, but primarily because they fall into one or more of these categories:

- They have been planned for several years, and other activities are dependent on their completion
- Sunk costs are at a level whereby it would represent a huge loss if not completed
- The UK requires the expenditure to remain safe and viable as a global power
- Managing aspects of the demographic change, such as the aging population

These include areas such as:

- Skills, where the UK is still failing to compete globally in terms of vocational and technical expertise
- Infrastructure, where the UK needs to invest to ensure connectivity and geographical access to services
- Security, where the growing pressures on UK interests at home and overseas require sustained financial support
- Energy, where the UK must invest to address the 'trilemma'
- Climate change, where the UK must play its part to secure a sustainable future

The engineering sector and profession underpins each one of these areas, and in many cases provide the 'prevention', saves the cost of the 'cure', and reduces costs in other areas of government expenditure. For one example, if more were done to minimise Legionnaires' disease and hot water scalding through construction and plumbing engineering, there would be considerable financial savings for the NHS.

Engineering the Future – how can we help?

Implementing the Review

Engineering the Future can help with the implementation of the Spending Review, however the final figures are decided. As can be seen from the preceding information, the engineering profession has a core role to play in ensuring public spending is meeting economic, social, and environmental needs. Potentially difficult and divisive decisions will need to be made within government departments in order to safeguard these areas of priority.

The *Engineering the Future* offer

We are the alliance of professional engineering institutions and national organisations that between them represent 450,000 professional engineers and technicians. We are here to advise government and others on all aspects of engineering policy, from the perspective of the engineering profession as a whole. We are particularly active in matters of education policy which affect the supply of people with engineering skills into the economy. Drawing on the expertise of 35 professional engineering institutions, the Royal Academy of Engineering, the Engineering Council, and EngineeringUK, *Engineering the Future* provides a unique mechanism

to test ideas, discuss policy implications, secure the support of the profession, and investigate potential engineering policy scenarios.

We are keen to help the Government, officials, and departments make the right decisions and implement policy in the most effective way. *Engineering the Future* can be contacted through the Secretariat hosted by the Royal Academy of Engineering.

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