

Skills for Science Industries

Skills at work
September 2008

Executive Summary

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National and International Context

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Skills - The Next Industrial Revolution?

The World of Skills – Public Policy Leitch Review

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Section One – The World of Skills

Cogent sector industries add value through skills-intensive products that support the infrastructure of modern society itself - energy, health, transport and materials. But the intellectual property, the generation of new scientific knowledge and, crucially, the skills and innovation to convert this to tomorrow's solutions to today's problems, are the core assets that will sustain these UK industries on a global platform.

From oil to pharmaceuticals, all of the sectors within the Cogent footprint are concerned with using science to add value. Through science and engineering we have unlocked value and functional sophistication from carbon in its various forms, and from non-carbon-based material in the case of the Nuclear sector. From chemical sources we have created pharmaceutical and biotechnological advances with valuable practical applications. It is the in-common skills around chemical transformation, separation science, molecular processing and physical containment that link the Cogent footprint.

Oil connects a significant part of the sector – as it connects a significant part of the world economy - primarily because we are intensively dependent on it both as a source of energy and as a raw material. Through oil, the carbon economy has shaped our civilisation. The majority of oil, 70%, is used for energy and energy fuels (petrochemicals); half of the rest is converted to chemicals, plastics and pharmaceuticals. The knowledge of those working in the Cogent sector will be vital to meeting the world's challenges relating to carbon, to ensure the future sustainability of our economy

It is **knowledge with skilled application and transfer** to commercial advantage and wealth creation that has earned the science-using industries in the Cogent sector their strategic platform.

Investment in skills is not just a matter of economic prosperity; it also concerns social justice. Skills embody an opportunity for individuals and businesses to improve their prospects, to contribute to improved business performance and national Gross Domestic Product, and to add to the national stock of skills.

The reward of success in this skills challenge is deeper than economic prosperity alone; workforce development opportunity linked to skills qualifications are also about fairness, quality of life and opportunity for all. The price of failure is a second-rate social and economic infrastructure.

Lord Leitch's review of Skills in December 2006 set out a clear challenge for the UK economy. To meet this challenge, his recommendations included specific targets to increase skill attainments at all levels, strengthening the employer voice on skills through their SSCs and launching a new 'pledge' for employers voluntarily to train more employees at work.

Since the Leitch review, there have been key skills policy publications in each of the four nations of the UK:

- England policy – World Class Skills – (July 2007)
- Scotland policy – Skills for Scotland - (September 2007)
- Wales policy – Skills that Work for Wales - (August 2008)
- Northern Ireland Policy – Success through Skills (February 2006 with update and Progress Report May 2008)

Each acknowledges and has been influenced by Leitch, with the common factor being their clear intentions to focus public funding on getting young people ready for the labour market, on basic skills for existing workers, and on any areas of market failure. In return for this, the government increasingly expect employers and individuals to meet the cost of acquiring intermediate and higher level skills, since these are the levels where clear economic benefits can be seen to accrue directly to the individuals and firms.

Section Two – The Skills Factory

Projecting the skills demand

Significant efforts have been made in recent years to ensure that the skills needs of the Cogent sector are being met. We are confident that the direction of travel is broadly correct, but in order to be confident that the effort is effective, we need to ensure that the magnitude is also appropriate – in other words, that we are moving far enough, fast enough. To test whether we are on track, we have undertaken the analysis presented in this section.

The Stock and the Flow

To assess the size of the challenge, we have used available data on current and projected levels of employment in the sector (“the stock”), and compared them with information on the expected rate of “flow” of people in and out of the workforce. The outflow will consist mainly of people retiring, but will also be affected by issues such as emigration and labour market mobility. The inflow will consist of university graduates, apprentices and, to a lesser extent, direct entry from schools and further education colleges. The comparison of the projected stock, outflow and inflow will show us whether the current rate of entry of appropriately-qualified people into the workforce will be enough to meet demand, or whether we need to make efforts to increase the numbers.

Summary

At present current forecasts for total employment in the Cogent sector by **2022** will be between approximately **401,000** and **523,000** employees.

Supply	Demand
Total forecast future retirements are estimated to be 145,000 by 2022	Total forecast supply of workers entering the Cogent sector 99,600
Estimated 72,000 Technicians and Operators needing to be replaced by 2022	Forecast of 31,600 apprentices entering the sector by 2022
Estimated 55,000 Managers and Professionals needed by 2022	Forecast of 68,000 graduates entering the sector by 2022

Shortfall

The evidence presented throughout this section leads to the following shortfall and mismatch in the estimated **SUPPLY** and **DEMAND**.

Employee Group	Forecast Demand	Forecast Supply	
Higher Level Workers (Managers and Professionals)	55,000	68,000	OVER SUPPLY + 13,000
Core Workers (Technicians and Operators)	72,000	31,600	SHORTFALL - 40,400

Conclusions

Comparison of the numbers above suggests that the current inflow of non-graduates (this is, entry via apprenticeship routes and vocational qualification routes) is insufficient to meet replacement demand in processing and technician roles. This deficit will increase significantly in the five-year period to 2017, which coincides with the known lowest point in 16-18 year-olds in the general population, meaning that recruitment will be taking place within the most competitive marketplace. Therefore, alternative sources of skills to meet demand will be required, including a focus on upskilling and re-skilling the current workforce, as well as initiatives to attract more entrants.

The development of National Skills Academies will help to address this gap, by stimulating employer demand for, and supporting the delivery mechanism of, relevant vocational programmes and qualifications.

At higher level, the current level of supply is likely to be sufficient overall, although of course further analysis will be needed to monitor the needs of individual industries and to avoid specific pinch-points.

The forecasts illustrate the need for a concentration on the Technician and Operator workforce through the development of qualifications and vocational training at relevant levels, and through the upskilling of the existing Cogent workforce. Although there is already a range of initiatives to address skills shortages across the sector, the analysis suggests that the emphasis on particular skills levels will need adjusting from current rates if we are to meet the future needs of the sector.

The figures on the left do need to be treated with some caution, given the limitations of the available data, and the simplifications we have made throughout the analysis. In particular, more sophisticated analysis of entry from Further Education, of age cohort changes and of expansion or contraction of individual industries would affect the estimates in various ways. However, the picture they paint does fit with the anecdotal evidence that Cogent regularly receives from employers, and we are confident that the analysis forms a strong basis for action. We plan to continue examining the figures available to improve the analysis further, including through the use of our forthcoming Oracle project, which will provide a detailed longitudinal study of skills needs in the sector.

Section Three – Industry Sectors

Nuclear Industry

The top priority in the nuclear industry is the need for an increase in vocational and technical skills, up to and including level 3. The sector needs to quadruple the number of apprentices over the next five years, and needs clear progression routes through to Foundation Degrees and Higher Education.

In the defence sector, a build programme of submarines continues alongside the studies to replace the national deterrent. This suggests the need for a steady flow of new entrants with the skills to undertake this work.

In the civil sector, the decommissioning of legacy sites continues, and as more nuclear power stations close down at the end of life, the transition into refuelling, de-planting and decommissioning requires a major re-skilling of their workforce. The prospect of new build will also require a new training and education programme. In the early years, many of the skills required will come from the engineering and construction industries, although some specific nuclear skills will be required to ensure safety of new designs. Once the new build programme is established, a new education and training programme will be required to ensure the supply of suitably qualified and experienced personnel to operate these new reactor plants.

The Oil and Gas Industry

New discoveries, ongoing operations, planned lifetime extensions for existing operations, decommissioning activities and retirement of the incumbent workforce, are all factors that mean the oil and gas industry has a sustained recruitment demand with a requirement for skills training and up-skilling of the incumbent workforce.

Keeping the UK Continental Shelf competitive will require exploration and production activities to be carried out, requiring a diversity of people from geoscientist to engineers and from environmental scientists to electricians.

Competition from national and international projects could potentially lead to shortages in oil and gas specialists and those conventional skills required to support the UK. Skills developed in the UK are in demand globally, so the supply of skilled workforce for domestic and international activity requires industry management.

Chemicals Industry

The UK Chemicals industry remains resilient in the face of high energy and raw materials costs and international competition. Through a number of reorganisations, mergers and acquisitions, the industry has achieved a high level of performance in lean manufacturing and process efficiencies.

The industry invests significantly in training and upskilling of its workforce. However, the workforce is getting older and there is a vital need to increase the supply of young people with the right skills and aptitude for the industry. Shortages of technical and engineering skills such as technicians, fitters, operators, and so on, remain a Europe-wide problem. These shortages are intensified by competition for skilled labour by the offshore oil and gas, and increasingly, the nuclear, sectors.

These factors suggest a remaining major need to achieve a cultural step-change in appetite for innovative thinking at all levels from shop floor to senior management. There are opportunities for radical redesign in processes and products. Successful initiatives such as the Chemistry Innovation Knowledge Transfer Network and National Skills Academy for the Process Industries are crucial for the continued prosperity of the Chemicals industry.

Petroleum Industry

The future direction of the petroleum industry appears stable, with a declining need for petrol but a rising demand for diesel. Maintaining this stability, however, will require investment in UK refineries to meet the changing product demand and crude oil supply, and avoid reliance on imports.

Over many years, the refining sector has sought to minimise its impact upon the environment and improvements continue to be made to reduce emissions. Cogent works with the refineries and the regulators to ensure that the correct skills mix is achieved in maintaining the best environmental standards.

Process safety continues to be of the highest priority for the downstream petroleum sector, given the response to high-profile accidents such as that at Buncefield, and further regulations are likely to emerge from continuing reviews of safe working practices.

Pharmaceutical Industry

Research by the Association of the British Pharmaceutical Industry, on over 100 UK Pharmaceutical companies, has revealed that

- More than a third of companies (35%) were expecting to reduce the level of investment in research and development over the next 12 months, currently standing at nearly £4 billion a year.
- Investment in assets such as buildings and equipment, etc is expected to decline by a similar amount (36%)
- 46% of companies are expected to reduce the number of UK clinical trials
- The level of manufacturing is forecast to drop by 42% of those surveyed
- Almost all the companies surveyed - 97% - said there is now an increasing level of uncertainty within the UK pharmaceutical market environment.

The success of the industry in Britain, and the ability to retain world-class pharmaceutical company investment, are critically dependent on the willingness of the Government to support an environment in which the industry can conduct its research, manufacturing and marketing activities as effectively as in all the other countries that are competing for investment. Recently, the Government has addressed a very broad range of issues relating to clinical research, licensing, intellectual property rights, the science base and the domestic market framework.

The stock of skilled people in this industry is a positive asset for the UK, and the priority for Cogent's sector should be to ensure that this remains the case into the future.

Polymer Industry

The polymer industry companies that prosper in the future will be lean and efficient in both manufacturing and administration, innovative with both design and materials and will ally themselves to winning markets, customers and products. Also in the UK market, locally produced products will be small quantity and higher quality with high volume to price ratio. As with other Cogent industries, there remain skills gaps at higher level, and the polymer industry also requires people with good knowledge of competitive business techniques. Other particular priorities include:

Green Issues – Plastic bag taxes are proposed, recycling has some way to go to happen in a constructive and coherent manner, and in the meantime, waste continues to be dumped into landfill. These issues suggest opportunities in new areas of business, with associated needs for new high-level skills.

The cost of crude oil has a direct effect on the cost of all polymers and as such will have an effect on plastic product prices affecting all other streams, from vegetable and fruit packaging to medical supplies and white goods.

Pressures from eastern economies, particularly China and India, which are often seen as an obstacle for the industry, but this may be overstated as they also have the same cost pressures as UK and much the same skills shortages. The main difference, however, is that these countries are investing more in automation and new technologies than is the UK, with major implications for skills investment.

Section Four – Regions and Nations

The Cogent industries are represented in all of the nations and regions of the UK, with varying concentrations and employment. Clustering provides advantages in some areas, and all industries are heavily integrated into their suppliers' and customers' locations. The level of international trade will inevitably vary by company type and size, but global markets for products and for individual employees' skills are strong features across the sector.

The skills issues facing all industries tend not to show large variation across the UK. Common issues that remain a priority for Cogent and for the sector relate to the skills gaps in all industries at level 2 and level 3. There are also specific shortages at higher levels across the UK. This suggests that those people currently qualified no higher than level 1 need to be up-skilled to meet the needs of the sector. In particular, there is a need to improve the supply of entrants qualified in science, technology, engineering and mathematics.

Cogent continues to undertake collaborative measures in each nation and region to improve the understanding of the industries to potential entrants so that they recognise the attractive opportunities available.

Section Five - 14-19 Education

In analysing the data relating to young people, who are potential entrants to the Cogent sector workforce of the future, we found that the number of 16 and 18 year olds is set to decline from 2009-2010 onwards. This will have important implications on the intake to the Cogent industries. A smaller pool of 'new talent' means more competition in attracting young people to a career within the Cogent footprint. The problem of needing a replacement supply, because of the ageing workforce, is exacerbated by a decline in the population of young people and the demand for scientific and mathematical skills across many employment sectors. Accordingly, Information, Advice and Guidance are important to promote the importance of these subjects and the benefits of a career in a related area.

The Department for Innovation, Universities and Skills has confirmed plans to raise the school leaving age in England to 17 years of age by 2013, with an aim of 90% participation in education or training among 17 year olds by 2015. A requirement to participate until 18 years will be introduced at a later stage. These changes will give Cogent the opportunity to raise participation in science and mathematics subjects for 14 to 19 year olds.

The number of young people across the UK studying science to Standard grade (Scotland) or GCSE (elsewhere) has fallen slightly over recent years, perhaps offset to some extent by slight increases in those studying mathematics. However, there have been declines in the proportions of these young people going on to further study at higher levels.

Section Six - Higher Level Skills

Since the Cogent industries are so knowledge- and skills-intensive, we rely heavily on higher level science, engineering and innovation. Graduate recruitment from science and engineering subjects is typically about half of the total graduate recruitment in the sector, and is steadily increasing.

Although current graduate supply would be sufficient to meet the industry's needs for now, there are potential problems caused by entry into other sectors in preference to science-based roles. This indicates a need to increase the attractiveness of Cogent industries to the graduate workforce.

Following the publication of the Leitch review, there has been an emphasis on increasing the number of graduates within the UK to over 40% of the total cohort by 2020, specifically in science and technology areas.

The detailed policies on higher education and higher level skills vary between the nations of the UK, but they share the general approach of increasing collaboration between business and academia at higher levels. Cogent is engaged with partners in all four nations and we expect to continue to discuss policy with each of them over the coming year.

Cogent has been developing its Higher Level Skills strategy in recent months, which aims to build and extend frameworks for greater employer engagement with higher and further education institutions. These frameworks will enable providers and the Cogent workforce to identify clearly routes to education and training that meet their needs at a number of levels.

Through this strategy, Cogent will prioritise working with learning providers, in conjunction with planning agencies and professional bodies, to develop new approaches to course delivery that meet a range of employer requirements for the workforce.

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**Cogent is the Sector Skills Council
for the Chemicals, Pharmaceuticals,
Nuclear, Oil and Gas, Petroleum
and Polymer Industries.**

