CIVITAS

Prospects for a Global Britain:

Three Strategic Export Industries and How Freeports Can Help.

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Introduction

The last 20 years has witnessed a steady offshoring of UK manufacturing. Industries such as the motor vehicles and pharmaceuticals are highly competitive, with exports to global markets growing at a compound annual growth rate (CAGR) of more than five per cent. And yet with the exception of aerospace, the UK's manufacturing sectors are becoming net importers – especially in trade with the EU. Global Britain aims to make the UK a major global exporter, but this won't happen if investment continues to slide overseas, and UK manufacturing is hollowed out.

These offshoring trends were identified and measured – sector by sector – in the two preceding reports: *Lessons learned for a Global Britain: UK trade in manufacturing, 2000-2019*, and *Two tests for UK Trade*. This final report aims to take the lessons and insights gleaned from those two reports and applies them to three strategic industries. Each of these are industries where the UK *should* be self-sufficient but isn't — or is only just self-sufficient. So, the purpose of this report is pragmatic: to suggest practical steps that can be taken to preserve, rebuild and create high-value export industries of the future, and reduce dependency on imports.

This report is ultimately data-driven and informed by global comparisons. Unlike other trade policy papers and industrial strategies, the suggestions put forward here are the direct result of a minute examination of the actual performance of UK trade over the past 20 years. This data-driven research has already identified what does and does not boost exports – sector by sector. Its foundations rest on an appreciation of those factors that have measurably impacted the performance of UK trade over the past two decades. These aren't obvious. According to analysis in *Two tests*, tariffs and regulatory alignment were only dominating factors in two of the UK's top 10 export sectors.

This report also sets UK industry in a global context. Like the two preceding reports, it is comparative, not theoretical. It avoids working from assumptions. It analyses why specific industries overseas are more competitive than they are here, and what the UK can do to emulate them. And it suggests the UK has nothing to fear from inviting successful enterprises from outside Europe to come to the UK and help build or rebuild high-skilled manufacturing industries.

Naval shipbuilding

The first sector is shipbuilding. With naval order books at post-Cold War highs, Prime Minister Boris Johnson has hailed a 'renaissance' in British shipbuilding. But the prospects are not promising. With the 2019 demise of Ferguson Shipbuilders on the Clyde, commercial shipbuilding in the UK has finally expired, and Britain has not exported any warship larger than a corvette or patrol vessel for 30 years. Almost all of Britain's slipways are silent, and our yards are uncompetitive by any global metric. The UK will struggle even to build naval tankers to support its two giant, new 65,000-tonne aircraft carriers.

In short: the country's new Shipbuilding Tsar will need more than a healthy naval order book to revive an export industry that collapsed in the 1960s and 1970s.

Fortunately, there are lessons to be learned from other parts of UK manufacturing. By far the fastest growing export sector of the past 20 years has been the UK's car industry in global markets. Exports to countries *outside* the EU have grown by a staggering 6.3 per cent per year, tripling in 20 years, and comprehensively overtaking exports to the EU itself. Analysis in *Lessons learned* revealed what these auto exports were: luxury brands owned by global auto makers who have brought experienced executives into UK board rooms to build – or create from scratch – highly skilled workforces.

The result is the biggest UK export success story of the past 20 years. Exports that were worth £7.2 billion in 2000 were worth £23 billion in 2019. This is not just due to the success of Jaguar Land Rover. Marques such as Rolls-Royce and Bentley, that were either dwindling or moribund, have roared back to life under overseas ownership. They have re-established the reputation of British motor manufacturing and craftsmanship on global markets. If that can happen in UK car manufacturing, it can happen in the UK shipbuilding.

To attain that 'renaissance' goal, UK shipbuilding should copy the auto industry, swallow some pride and lure the world's best shipbuilding expertise to British shores. Otherwise, shipyards that have stayed in British hands and withered in British hands will die in British hands. Freeport shipyards provide a commercial route. With sufficient taxation and regulatory leeway, with the ability to purchase steel tariff-free, and with the freedom to create workforces in their own image, Korean or Japanese shipbuilders could revitalise British shipbuilding on the back of the UK's naval order book.

Global pharma

Next is pharmaceuticals. From 2000 to 2010, this was the UK's fastest growing export sector, with the real value of exports more than doubling in just 10 years. Then investment began shifting overseas – including to Ireland. Manufacturing output, gross value added (GVA) and exports all fell over the next five years. Meanwhile, imports from the EU rocketed. A modest recovery has now set in, with output and exports to non-EU countries back above 2010 levels. But exports to the EU are in a steady decline which began five years prior to the referendum. The result: UK–EU trade has another huge sectoral deficit on its hands, which has averaged -£8.9 billion over the past three years. And the pandemic was a poor time to discover that the UK was becoming ever-more dependent on EU supply chains for vital medicines and treatments.

It doesn't have to be this way. The US pharmaceutical industry has undergone an eerily similar trade trajectory, notably via the disinvestment that occurred in Puerto Rico from 2004 onwards. Therefore, the UK has an overseas example to learn from. Some of the causes of offshoring from the US are known, including the willingness of global pharma to re-jink their supply chains to maximise profits in low-tax jurisdictions. This dynamic is well understood across the Atlantic, less so in Britain. The 'global minimum corporate tax' initiative seeks to address it. But the key takeaway from any analysis of the US pharmaceutical industry is that investment decisions in the pharmaceutical industry are heavily influenced by a raft of tax considerations, and these extend to tax credits for capital investment, and research and development (R&D).

This report argues that without decisively re-balancing the tax calculus for global pharmaceutical companies, investment in pharma manufacturing will continue to slide overseas – including to Ireland. The UK will become more dependent on imported pharmaceuticals instead of more self-sufficient. UK medical services will be vulnerable to supply chains that are set up *specifically* to cross multiple borders. UK expertise in medical science and pharmaceutical discovery has just achieved global renown. But the money ploughed into R&D in the UK will ultimately benefit manufacturing in other countries unless the UK Government changes the tax calculus for global pharma companies — and their shock-troops of accountants and tax lawyers.

Offshore wind power

The third strategic industry is offshore wind power. The decade 2020–2029 will likely see the UK install more offshore wind-generating capacity than any other country in the world, bar China. The history of the wind-turbine industry shows that manufacturing capability follows installation. Currently, the UK is largely dependent on imports for the wind turbines themselves. The three major manufacturers, GE, Siemens-Gamesa and Vestas, are building blade-manufacturing plants in the UK,

but the UK appears to be missing out on a major new area of manufacturing — one that has a vast, global market as developed economies turn swiftly to renewable power.

This report suggests options. For example, the UK should aim to become a global leader in offshore wind engineering, technology and services. The example of the Australian mining engineering, technology and service (METS) sector is there to follow. By letting industry take the lead in creating university schools and departments dedicated to innovation and research, the UK could build intellectual property and world-leading commercial expertise during the decade that it leads in installations. By ensuring that intellectual property (IP) is locally exploited, the UK can ensure that operations and maintenance (O&M) startups from this decade become global O&M service providers in the next. And by targeting funding in small and medium-sized enterprises (SMEs) as opposed to incumbents, the UK has the best chance of rearing second-tier suppliers with global potential. The success of small British companies as global exporters and suppliers is a key learning from analysis of UK trade over the past two decades – especially in the aerospace industry.

Finally, there's floating offshore wind. Scotland has ambitions to become the global leader in deep-water wind power. But this will never happen unless it can attract the world's most efficient marine engineering companies to invest in fabrication yards, either in the Moray Firth or on the Clyde. Only these world leaders have the engineering capabilities to create high-skilled workforces capable of building wind platforms more efficiently than other yards in Europe. But if Scotland wants a world leading marine engineering export business, it will need to provide a profitable venue for world-leading marine engineering companies to invest in. As with shipbuilding, freeports provide the opportunity to compete on steel, tax and labour, and to calibrate a set of incentives without compromising national employment standards.

The challenge of international political economy

The politicians who supported Brexit were mostly free traders. But the global economy into which Britain now steps is mired in market distortions. These include huge levels of subsidies in autos and shipbuilding, and tax regimes that derange the corporate structures of technology and pharmaceuticals companies. Instinctively, pro-Brexit politicians may want to leave British enterprises to find their feet in global markets. But if the UK wants self-sufficiency in strategic markets, then it will need to act strategically. The UK Government will need to strike a balance between cultivating a competitive spirit in future industries and giving UK manufacturing a fair go in international markets. That's the oldest challenge in international political economy – and it's a challenge that has generally defeated British Governments since the 1960s.

Chapter 1: Shipbuilding

The UK's shipbuilding industry is now a strategic industry. Maritime power projection has replaced European security as the prime goal of UK defence policy, but this creates an industrial vulnerability. Our naval shipyards are inefficient and commercial shipbuilding has expired. If the UK wants a shipbuilding renaissance to match its maritime ambitions, it will need the assistance of the world's premier shipbuilders – and that means looking for new industrial partners in Northeast Asia.

Britain's steady return to maritime defence

The UK's stated ambition is to be the foremost naval power in Europe,[1] with the ability to project maritime power around the world that is second only to the United States Navy. The chief purpose: to buy Britain allies. In September, the UK signed a defence pact with Australia that will see the Royal Navy remerge as a prominent factor in the alliance systems of the Indo-Pacific region. Britain is reverting to its historic maritime power status. And naval power is the one domain in which the UK *is already* an ally worth having.

But a mighty challenge looms on the industrial horizon: how to grow and sustain that maritime power? The UK no longer has a large commercial shipbuilding industry. All major yards are dependent on naval contracts. By global standards these yards are not competitive, and the UK recently turned to Korean yards to build naval tankers. In recent decades, British shipyards have succeeded in selling nothing larger than patrol vessels to overseas navies. In 2018, BAE Systems won a tender to supply nine frigates to Australia, and in 2021, Babcock won an order for two frigates from Indonesia. But in both cases, what the UK is exporting is the design, plus propulsion, sensors and some weapon systems. If the UK is serious about making naval power its central contribution to global security, then it needs an efficient shipbuilding capability.

There's a commercial *and* a strategic aspect to the UK's ambition. Commercially, UK shipyards suffer because they aren't busy enough to become efficient. Since the mid-1990s, UK yards have semi-survived on an intermittent drip-feed of naval contracts. When contracts end or bids are lost, they become semi-dormant, surviving on odd engineering or repair contracts. Without demand for exports, they will never be consistently busy, nor will they generate the turnover required for sustained investment. This means they can never be efficient or genuinely competitive, and UK taxpayers pay the price in ultra-expensive warships – or at least ultra-expensive hulls.

Then there's the strategic angle. If the UK wants to be taken seriously as a maritime power, then it needs one capability above all others: the ability to mass produce cheap escort vessels – frigates or corvettes – very fast. Without that domestic industrial capability, the Royal Navy will be unable to fulfill its historic and war-winning role: the safe passage of mercantile traffic on the high seas. And the value of the UK as an ally will always be open to question. Besides, the ability to quickly build heavily armed escort vessels for allies in Asia could – in the very near future – become a profoundly profitable business.

The UK's strategy for a shipbuilding export industry

The Government intends to use increased naval orders as a trigger to re-invigorate British shipyards. This intent was made clear in the Defence and Security Strategy, published in March 2021. Specifically, the Government wants to use a continuous program of frigate and support-vessel

[1] Defence and Security Industrial Strategy. Page 90.

construction to spur increased investment and technology adoption in UK yards.[2] And it also wants to encourage more competition in the UK because BAE Systems yards on the Clyde have held a monopoly on frigate/destroyer construction for almost two decades.

But this strategy has been tried before. In 2005, Rand was invited by the Ministry of Defence (MoD) to review UK shipbuilding, and duly pointed out that regular demand was the principal enabler of a healthy shipbuilding sector.[3] John Parker's review in 2016 made the same point in terms of regular orders and encouraged the MoD to simplify naval specifications to encourage the construction of exportable frigates. The 2017 Naval Shipbuilding plan largely adopted the Parker recommendations, including the 'simplify-to-export idea'. The MoD aimed to free itself from BAE Systems' stranglehold on destroyer/frigate programs by purchasing a new class of frigates (the Type 31) from Babcock's yard at Rosyth.

So far, nothing meaningful has changed. Naval orders have proved insufficient to sustain shipbuilding at anything approaching capacity. And five years on, the UK still has no export orders for the Type 31 frigate that was supposed to spearhead the new naval export strategy. The UK can sell designs, but not construction. For example, the sale of the Type 26 design to Canada and Australia will benefit multiple UK naval suppliers, including Rolls-Royce (part of the engines, and handling equipment) and Ultra Electronics (Sonar). But the vessels will be constructed in Halifax and Adelaide.

True, the MoD has assembled an impressive order list of vessels to be constructed over the next decade for the Royal Navy and the Royal Fleet Auxiliary. This is largely because the Government decided to grow the Navy's surface fleet to 24 frigates and destroyers[4] shortly after the 2016 referendum. As of July 2021, the order book comprises:

- Eight large Type 26 frigates, the first three of which are under construction on the Clyde;
- Five simplified Type 31 frigates, about to begin construction at Rosyth;
- Five new Type 32 frigates, optimised for permanent basing overseas;
- Three large 'solid support' tanker vessels;
- Up to six multi-role amphibious strike ships;
- An ocean surveillance ship; and
- A national flagship which will resemble the old HMY Britannia.

The UK Government hopes that demand for offshore wind power infrastructure will also trigger increased demand at shipbuilding yards. But this has only occurred to a limited extent at Harland and Wolff in Belfast – and Harland and Wolff has not constructed a major warship or auxiliary in over 30 years.

To focus the MoD's attention on its responsibility towards the UK's yards, the Prime Minister has appointed the Defence Secretary as the government's 'Shipbuilding Tsar'.[5] Their job:

> '… to achieve an innovative, efficient and competitive shipbuilding enterprise which is at the forefront of the technical and environmental innovations which drive the sector.'

[2] UK Defence and Security Industrial Strategy, March 2021. Page 90-91. Link.
[3] Rand Corporation. The United Kingdom's Naval Shipbuilding Industrial Base. 2005. Link.
[4] National Shipbuilding Strategy, 2017. Page 6. Link.
[5] UK Defence and Security Industrial Strategy, March 2021. Page 90. Link.

But the fact remains, British shipyards are chronically uncompetitive. So, the challenges facing the new Shipbuilding Tsar are formidable — even without the doom-laden title and even with a large notional order book.

The revival of British shipbuilding

First, the strategy to revive shipbuilding hinges on a rapid recovery in national finances. The analysis site, Navy Lookout, estimates that current plans will result in a new frigate commencing construction approximately every 12 months up to 2030.[6] But every other frigate/destroyer program since the 1970s has suffered cuts as program costs mount and as new technologies are inserted into already completed designs. The navy's current Type 45 destroy fleet is a typical example. The program envisaged 12 destroyers; only six got built. A national debt that is edging 100 per cent of Gross Domestic Product (GDP) is the worst possible portent. History suggests the current naval program won't be built. And without scale, the supposed catalyst for greater efficiency will be dead in the water.

Worse, the Government has got its commercial incentives back to front. Export campaigns are supposed to be led from a cross-Whitehall group.[7] The Type 31 frigate design has been formulated by officials who have anticipated the capabilities that other navies might want. Precisely how a UK Government Department is supposed to be more attuned to demand signals from foreign navies than a commercial business is not clear. Exporting is always profit-driven endeavour. The enterprises themselves – the shipyards and naval architects – are best placed to figure out where their best commercial prospects lie. And yet they are taking a back-seat in ship design to officials.

But the chief obstacle to a revival of naval shipbuilding is the lamentable state of shipyard infrastructure across the UK. A quick tour is in order, starting on the Clyde. The defence giant BAE systems owns the Scotstoun yard on the north bank and runs the Govan yard almost directly opposite. These yards only build surface warships, and until recently held a monopoly on the construction of frigates and destroyers. However, even that privilege was insufficient to fill a gap between the last Type 45 destroyer program and the current Type 26 frigate program. For several years its workforce subsisted on a trickle of patrol boats. Capacity far exceeds demand. And its workforce is not youthful.

The only remaining commercial shipbuilder on the Clyde – Ferguson Marine – was bought by the Scottish Government in 2020 after a contract to build ferries ended in fiasco. The company's engineering competence is now rated so low that the yard lost its first post-nationalisation bid to build more Scottish ferries. This was despite the fact that the contract was placed by its new owner – the Scottish Government.[8]

BAE Systems also owns the Barrow yard in Cumbria. This shipyard, formally Vickers, only builds submarines for the Royal Navy, and it is the only British yard operating steadily and at capacity. It has approximately 10,000 employees. Currently, Barrow is finishing two large nuclear-powered attack submarines and has begun piecing together the gigantic steel rings of two new ballistic missile submarines that will carry the British nuclear deterrent into the second half of the century. This yard may pick up substantial work from Australia's decision to procure nuclear-powered attack submarines with the help of the UK and US. However, the value of export work will depend entirely

[6] Navy Lookout: Making sense of the Royal Navy's Frigate Building Program. Link.
[7] National Shipbuilding Strategy, 2017. Page 27. Link.
[8] The Herald. Ministers urged to act after state-owned Ferguson loses 100 million marine ferries contract. September 2021. Link.

on whether Australia chooses a derivate of the UK's Astute class design, or the US Navy's Virginia class, and on whether the Australian Government mandates construction in Adelaide.

Down on the Mersey, Cammell Laird sustains a modest-sized ship-repair business. This is a valiant, re-constituted business that has begun to revitalise a yard that was largely moribund from the late 1980s. It sits among the silent slipways, non-tidal basins, and battleship-sized dry docks of what was once a gigantic industrial estate. The 1,000-strong workforce completed a complex survey ship, RMS David Attenborough, in 2020. But this is the only major shipbuilding that the revitalised company has attempted. Cammell Laird has confidence and potential, but it is small and precariously dependent on naval repair.

Across the Irish Sea, the equally vast wharves and dry docks that once comprised Harland and Wolff are in far worse commercial shape. Since 2019, the yard has been owned by a company called Infrastrata, which is not a marine enterprise at all. Its main business is the development of a gas storage facility in County Antrim. The yard does construct foundation stands for offshore wind turbines (called 'jackets') but shipbuilding is long-gone from Belfast Lough. Only the site, the slipways and some truly gigantic dry docks remain for a skeletal workforce.

There are multiple small-scale shipyards around Britain's southerly coasts, which mostly conduct ship repair. Yards in Falmouth construct superyachts, while A&P Appledore has bobbed in and out of active shipbuilding. Similarly, yards on the Tyne and Tees in England's northeast maintain a brisk business in ship repair and maintenance. The last major shipyard in the northeast, Swan Hunter, met an ignominious end in 2006 when its final order – an amphibious assault ship – had to be towed downstream for completion elsewhere. Since then, the yard – like all ex-yards on England's east coast – have subsisted on fabrication, repair and engineering services, mostly for ferry companies and the UK's offshore oil and gas industry.

Back over the border, Babcock's yard at Rosyth is the sector's brightest star. But it too is dependent on naval orders. The yard's 300 metre dry dock was the assembly point for the giant hull blocks that make up the UK's two new aircraft carriers. The MoD must have been impressed by its performance as it's chosen Babcock's to break the BAE Systems stranglehold on frigate/destroyer construction. It has just built a cavernous fabrication hall in which to build the UK's new Type 31 frigates and – it hopes – export versions of the same design. This is the only UK yard that has a warship export campaign underway.

So, the physical inheritance of Britain's new Shipbuilding Tsar is essentially a large collection of silent slipways and empty drydocks in under-utilised yards, and shipbuilders that are almost 100 per cent dependent on the Royal Navy. No commercial shipbuilding remains for hulls greater than 5,000 tons. Only vestiges of skills remain in assembly and repair yards on the Tyne and at Belfast, although the Cammell Lairds at Mersey is gamely trying to grow. If any of these yards were genuinely competitive, they would already be exporting. And they can't.

Sadly, the global economy offers no examples of pure naval construction yards suddenly becoming efficient enough to become commercial shipbuilders again. To succeed, the UK's Shipbuilding Tsar will have to look overseas for a dose of industrial revitalisation. If UK shipyards are to become efficient enough to export warships, they will need a direct injection of fresh management, skills, capital, engineering technology, and sheer commercial nous from shipbuilding enterprises that are truly competitive. So, where is that likely to be?

Lessons from global shipyards

In terms of high-quality shipbuilding, the world can be roughly divided into three areas: continental Europe, the United States and Northeast Asia. Each region has a speciality, and each works to a different commercial dynamic.

Europe's bustling slipways have deftly navigated the transition from lower-cost bulk shipping to complex vessels.[9] Currently, European yards are the masters of cruise-ship construction. European industry is also a leading supplier of maritime equipment, supplying upwards of 50 per cent of inputs into shipbuilding.[10] There are approximately 150 large shipyards in Europe, according to official EU data, with 40 active in global markets – meaning they export.[11]

The biggest include the Turku yard in Finland; the mighty Meyer-Werft yard at Papenburg, Germany; Fincantieri at Trieste in Italy and its seven sister shipyards; Chantiers d'Atlantique at St Nazaire, France; and state-owned Navantia in Spain. Romania is a special case: the Daewoo-owned Mangalia Shipyard on the Black Sea builds container ships, as opposed to the specialised shipbuilding that predominates elsewhere. According to the European shipbuilding association (CESA), European and Turkish yards build approximately €42 billion-worth of vessels per year and employ 300,000 people.[12] So, as industries they are far larger than anything that survives in the UK. Between them, these yards built almost the entire current fleet of passenger ships operated by Cunard and P&O Cruises.

The fact that Germany, France and Italy all have a commercial shipbuilding industry, and the UK doesn't, shows how sharply the UK diverged from continental industry during its EU era. Partly this is due to differing political responses to a highly cyclical industry.[13] Historically, the UK's response to failing shipyards was nationalisation and consolidation. For example, the Aircraft and Shipbuilding Industries Act of 1977 nationalised 27 shipbuilding yards in one go and grouped them into one entity. But British yards did not react well to state ownership, nor the removal of competition, nor the disappearance of the basic need to make profits. Within a decade of the 1977 Shipbuilding Act, little was left of the British Shipbuilding Corporation, and non-naval shipbuilding had more or less vanished as an industry.

In contrast, European governments have tended to subsidise their shipyards directly and tried to keep them in private hands – or at least successful ones. Mayer-Werft is still family-owned. Fincantieri, which is usually cited as Europe's largest shipbuilding company, is publicly listed. Ownership of Chantiers D'Atlantique has bounced around French and overseas conglomerates. Currently it is part-owned by Fincantieri and partly by other industrial groups in which the French Government holds stakes. Similarly, when the Turku yard in Finland hit trouble in 2012, the Finnish Government engineered a transfer of ownership to Mayer-Werft.

This highlights one critical difference between UK and European yards: openness to foreign ownership. With the exception of Govan's brief spell with Norway's Kvaerner, major UK shipyards

[9] The European Commission. Shipbuilding Sector. Link. Complex vessels includes cruise ships, ferries, mega-yachts and dredgers.
[10] EU Directorate-General of Enterprise and Industry, Study on Competitiveness of the European Shipbuilding Industry. 2009. Page 8. Link.
[11] The European Commission. Shipbuilding Sector. Link.
[12] CESA: The Industry. Link.
[13] In a recent study, Dr Paul Scott of Newcastle University reckoned that the peaks occurred roughly every 30 years. Newcastle University School of Engineering: Competition and Subsidy in Commercial Shipbuilding, Paul Scott. January, 2018. Link.

have stayed in British hands and have gone bust — or been left to survive on orders from the Royal Navy. Perhaps this reflects national security needs, but if so, it's proven a death knell for competitive shipbuilding. It's also meant that failing British shipyards have not received an influx of technology and expertise from successful shipyards overseas.

Could US shipyards offer any pointers to help revive British shipbuilding? After all, the United States has easily the most powerful navy afloat, and its entire combat fleet is US-built.

Sadly not. The US experience strangely mirrors Britain's, although historically shipbuilding was a far greater contributor to the UK economy than it ever was to the US economy. Just as in the UK, shipbuilding in the United States is now largely confined to the naval sector. Commercial shipbuilding survives only because of legislation – the Jones Act. This requires that vessels transporting goods from one part of Continental US to another should be built domestically. Even with this mandate, 80 per cent of shipbuilding in the US is for naval or government purposes.[14] The rest is riverine or coastal vessels, which are launched (sideways) from numerous small yards around the US. There is no major commercial shipbuilding industry in the US that exports vessels.

As in the UK, the competitiveness of US shipbuilding has declined consistently since World War One. According to official estimates, US shipbuilding was 20 per cent more expensive than overseas yards in 1922, with the cost differential increasing to 50 per cent in the 1930s.[15] By the 1990s, the cost of building merchant ships in the US was estimated to be three times the cost of non-US yards and is now estimated to be four-to-five times more expensive.[16]

If the UK's naval yards are as comparatively inefficient as their US counterparts – and this is fiendishly difficult to estimate – then radical change is needed.[17] In effect, the UK is not self-sufficient in naval shipbuilding at all, it simply has governments that are willing to sacrifice warship numbers for the sake of domestic production, and to an extraordinary degree.

The demise of shipbuilding in the US mimics the UK in certain particulars. The Reagan Presidency discontinued subsidies for commercial shipbuilding[18] in 1981,[19] and so the 1980s saw a cascade of shipyard closures, which is just what happened in the UK at the same time. Also, no pattern of overseas takeovers occurred in US yards, in contrast to what happened in Europe when European shipyards got into trouble. Today, the profile of the US shipbuilding industry is almost identical to the UK's. It is almost entirely naval, owned by US companies, and specific shipyards specialise in specific types of naval vessels under the general guiding hand of a monopsony customer.[20]

[14] Cato Institute: How would the Jones Act Reform impact US Shipbuilding, July 2021. Link.
[15] Congressional Research Service, Shipping under the Jones Act: Legislative and Regulatory Background, November 2019. Page 4. Link.
[16] Congressional Research Service, Shipping under the Jones Act: Legislative and Regulatory Background, November 2019. Page 4. Link.
[17] No replicas of Royal Navy frigates have been built in overseas yards for over 30 years, and so there is no way to compare UK frigate-building costs with those in commercial shipyards overseas. This will change as Australia and Canada commence construction of Type 26 frigates, but the results won't be known until the late 2020s, and those countries do not have major shipbuilding industries either.
[18] Forbes: US Shipbuilding is at its lowest ebb ever, July 23, 2021. Link.
[19] Eno Centre for Transportation: Decline in US Shipbuilding: A cautionary tale of foreign subsidies destroying US jobs, September 2015. Link.
[20] Defense News: American Shipbuilding, an anchor for economic and national security.

Despite huge naval orders, the shipbuilding sector in the US is also in deep trouble.[21] A recent article in *Forbes* reported:

> 'Today there is only one full-service shipyard left on the entire West Coast, and outside of submarines every segment of the domestic shipbuilding industry, both military and commercial, is facing major uncertainties in the years ahead.'

As in the UK, the US is trying to take remedial action. The US Shipyard Act is a US$21 billion shipyard re-capitalisation plan[22] and includes a US$4 billion provision to help private yards that build and maintain navy ships.[23] The root cause for action appears a deep-seated fear that in the absence of a vibrant commercial shipbuilding sector, inefficient US naval construction yards are going to struggle to compete with highly efficient yards in China. This lack of efficient construction is a strategic liability as the two navies square up for a trial of strength in the Western Pacific. But the US offers no pointers for UK shipbuilding, because its industry is in the same state, for near-identical reasons, and is only now trying to achieve the same objective, and for similar reasons.

What about the Asia-Pacific: is there any chance that the epicentre of cargo-vessel shipbuilding can help re-vitalise construction in the UK?

The dominance of Northeast Asia in commercial shipbuilding is astonishing. Today, Korea accounts for 34 per cent of the world's US$121 billion shipbuilding industry; China accounts for 33 per cent, and Japan for 17 per cent. [24] But this isn't just an efficiency story: these industries are also the result of huge state subsidies and multi-decade strategic industry programs.

Again, a little history helps. Japan's naval shipyards achieved world-class standards by the 1920s – principally by importing expertise and know-how from Britain's naval yards. But Japan's commercial shipbuilding only became globally significant in the 1950s, with a co-ordinated program of shipyard development. Success took two decades. But by the 1970s, Japan and Europe accounted for a combined 90 per cent of world shipbuilding,[25] with Japanese yards progressively eliminating European yards from the construction of bulk carriers, tankers and container ships.

South Korea followed Japan's lead in the 1970s with a similar industrial-program strategy. This took Korean shipbuilding to 25 per cent of global output by the mid-1990s and pole position by 2005.[26] There was a subtle difference in approach.[27] Japan's shipbuilding ascendancy relied on technical leadership and domestic demand (as had the UK's until the 1960s) whereas South Korea's industry was the result of economy-of-scale efficiencies at seven gigantic shipyards.

Chinese shipbuilding followed in their wake. With huge subsidies, Chinese shipyards became globally significant in the decade to 2010. And this commercial shipbuilding prowess has now spilled over into fast-paced naval shipbuilding. From 2015 to 2017, Chinese shipyards outbuilt the United States'

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[21] Forbes: US Shipbuilding is at its lowest ebb ever, July 23, 2021. Link.
[22] Defense News: Seapower backers propose $25 billion to fix US shipyards. Link.
[23] Defense News: Seapower backers propose $25 billion to fix US shipyards. Link.
[24] Source: 360 Market Update: Global Shipbuilding Market Research Report 2020.
[25] EU Directorate-General of Enterprise and Industry, Study on Competitiveness of the European Shipbuilding Industry. 2009. Page 7. Link.
[26] EU Directorate-General of Enterprise and Industry, Study on Competitiveness of the European Shipbuilding Industry. 2009. Page 7. Link.
[27] Newcastle University School of Engineering: Competition and Subsidy in Commercial Shipbuilding, Paul Scott. January, 2018. Page 3. Link.

in terms of naval vessels, according to the International Institute for Strategic Studies.[28] This is what's irking US policy makers. It's forcing them to face the same predicament as the UK, but in a more acute form. How to revive an industry that has become dependent on naval contracts and is not remotely efficient, when that industry also underwrites your security policy.

Subsidies alone aren't going to solve UK challenges. Matching EU or Asian subsidy levels would be hard enough for the UK in the post-Covid fiscal environment, even in a successful, established industries like the UK car industry. Using subsidies to resurrect industries that are largely defunct looks hopeless. The continuity of workmanship involved in high-end shipbuilding is gone, at least in non-naval shipbuilding. Rekindling shipyard skills is extremely difficult, as the UK's Barrow yard discovered when it incurred a multi-year gap between finishing one class of submarines (the Vanguards) and starting another (the Astutes). But at least the UK has learned that nationalisation and consolidation do not work.

Knowing when to seek help

The sectoral analysis published in *Lessons learned* revealed three traits of direct relevance to any attempt to revive UK shipbuilding:

- The correlation between productivity gains in UK manufacturing and foreign ownership.
- The success delivered by competing overseas investors in the UK's luxury vehicle industry.
- The role of small and medium-sized enterprises (SMEs) in Britain's recent export performance.

MakeUK is the peak industry association for manufacturing, and its recent reviews of UK manufacturing were used in eight of the 10 sectoral analyses published in *Lessons learned*. One fascinating insight from this series is that the UK's auto industry clocked up one of the fastest rates of productivity growth in UK manufacturing from 1995 onwards – and easily the fastest after 2008.[29] This is relevant because the UK's auto industry is almost entirely foreign owned. The biggest investors currently are Tata (Jaguar Land Rover), Nissan and Toyota, as well as VW (Bentley) and BMW (Rolls-Royce Motor Cars and MINI). MakeUK reckons foreign ownership across the entire automotive sector – including parts suppliers – is twice the average for UK manufacturing.[30]

However we chose to evaluate its broader merits, foreign ownership has worked wonders on the UK car industry's *recent* export performance. From *Lessons learned*, it's clear the UK's motor exporters were easily the UK's fastest-growing export industry *outside the EU* over the past two decades, with exports growing at over six per cent per year from 2000–2019. In 2000, motor vehicles and parts accounted for just 10.7 per cent of UK manufacturing exports. By 2019 this was 14.1 per cent. This implies that so far as UK manufacturing is concerned, overseas skills and capital are directly linked to a revival in exports. And note: this export success is *solely* due to competitiveness in the luxury end of the market; exports to the EU fell in real terms during this period, and that trade is dominated by Nissan, Honda and Toyota.

There is a definite pattern to productivity and overseas ownership across the MakeUK reports. The chemicals sector has delivered the second largest productivity gains in UK manufacturing since 2009.[31] MakeUK reports that foreign ownership is also double the national average in this sector.[32]

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[28] International Institute for Strategic Affairs: China's naval shipbuilding: delivering on its ambition in a big way. Nick Childs. May 2018. Link.
[29] Make UK: Automotive Sector Bulletin, 2018 Update. Page 3. Link.
[30] Make UK: Automotive Sector Bulletin, 2018 Update. Page 4. Link.
[31] Make UK: Sector Bulletin, Chemicals. Page 9.
[32] Make UK: Sector Bulletin, Chemicals. Page 9.

Third for productivity gains is the UK's machinery sector. Here again, foreign ownership is more than twice the average. And in the machinery sector, the data is more specific. MakeUK claims that foreign-owned machinery companies are currently 37 per cent more productive than domestically owned ones. And machinery is still the UK's third-biggest export industry, delivering 11.4 per cent of UK manufacturing exports in 2019, a one ppt rise on its contribution in 2000.

Looked at this way, the plight of the UK's resolutely British-owned yards becomes less mysterious. Their core problem is that there has been no vector for importing world-class shipbuilding expertise for decades — be it Korean, Japanese, Finnish, German or Italian. There may be solid security reasons to keep naval yards in British hands, but that precludes them from gaining the skills and engineering expertise that occurs when uncompetitive enterprises are purchased by successful ones. After all, it's the consciousness of superior technique that typically drives overseas companies to invest in UK manufacturing in the first place. They see a brand or a product, they know how to improve it, and so they invest. This is a vitalising element in commercial natural selection, as enterprises grow, expand, and then stagnate.

There was one other fear factor at play in UK shipyards that kept investors away until relatively recently: labour relations. But self-destruction has largely eradicated that problem – whether its origins lay in work culture, inept management, or sheer inertia. This creates a positive for present-day Britain. An overseas shipbuilder wanting to invest in a British shipyard has several almost clean slates to choose from. There would be few barriers to the wholesale import of expertise – and with it, engineering competence and technological sure-footedness. Investors could build new shipbuilding businesses on old yards in their own corporate image. And recent examples from the car industry suggest how that could be done.

Case Study: Rolls-Royce, Bentley and the revival of luxury auto exports

As stated above, the fastest growing export sector in UK manufacturing over the past 20 years has been the sale of motor vehicles to markets outside the EU. The value of these exports has tripled: from £7.2 billion in 2000 to £23.4 billion in 2019 (real prices). This is a luxury car success story. The UK's mass-market car makers (Nissan, Toyota, Honda and Vauxhall) do not widely export outside the EU, and during the 2000–2019 period, UK auto exports to the EU fell in real terms. The exceptional growth represents export success by:

- Jaguar Land Rover, which has been owned by Tata Motors since 2008.
- Bentley Motors, owned by the world's largest carmaker, Volkswagen, since 1998
- Rolls-Royce motor cars, which has been owned by BMW since 1998.
- MINI, which has also been owned by BMW since 2000.
- Other niche or luxury brands, including Aston Martin, Lotus, McLaren, Morgan and TVR.

Jaguar Land Rover has enjoyed a fair degree of continuity over the past 20 years, so this case study will focus on Bentley and Rolls-Royce. Both have been rebuilt – physically – almost from scratch, since 1998. Back then, the brands resembled UK shipbuilding: they lived on the prestige of former years, output was flat, and the physical infrastructure involved was of WWII vintage.

First, a short history. Both brands were sold as a single company by Vickers in 1998, whereupon the successful bidder, VW, discovered that what it had actually bought was not the coveted Rolls-Royce brand, but a clapped-out factory just outside Crewe. The Rolls-Royce brand was in fact owned by Rolls-Royce Limited (of aero-engines fame), which promptly sold the brand rights to BMW. After some tense rounds of golf on a course just outside Munich, the company split in 2001. VW retained the Bentley brand, which it would assemble at the progressively rebuilt and now sparklingly clean £1

billion factory in Crewe. Meanwhile, BMW built an entirely new factory at Goodwood for its Rolls-Royce brand.

The results have been amazing. In 2001, VW manufactured just 1,466 Bentleys.[33] By 2020, output had risen by a factor of seven. Bentley manufactured 11,006 vehicles in pre-pandemic 2018–19, and 11,206 vehicles in 2019-20.[34] The Bentley brand is now reckoned to be a €2 billion business,[35] and – the killer stat – while output rose by a factor of seven, employment has only doubled, to approximately 4,000. This implies a colossal increase in efficiency, though the subject requires further study. Like shipyards, car factories rev-up local supply chains. By 2021, there were 82 suppliers within a 50-mile radius of the Crewe factory.[36] Its first six months of 2021 were its most profitable. And this is an export business. Pre-pandemic, Bentley sold approximately 85 per cent of its cars to overseas customers.

Rolls-Royce has grown even faster, and from a smaller base. Just 378 Rolls-Royce motor cars glided off the production line at Crewe in 2001 – the last year before manufacturing switched to Goodwood.[37] But output from the £100 million new factory at Goodwood has increased by a factor of 10, and production has averaged 4,105 units over the past five years.[38] Both companies sold a record number of vehicles in 2021: 5,586 for Rolls Royce, and a staggering 14,695 for Bentley. Bespoke, luxury car making is now a major UK export success story.

For both companies, China and the US are easily the biggest markets. In statistical fact, without Bentley, Rolls-Royce and Jaguar Land Rover (which is also foreign owned), motor vehicles would *not* be the UK's biggest goods-export sector today. The aerospace sector would be – probably followed by machinery.

But here's the kicker: there is powerful but unspoken rivalry between these two German-owned brands. Both are competing for the same high-end customers in global markets; and they both compete in terms of craftsmanship and customisation. The customisation factor is important. The optional extras on a new Rolls-Royce Ghost are claimed to equal the cost of a new Porsche 911.[39] In effect, the innate competitiveness of two of Germany's top-three carmakers has migrated overseas, and UK-based engineering and craftsmanship has become the field of battle. Both VW and BMW have nurtured what they believe to be a UK comparative advantage in high-end auto engineering and craftsmanship, and created global export industries thereby.

There are four lessons from this export triumph:

1. Successful global engineering companies *can* re-generate historical and near-defunct British industrial enterprises and turn them into major export industries.
2. These overseas companies have done this by essentially re-creating high-skilled, specialised workforces. (The average length of service at Bentley is now 12 years.)[40]
3. Foreign executives have demonstrated their ability to work well within what was once a highly unionised industry.

[33] Volkswagen Annual Report, 2001. Page 64. Link.
[34] Volkswagen Annual Report 2020. Page 34. Link.
[35] Volkswagen Annual Report 2020. Page 34. Link.
[36] Bentley Media. Link.
[37] Volkswagen Annual Report, 2001. Page 64. Link.
[38] BMW 2020 Annual Report, Page 9. Link.
[39] AutoX. 2021 Rolls-Royce Ghost: First Impressions, June 2021. Link.
[40] Bentley Media. Link.

4. The key to success is in the ability – on the part of an overseas investor – to identify where the UK, its workers and suppliers can develop a niche, competitive advantage.

Playing to instincts of pride and competitiveness on the part of the investor also pays dividends. So, inviting in two investors who compete anyway is likely to be far more successful than just inviting one. Besides, they will (secretly) compare notes – and that's to the benefit of everyone. If this 20-year revitalisation can succeed in Britain's luxury car industry, there's no reason it cannot be applied to UK shipbuilding. Remember, Rolls-Royce's factory and workforce have been built up from scratch since 2001, and Bentley underwent a top-to-bottom rejuvenation.

Go East

If the will to revive British shipbuilding is real, and the efficacy of overseas investors is accepted, then three questions present themselves: which candidates are ideal; how can they be induced to invest; and what sort of ships would they build? To find successful commercial shipbuilders that are also experts in building advanced warships, ministers will have to go east.

Korea's Daewoo Shipbuilding and Daewoo Marine Engineering (DSME) is the obvious starting point. One of Korea's big three commercial shipbuilders, the company recently built four large, fast tankers for the Royal Navy's logistics service, the Royal Fleet Auxiliary (RFA). They were based on a UK design by BMT Defence Services, which is the UK's premier, independent naval architect. The ships were built in Korea with breathtaking speed: just four months from laying down to launch for the 38,000-ton lead-ship, Tidespring. Daewoo is currently building destroyers for the Korean Navy that are powered by Rolls-Royce gas turbines. This means the company already has direct links with UK-based naval architects, UK naval suppliers and the Royal Navy – and it possesses the sort of shipyard efficiency that European yards can only dream of.

Then there's Hyundai Heavy Industries (HHI), whose Ulsan shipyard in southeast Korea is the world's biggest. Along with DSME, the company is also building Daegu-class frigates for the Korean Navy. It also has deep links with Rosyth's Babcock. In September 2021, Babcock partnered with HHI to submit a design for Korea's first fixed-wing aircraft carrier.[41] HHI is also an expert in offshore engineering. This may become highly relevant to the UK's ambitions if it wants to translate putative leadership in floating wind power (which it currently enjoys) into a major offshore engineering industry (which it only partly has – see Chapter 3). So, there are two Korean shipbuilders that combine commercial and naval shipbuilding, and which already have close ties to UK marine engineering.

Across the Straits of Tsushima, two of Japan's largest shipbuilders also combine commercial and naval work. The scale of naval shipbuilding in Japan now exceeds anything underway in Europe. The Japanese navy looks set to order two Mogami-class frigates per year from 2019 until 2032. Orders are split between two huge maritime-engineering businesses: Mitsubishi Heavy industry (MHI) and Mitsui. MHI resembles a large and less defence-dependent BAE Systems. Besides its three shipyards, it has an aerospace business and an interest in offshore wind power, via a holding in Vestas. Mitsui also has three shipyards. Both these companies also have UK connections, since they too install Rolls-Royce gas turbine engines into their destroyers.

A third conglomerate – Japan Marine United, which is part of HHI – also has a naval side. It recently completed the pair of large flat-topped ships that mark the tentative re-emergence of Japan's aircraft carrier fleet. And the UK is likely to be closely involved at multiple levels in this program, because the Royal Navy is the only other navy in the world to create a genuine carrier strike

[41] Naval News: South Korea's HHI and Babcock Ink Strategic Alliance for CVX Carrier. September 2021. Link.

capability around the F-35 B short take off/vertical landing fighter. For the UK, the strategic aspect is hard to miss. The HMS Queen Elizabeth aircraft carrier spent September 2021 exercising with the Japanese and US navies in a carefully photographed show of maritime amity.

If the UK's Shipbuilding Tsar genuinely wants to trigger a renaissance in British shipbuilding via its current naval procurement, then the skills he needs will be found in one or more of these five companies. The blunt but realistic truth is that UK shipbuilding won't be reborn without a direct transplant of the shipbuilding capabilities that have been developed to a high pitch by these five companies. Just like Japan during the Meiji restoration, British shipbuilding knows it must look overseas if it genuinely wants world-class shipbuilding. That accepted, the task is straightforward: what can the MoD, the UK Treasury and regional authorities offer that will trigger a strategic investment from these companies?

Freeports and UK shipbuilding

The answer lies in a combination of the large naval order book as it currently stands and the development of freeports. The first offers a commercial opportunity for Korean and Japanese engineering companies to enter the UK shipbuilding industry. The second offers the prospect of creating ongoing shipbuilding and engineering enterprises that are competitive and profitable/

The timing is propitious. . The UK and Scottish Governments have just agreed to open the bidding for two, new freeports in Scotland.[42] One or both, could be established in a shipyard. Meanwhile, the naval order book offers an immediate trigger. The MoD has just down-selected competitors for the £1.5 billion procurement of three 'Fleet Solid Support (FSS)' tankers. Each of these ships will displace 30–40,000 tons, making them roughly half the size of HMS Queen Elizabeth. In terms of complexity, they occupy a class approximately mid-way between a standard commercial tanker and a large warship.[43] These are the types of vessels where – if they were built in Korea or Japan – a commercial shipbuilder would deliver a devastating competitive advantage.

Interest already exists. Japan's Marine United and Korea's Daewoo Shipbuilding participated in the MoD's first aborted procurement for these vessels. The MoD's objective now should be to contrive the procurement in such a way that the various consortia currently in the running invite Japanese and Korean shipbuilders into their bids. For the MoD, the specific purpose should be to use the procurement to encourage a Japanese or Korean shipyard to buy or lease a dormant or low-activity shipyard in a way that permits it to recreate that shipbuilding site according to their own best practice.

The idea is far less radical than it might appear. It's already happened in Australia, for example. When the UK's BAE System won the contract to build nine anti-submarine warfare frigates for the Australian Navy in December 2018,[44] it was on the explicit understanding that BAE Systems would take over the government-owned ASC Shipbuilding company in Adelaide, where it would then construct the frigates. As a subsidiary of BAE Systems, ASC shipbuilding (renamed BAE Systems Maritime Australia) is building up a new shipbuilding workforce and triggering a vastly expanded local supply chain. It is obliged to ensure that the highest proportion possible of the value of these nine warships is sourced from local suppliers. At the completion of the contract, ASC shipbuilding will be returned to government ownership.

[42] The Scottish Government: Deal announced to establish Green Freeports. February 2022. Link.
[43] UK Defence Journal: Fleet Solid Support Ship competition narrows, September 1, 2021. Link.
[44] BAE Systems, Next generation frigates contract awarded to ASC Shipbuilding under BAE Systems Australia, December 2018. Link.

This example shows how an advanced western country can trigger inward shipyard investment via naval procurement. The difference between the two is that Australia has always struggled to maintain a naval shipbuilding industry, whereas until comparatively recently, the UK had more capacity than naval demand could sustain.

One of the attractions for Korean or Japanese participation in the FSS contract is the prospect for future orders. Indeed, the scale of investment brought by an overseas shipyard in its bid should be counted in assessments, since it will improve their ability to bid competitively for future naval orders. The efficiency bought by an overseas yard would inevitably make the UK's naval order book more feasible as the defence budget tightens. As long as those Japanese and Korean shipyards had complete freedom to train a fresh workforce, and import fresh work processes, engineers, managers and construction techniques from their home shipyards, they should – after the initial contract – be ideally placed to win subsequent procurements.

But if the UK Shipbuilding Tsar's purpose is to make British shipbuilding genuinely competitive – or even just competitive within Europe – then the cost of inputs will have to change. And this is where freeports provide a potential answer.

After an initial flirt with free trade, the UK has elected to maintain tariffs on most steel imports.[45] This will benefit the UK's small and troubled steel industry, but it directly adds cost to UK shipbuilding. Extruding UK shipbuilding out of protected UK steel prices will, however, trigger competitive opportunities. If the future naval shipyards are themselves within freeport areas, this means shipbuilders will be free to purchase steel at global prices, including steel that is supposedly 'dumped' on world markets. This would provide a Korean or Japanese investor with a conveniently located shipyard with a unique competitive advantage in Europe. And the advantage would be substantial: in 2008, Rand estimated that iron and steel contributed approximately 20 per cent to the cost of a US destroyer.[46]

Outside steel, the benefits would be fairly minor under the UK's new global tariff schedule.[47] If a freeport site in Scotland or Northern Ireland mimicked those in England, lower national insurance rates would help the investor regenerate a shipyard workforce on its own terms. But if Government is dealing with brownfield sites, or a near-defunct shipyard, why stop at tax incentives? Some commentators, including *The Times*' Ed Conway, have suggested that the freeport concept should be radically expanded such that the freeports become self-regulating, or even self-governing jurisdictions.[48] This would mean, in effect, that the freeport zones would be hived out of a broad array of workplace, market and commercial regulations. These would all be reformulated – by the freeport authority – with one specific goal: the industrial regeneration of the freeport area, and the businesses that supply into it.

Time to experiment

The UK should experiment with the freeport concept, and trial various 'freedoms'. Again, Asia offers insights. The Chinese Government has set up multiple freeport *pilots*, precisely to see what works, what does not, and what can be replicated across the country.[49] In other words, there is no 'one' model of freeport. And China has consistently used freeports as catalysts for triggering export industries. Across Asia, the scope and depth of freeports varies enormously. For example, by 2025,

[45] Reuters: UK to extend tariffs and quotas on most steel imports. July 2021. Link.
[46] Rand: Using the steel-vessel material-cost index to mitigate shipbuilder risk. 2008. Page ix.
[47] Financial Times: Freeport Advantages for Business are almost non-existent. August 2020.
[48] The Times. Tinkering Rishi Sunak should focus on a big idea. Link.
[49] Chinaforex.com.cn. Hainan Port. Link.

the Chinese Government wants to turn the whole of Hainan Island into a gigantic duty-free freeport area, with the upper limit of enterprise and individual income tax reduced below levels in Singapore. Meanwhile, Singapore has abolished its seven per cent goods and services tax (the equivalent of VAT) in its seven free trade areas.

Thailand's approach is also worth analysing. This is because the country has rapidly evolved to become a world-class exporter of advanced engineering – a trajectory that Britain wants to emulate. Almost all Triumph motorbikes, for example, are now assembled at three factories in Thailand, all in enterprise zones. Thailand's new Eastern Economic Corridor was established in 2017 and is particularly instructive, since it combines rail, airports and deep seaport development. These zones provide corporation tax reductions and exemptions[50]. Tellingly, they have already attracted huge investment from Japanese companies.

The point is that there are numerous models of freeport on offer, especially in the Asia-Pacific region. They show that investment-friendly governments are not afraid to experiment with offering liberalised terms in multiple aspects of governance and taxation, specifically to attract overseas investors. And in some cases, this includes corporation tax. This is important for the UK as nationwide corporation tax is set to rise. This will further undermine UK competitiveness as a destination for investment in some footloose strategic industries, notably technology and pharmaceuticals (see Chapter 2). Giving UK freeports a corporation tax escape clause would square the circle of the UK's fiscal needs and an enterprise-based levelling up agenda.

One other element is labour. Until recently, labour contributed approximately 20 per cent of the value of shipbuilding in Europe,[51] according to EU data, and note that Europe is dominated by complex shipbuilding. This means that labour and steel together will likely represent approximately 40 per cent of the cost of the vessels that the UK wants to be competitive at building. So, to succeed in its ambitions, the UK is going to have to quickly develop high-skilled shipyard workforces that are cost-competitive. This means attracting young people and training them quickly.

History reveals possibilities. In the past, the UK has allowed investors to introduce new labour regimes as the price of securing long-term investment. It is a point now generally forgotten that when the Thatcher Government lured Japanese car companies into the UK in the mid-1980s, it didn't just offer financial incentives, it also allowed Japanese companies to negotiate single-union representation and provisions that either banned strikes or made them unlikely.[52] The result in Sunderland was 25,000 applications for the first 450 jobs at the new Nissan plant.

The answer today won't be the same, because labour relations aren't the big issue. In terms of labour, the principal challenge is incentivising young people into the industry, skilling them up quickly, and creating a positive commercial culture that rewards energy, ambition and talent. And note: VW and BMW have done this brilliantly at Crewe and Goodwood.

Perhaps new forms of standard labour contracts could be pioneered within freeports. But whatever the answer, UK politicians should take a dose of pragmatism, like their forebears in the 1980s. It worked for Nissan, after all. Spectacularly so. By 1999, Nissan's Sunderland plant was rated the most

[50] EY: Thailand announces tax measures supporting investments in Special Economic Zones and Industry 4.0. April 2020. Link
[51] EU Directorate-General of Enterprise and Industry, Study on Competitiveness of the European Shipbuilding Industry. 2009. Page 12. Link.
[52] The New York Times. Nissan's Revolution in Britain. June, 1987. Link.

efficient car plant in Europe by the Economist Intelligence Unit.[53] This achievement would have been unimaginable to anyone visiting British Leyland's Longbridge plant two decades before. There's no reason why a freeport shipbuilder couldn't emulate that achievement. And there's every reason to see Japanese or Korean companies as catalysts.

Ultimately, the opportunity is there for the taking because there's little left to lose. Freeports provide a trigger opportunity precisely because of the vast, semi-derelict spaces around once great shipyards. These spaces provide the scope for successful overseas shipbuilders to re-create the sorts of engineering ecosystems that once thrived on the banks of the Clyde, the Tyne, and on Belfast Lough. Freeports could provide a mix of freedoms that would enable Japanese or Korean shipbuilders to create profitable, complex shipbuilding businesses in Europe. They could also ensure that the Royal Navy can purchase frigates at something approaching competitive prices – which would in turn transform the navy's global reach and Britain's diplomatic capital.

[53] EIU. Nissan Motor Corporation, What Makes Nissan's Sunderland Car Plant Europe's Most Efficient. August 1999. Link.

Chapter 2: Pharmaceuticals

If there's one industry where the UK needs to adjust trade policy quickly, it's pharmaceuticals. This is because the pharmaceuticals sector has the greatest potential to rapidly increase UK exports, and because it's the sector where a rising import-dependence presents a direct threat to UK citizens. But the UK can only rescue this sector if it faces a single dominating factor within the pharmaceuticals industry: where tax breaks go, pharma follows.

If only…. UK pharmaceuticals and the success story that wasn't

Pharmaceuticals was *almost* the UK's great export success story of the past 20 years. From 2000 to 2009, UK exports from pharmaceuticals grew at a compound annual growth rate (CAGR) of 9.8 per cent p.a. This is easily the fastest sustained export growth rate of any sector of UK manufacturing in the past two decades. It took the pharmaceuticals sector from sixth to fourth place among the UK's manufacturing export sectors, as its contribution rose from 4.7 per cent to 11 per cent of manufacturing exports. But since 2010, exports have stagnated. According to ONS data, turnover in the UK's pharmaceuticals industry fell by over one-quarter from 2010 to 2015.

Meanwhile, imports *from the EU* have grown by 4.5 per cent since 2010, or almost twice the average rate of import growth into the UK. And this has led the UK into becoming strangely dependent on EU pharmaceutical supply chains. Economists were sanguine about the 'captive market' effect in UK–EU trade before the UK's exit from the Customs Union. (This is the phenomenon described in detail in *Lessons learned*, whereby EU countries take a falling share of UK exports but supply a high or increasing share of UK imports.)[54] The effect is pronounced in UK trade in motor vehicles, machinery, chemicals, steel, pharmaceuticals, food and beverages, which, combined, accounted for 52.3 per cent of UK manufacturing exports in 2019. But the captive market effect is especially severe in the UK's pharmaceuticals industry. In the pharma sector the UK sends just 40.2 per cent of its exports to the EU, but the EU supplies 80.3 per cent of UK imports. This is by far the most imbalanced trade of any UK sector, and the imbalance has deteriorated faster than in any other sector.

Recent supply disruptions in the UK's pharmaceuticals and energy markets have injected a dose of strategic thinking into the commercial considerations that typically dominate trade policy. Suddenly, import dependence matters. As the Covid-19 pandemic bit in May 2020, NHS leaders called for ministers to ensure that more drug manufacturing was brought to the UK to reduce the risk of future shortages.[55] This was partly in response to temporary restrictions the Government of India placed on exports of paracetamol.[56] Then, in March 2021, the EU Commission threatened to take measures to curb vaccine exports to the UK.[57]

It shouldn't have to be this way. The UK has extraordinary advantages right across the pharmaceuticals supply chain. These include the largest biotech clusters outside of the United States,[58] a university research base that has now justified its reputation in the top rank of medical science, and a health market so dominated by state services that it can impose terms on suppliers to a greater extent than the health services in any other major economy. The UK Government is also enthusiastically embodying pharmaceuticals within its various industry strategies. According to

[54] Civitas: Lessons learned for a Global Britain: UK trade in manufacturing, 2000-2019, April 2021. Page 177.
[55] The Guardian: Drug manufacturing must be brought to UK; NHS bosses and charities tell MPs. Link.
[56] UK India Business Council: UK-India ties exemplified by paracetamol trade. April 2020. Link.
[57] Reuters: EU threatens tougher vaccine export curbs in dispute with UK, U.S. Reuters, Link.
[58] Industrial Strategy: Life Sciences, Sector Deal 2. Page 4. Link.

recent reports by the *Financial Times*, the UK Government wants to make life science and genomics two of its seven 'families of innovation'.

Yet, while the UK excels at innovation and research in pharmaceuticals and life science, this has failed to result in manufacturing growth or an export boom since 2010. What's more, this failure to turn high-performance pharmaceuticals research into high-performance pharmaceuticals manufacturing is becoming more pronounced[59] — as UK trade data attest (see below). In fact, the recent history of UK pharmaceuticals proves the very painful point that high R&D does *not* automatically result in higher manufacturing output. As the UK emerges from the pandemic, policy is in a bind. The Government has a strategic duty to limit dependence on imports of pharmaceuticals, and increasing pharma exports is official UK government policy. But that requires a 180-degree reversal of a clear industrial trend that began back in 2010.

Worse, there's no solid diagnosis for what went wrong with UK pharmaceuticals manufacturing from 2010 onwards, why manufacturing is moving offshore, and why pharmaceuticals is slipping as a top UK exporter. And its recent performance *is* a shocker. In 2018–19, pharmaceuticals fell from fifth to sixth place as a UK manufacturing export sector. The value of exports slipped from £28 billion in 2017 to £23.8 billion in 2019 (2018 prices), even though pharmaceuticals is one of the UK sectors that was *least* impacted by the UK's then-imminent withdrawal from the Customs Union and Single Market.[60] And the UK now has one the smallest pharmaceuticals manufacturing industries of any major European economy (see below).

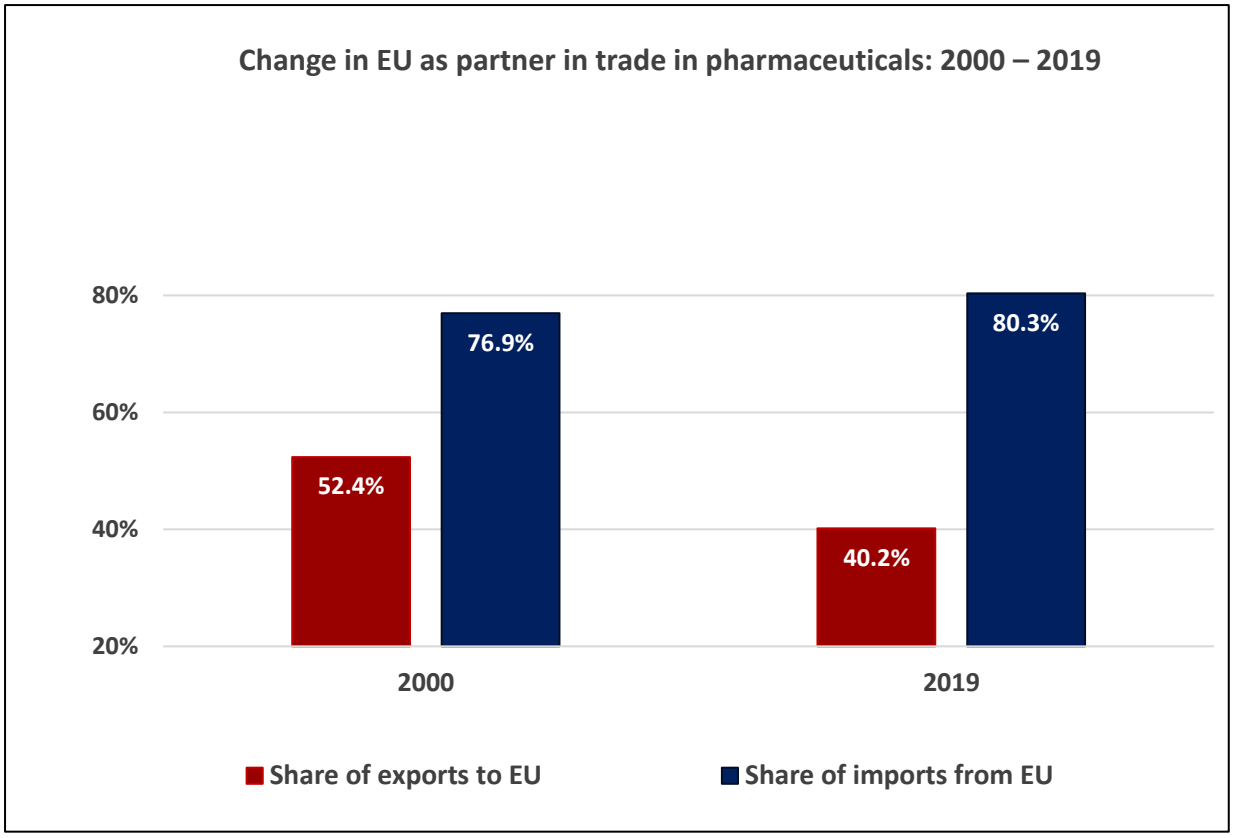
As this chapter will show, trade and domestic manufacturing in pharmaceuticals are intimately linked. The factors that have made output and exports stagnate are the same factors that have led imports to rise. Amongst all the policies initiatives to increase pharma manufacturing – clusters, collaboration, research spending – success will depend on one factor alone: changing the balance of financial incentives so that global pharmaceuticals want to re-invest in UK manufacturing.

UK trade in pharmaceuticals: the basics

First, some home truths. UK trade in pharmaceuticals is a tale of two markets. In terms of exports, trade is already fairly globally oriented. In 2019 – before Covid-19 impacted trade in pharmaceuticals – the UK exported £9.7 billion of pharma goods to markets inside the EU and £14.5 billion to countries outside the EU. This represents an EU/non-EU ratio of 40/60. This a rapid turnaround from 20 years before, when the EU took just over half, or 52.4 per cent, of UK exports. The speed of that switch to global markets is faster than the average for UK manufacturing, and the proportion of exports going to non-EU markets (59.8 per cent) far exceeds the average for UK manufacturing (51.1 per cent). So far as data tells a story, the pharmaceuticals industry adopted a Global Britain approach before the UK did.

[59] European Pharmaceutical Review' Rich Quelch, Building the UK's domestic pharma manufacturing capability, April 2021. Link.
[60] Civitas, Two Tests for UK Trade. September 2021. Page 24.

Figure 2.1



Source: *Office for National Statistics BoP Publication tables, UK trade in goods, CPA (08). UK Trade in goods by Classification of Product by Activity, time series dataset, June 2021.*

It's a far different story with imports, however. As the graph above shows, the share of the UK's imports coming from the EU was already extremely high, at 76.9 per cent in 2000. By 2019, this had increased, to 80.3 per cent. Among major sectors, only the UK auto industry relies on the EU for a higher share of imports (83 per cent in 2019), and the average across all manufacturing is 59 per cent. What's more, the difference between the share of exports that the EU takes and the share of imports the EU supplies is the widest of any major UK manufacturing sector. This implies that some aberrant factor is at play in UK–EU trade in pharmaceuticals.

Whatever that factor is, the effect is extraordinary. From *Lessons learned* it is clear there is no other major sector of UK manufacturing during the period 2000–2019 where exports grew so fast but then stopped. And there is no other UK manufacturing sector where dependence on the EU for imports so high and also rising. To see what's been going on, it's necessary to look more closely at UK trade and output data.

UK trade

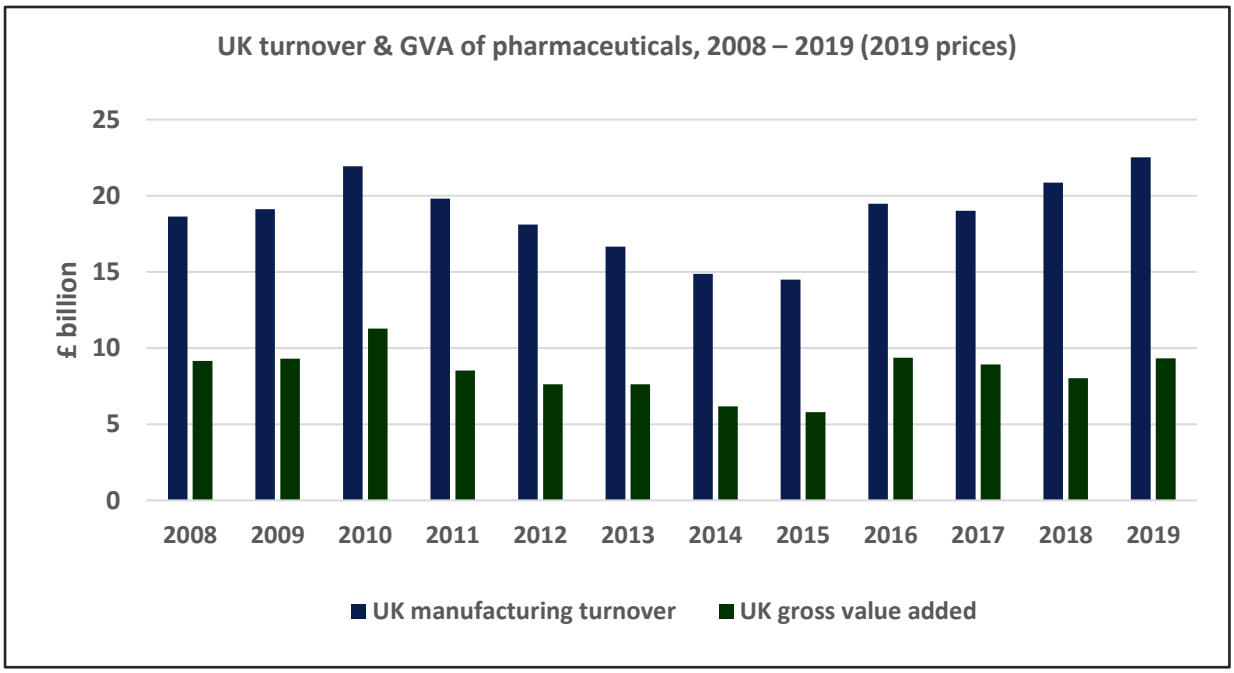
The principal source for manufacturing data is the ONS' Annual Business Survey (ABS), which uses the same classification system as the trade data used in this research. Thus, the two data sets are compatible. It's mildly confusing, because the value of pharma exports frequently exceeds UK turnover. This occurs because the value assigned to factory output in ONS surveys is quite different to the 'free on board' value assigned in ONS export data. And this happens for three reasons. First, the value of pharmaceuticals increases swiftly post-production as treatments are re-packaged, re-bottled, re-labelled, parcelled and consigned. Also, a large proportion of export value in

pharmaceutical goods isn't manufactured in the UK but imported and added as an input into a pharmaceutical good. Finally, goods often cross borders multiple times anyway – for example, as vaccines are decanted and rebottled.

For perspective, the pharmaceutical industry itself reckons that 41 per cent of UK production is generated from overseas sales. This makes the UK's pharmaceuticals industry the third most export-intensive in UK manufacturing.[61]

ABS data shows that pharma manufacturing has had a roller coaster ride since 2008, and this partly tracks export performance. According to the data (which only go back to 2008) UK factory turnover peaked in 2010 at £18.7 billion (or £21.9 billion in 2019 prices) and then entered a dramatic five-year decline, bottoming out at £13.4 billion in 2015. Since then, domestic turnover has staged a recovery, hitting a peak of £22.5 billion in 2019. However, a better measure is gross value added (GVA), because this eliminates the role of imports into ultimate factory output. This GVA measure also fell brutally after 2010 but has *failed to recover* to 2010 levels. This implies that a greater share of UK pharma manufacturing supply chains is delivered by imports as compared to a decade ago.

Figure 2.2

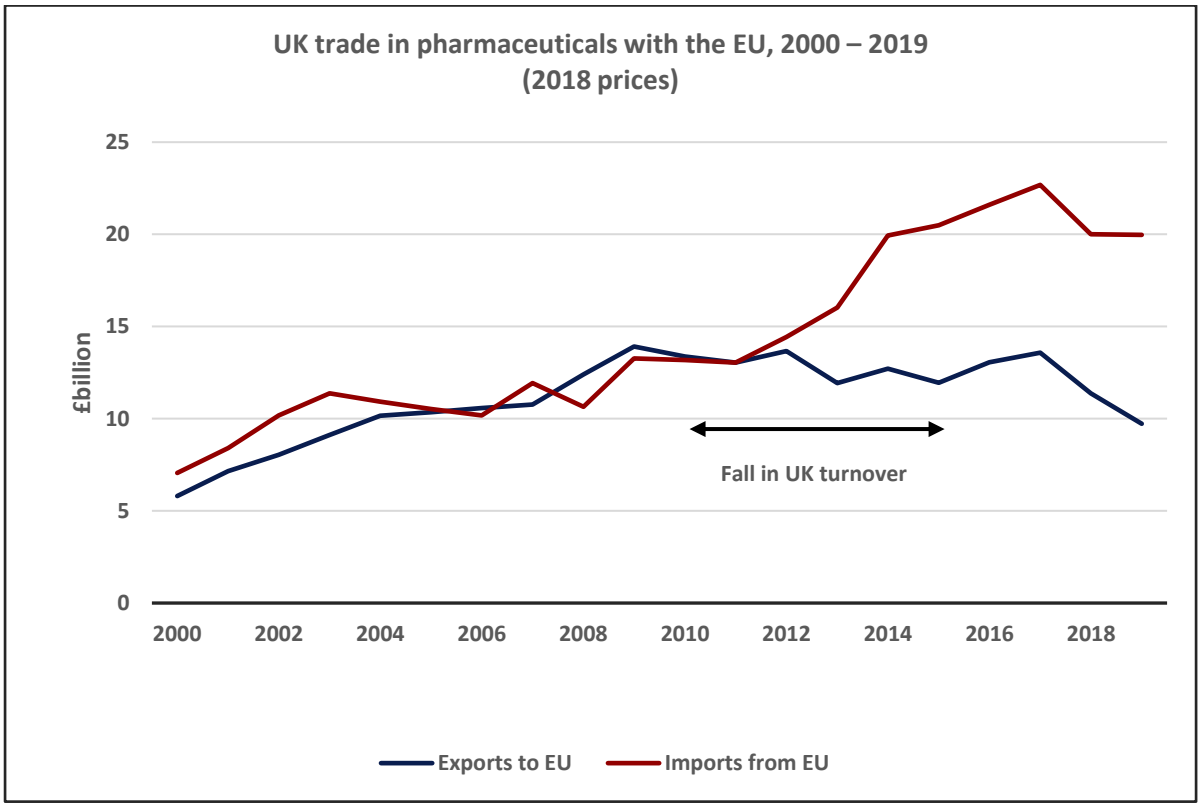


Source: *ONS Annual Business Survey (ABS). Section C, Manufacturing. Release Date June 24, 2021. 2019 prices using Treasury GDP deflators. Link. Current ABS data commences in 2008.*

This trend almost exactly matches UK trade trajectories and is just as exceptional. No similar fluctuation in GVA has occurred in any other major UK manufacturing sector in the last 11 years, except in the iron and steel industry. As the graph above shows, the 2010–2015 fall in UK manufacturing turnover and GVA coincides *exactly* with the period when exports to the EU stalled and imports accelerated. Necessarily, this impacted the UK's trade balances. Up until 2012, the UK's imports and exports of pharmaceuticals roughly balanced, so far as EU trade was concerned. But by 2016, a huge £8–10 billion sectoral deficit had emerged, which continued to 2019.

[61] Make UK: Pharmaceuticals Page 4. Link.

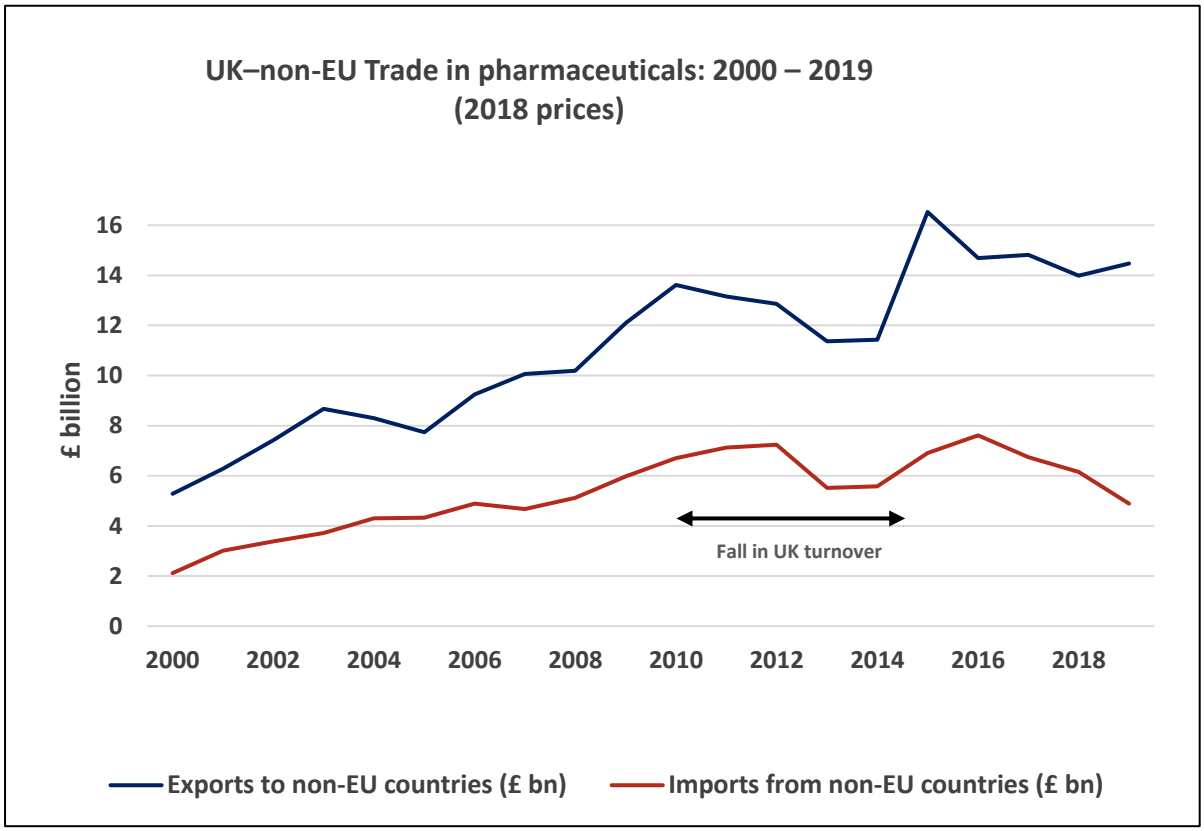
Figure 2.3



Source: *Office for National Statistics BoP Publication tables, UK trade in goods, CPA (08.)*
UK Trade in goods by Classification of Product by Activity, time series dataset, June 2021

A subtly different picture emerges from the UK's pharma trade outside the EU. The fall in UK manufacturing *also* coincides with an end to rapid export growth to markets outside the EU. Actually, the decline in exports post-2010 was more severe. But unlike in the EU, exports recovered in 2015. They have generally stayed consistently higher. And with non-EU imports, the story is entirely different. Having oscillated slightly, they are now down to the level they were in 2006–2008, in real terms. In contrast, imports from the EU are now roughly double what they were in 2006-2008. In short, UK trade in pharmaceuticals is utterly different between EU and non-EU markets.

Figure 2.4



Source: *Office for National Statistics BoP Publication tables, UK trade in goods, CPA (08). UK Trade in goods by Classification of Product by Activity, time series dataset, June 2021*

This comparative analysis indicates that the health of UK pharmaceuticals manufacturing is intimately connected with EU trade – and negatively so. From 2010 to 2015, turnover in UK pharmaceuticals manufacturing fell steeply from £19.7 billion to £14.4 billion (current prices). The fall in GVA was even steeper; it approximately *halved.*[62] This was a brutal decline, unmatched in any other major manufacturing sector over the past two decades.

But the essential point – clear from the charts above – is that this decline in the value of UK pharma manufacturing coincides with a dramatic rise in imports from the EU. And this is a pure UK–EU phenomenon, because the value of UK imports from non-EU countries stayed relatively stable during this period and were only worth fractionally more in 2015 as compared to 2010. They are also worth far less in absolute terms. Imports of pharmaceuticals from non-EU countries were worth just £4.4 billion in 2019, or one quarter of the EU total. This illuminates exactly where the problem lies, and where a fix will have to be found.

And a fix will have to be found if the UK Government wants the country to emerge from the pandemic as a global leader in pharmaceuticals manufacturing, and not a vulnerable dependent on EU supply chains. Following the 2010–2015 fall in output, the UK has become a laggard in pharmaceutical output in Europe. According to Eurostat data,[63] the UK's pharmaceuticals

[62] ONS Annual Business Survey. Non-financial business economy, UK: Sections A to S. Section C, lines 1575 to 1580. Link

[63] The European Federation of Pharmaceuticals Industries and Associations. The Pharmaceuticals Industry in Figures, 2019. Page 11. Link.

manufacturing – valued at €20.6 billion in 2017 – was worth less than half of Switzerland's (€44.9 billion), two-thirds of Italy's (€31.2 billion) and Germany's (€30.6 billion), and slightly less than France's (€21.9 billion). Tellingly, it was barely bigger than Ireland's (€19.3 billion). And it's across the Irish Sea that analysts have to look to gain a fuller perspective on what exactly has been going on.

The Irish problem

Pharmaceuticals is now Ireland's most valuable manufacturing industry by far,[64] and the Republic's premier export industry. The success story has been a long while in the making. Ireland's Government targeted the pharmaceuticals sector as a strategic industry well before 2000, but by 2010, the sector was already exporting pharmaceutical and medical products worth €24.3 billion, according to Ireland's Central Statistics Office. In real terms, this is approximately what the UK's total pharma exports are currently worth. Irish medicinal and pharma exports almost doubled in the decade to 2019 to reach €49.5 billion and €62.1 billion in 2020.[65] According to Ireland's inward investment agency, the IDA, the last decade has seen 'close to' the biggest wave of investment in biotech facilities anywhere in the world.[66]

The scale of this industry is truly impressive for a country with a population that is less than one-sixteenth that of Germany. According to EU data from 2021, Ireland was the second largest extra-EU exporter of pharmaceuticals in the EU in 2020.[67] In 2019, medicinal and pharmaceuticals delivered 32.6 per cent of the Republic's goods exports.

There are multiple accounts of what's driven this investment surge. According to the Irish Pharmaceutical Healthcare Association, 120 foreign companies have pharma plants in Ireland, including nine out of the 10 largest global pharmaceuticals companies.[68] But what's powering it? Most sources cite a combination of a low corporate tax rate (12.5 per cent in 2021, but set to rise to 15 per cent), skilled workers and strong regulation.[69] But the latter two are also UK strengths, with the UK's Medicines and Healthcare Products Regulatory Agency (MHRA) being one of the most respected health regulators in the world. In addition to low corporate tax rates, the professional services company, PwC, also cites Ireland's tax treaty network and the availability of R&D credits.[70]

Is Ireland alone the cause of England's pharmaceutical woes? Partly, at least. From 2009, a series of corporate closures took place across the UK's pharmaceuticals industry. The highest profile example was Pfizer's 2011 decision to relocate its Viagra plant from Sandwich in Kent to Ringaskiddy in Ireland, with the loss of 2,400 jobs. But investment flows into Belgium and the Netherlands have also impacted UK industry. By the end of 2019, the Netherlands supplied 23 per cent of the UK's total pharmaceutical imports. GSK – which billed itself as the world's largest vaccine manufacturer until 2019 – concentrates its vaccine manufacturing in Belgium,[71] including at a gigantic facility at Wavre.

But as far as Ireland is concerned, the circumstantial evidence is compelling. The great offshoring in UK pharmaceuticals began around 2010; UK GVA dropped by almost half in the following five years;

[64] Central Statistics Office (Ireland): Irish Industrial Production Per Sector, 2019, released July 2020. On a net selling value (NSV) metric, the value of pharmaceuticals production to the Irish economy was worth 40% of total NSV in 2019, which was twice the contribution for food.
[65] Central Statistics Office (Ireland). Link
[66] IDA: Biopharmaceuticals Industry Ireland. Accessed August 2020. Link.
[67] Eurostat: International trade in medicinal and pharmaceutical products, Extra EU trade in medicinal products by member state, 2020. Link.
[68] The Irish Pharmaceutical Healthcare Association: About the Industry. Link.
[69] PwC: Why Ireland for Pharma and Life Sciences. Link.
[70] PwC: Why Ireland for Pharma and Life Sciences. Link.
[71] GSK. A unique company in Belgium. Page 15. 2019.

and UK exports stagnated, then fell. Imports from the EU rocketed from 2012 onwards, just as Ireland grew one of the largest pharmaceuticals-export industries in Europe, whose exports were worth 1.8 times the value of the UK's equivalent exports in 2019, and far more than double in 2020. Only a thorough examination of corporate annual reports will reveal a truer picture or pattern of investment diversions. But as will be seen, finding out the exact value of what pharma companies produce – and where – is an epic of detective work.

Treading a similar a path to the US

The evidence for systematic offshoring to Ireland becomes more compelling if the focus for research takes a leap across the Atlantic. The fact that US pharma manufacturing has suffered an almost identical trajectory to the UK in the past 15 years is entirely ignored among UK-centric industry analysis and policy recommendations. This is a pity. Comparison aids proper diagnosis, and it will also help to identify a cure that actually works.

According to an analysis published in 2020 by the Council for Foreign Relations,[72] US pharmaceuticals manufacturing peaked in 2006, and then carried on falling to 2014. Unlike in the UK, however, there has been no recovery. Production in January 2020 is reported still to be 20 per cent below the level reached 14 years earlier.[73] The scale of manufacturing decline in the US approximately matches the UK's experience and only slightly predates it. And as in the UK, there is a concomitant impact on overseas trade. Declining production triggered a deficit in the US' trade in pharmaceuticals, which grew from US€32 billion at the end of 2006 to $93 billion in 2020.

The Council for Foreign Relations report identifies tax as the principal factor in the decline of pharma manufacturing in the US. According to this analysis and others, Puerto Rico had become a pharma manufacturing hub by the early 2000s, but the removal of tax credits from that jurisdiction encouraged global pharma companies to relocate manufacturing facilities elsewhere – and not in the US. The driver for investment relocation was said to be a 'cocktail' of tax arrangements that allows global pharmaceuticals to move profits to those parts of the supply chain where their overall tax burden can be minimised.

Where the US differs from the UK is in the public acknowledgement and politicisation of offshoring. Divestment in US pharma manufacturing was a major issue in US trade politics from the start of the Trump Presidency. By 2017, commentators in the US were well aware that US-based pharma companies were shifting pharmaceuticals production to Ireland in order to take advantage of that country's 12.5 per cent corporation tax.[74] President Trump complained about the offshoring of US pharmaceuticals in the first weeks of his Presidency.[75] According to *The Irish Times*, Irish pharma exports to the US totalled €21.1 billion in 2019,[76] and Trump never stopped repeating his intention to re-route pharmaceutical supply chains back to the US – specifically from Ireland.[77]

This controversy is extraordinary, given what *didn't* happen in the UK during the same period. Offshoring in British pharmaceutical manufacturing was at its height in the run up to the 2016 referendum, when UK trade was under scrutiny. Yet, as a topic, it was entirely ignored by both sides. Fear of the potential for dislocation in UK trade seemed to blind analysts to the reality of what was

[72] Council on Foreign Relations, The Irish Shock to US Manufacturing?, Brad W Setser, May 2020. Link.
[73] Council on Foreign Relations, The Irish Shock to US Manufacturing?, Brad W Setser, May 2020. Link.
[74] Forbes, Trump Trade Policy and Manufacturing: The case of the Chemicals Industry, Thomas Deusterberg, Sept 2018. Link.
[75] Wall Street Journal: Trumps Criticism of Imports Adds to Drugmakers' Headaches. Link.
[76] The Irish Times. Irish pharma exports to US in Trump's sights, May 2020. Link.
[77] The Irish Times. Trump vows to bring Ireland's pharma production to US. May 2020. Link.

already happening. Trump identified a trend and said he wanted to do something about it. In the UK, however, no-one appeared to notice that a trend had actually set in

But what actually drives shifts in pharma manufacturing? Is it purely the ability to manufacture a drug more tax-efficiently in one country over another, or are companies winding the various parts of their pharma supply chains though optimal jurisdictions for other reasons as well? A forensic analysis by Reuters journalists in 2015 indicates that offshoring may be a more insidious practice than first appears.[78] After leafing through corporate filings in Europe and patent databases, journalists concluded that US-based Pfizer had been shifting profits generated by American scientists and sales to its subsidiary in Cork, Ireland. The drugs involved included the anti-cholesterol treatment, Lipitor, and the epilepsy drug, Lyrica.

The journalists asserted that:

> 'Pfizer licenses the rights to drugs developed in the United States and in other countries like Britain, to Pfizer Ireland Pharmaceuticals, according to accounts filed by the Dutch and Belgian parents of Pfizer's Irish units.'

The report noted that Pfizer maintains plants in the US, but that filings for overseas units:

> '…show non-U.S. companies supply over 80 percent of U.S. sales … those sales generate margins of around 40 percent for Pfizer's overseas arm – earning it over US$17 billion in 2013. However, Pfizer has reported losses on its U.S. business in each of the past five years.'

The implication is that offshoring in the pharmaceuticals industry has multiple aspects to it. First, the cause isn't essentially the draw of lower-cost labour or more efficient manufacturing. The opportunity is to be found in tax laws, including exemptions, that allow global companies to transfer pricing to different parts of their supply chains and book profits in jurisdictions that are most congenial to their balance sheets. If the assertions made in the Reuters article hold true, then the damage from offshoring isn't confined to lost manufacturing jobs, profits and exports. The damage extends to the profits from intellectual property being offshored, as well as tax revenue – some of which presumably funded research to begin with.

In other words, the fiscal and commercial *benefits* of pharmaceutical R&D that is executed in one jurisdiction are being smartly transferred to another.

The R&D conundrum

The issue of tax-driven pharma investment must be faced if the UK wants to return to top-league pharma manufacturing. And to do that, some basic assumptions should be examined.

Leading UK academic bodies, including The Royal Society, the British Academy, the Royal Academy of Engineering and the Academy of Medical Science, trumpet the political consensus for raising spending on R&D to 2.4 per cent of GDP by 2027.[79] But high R&D spending does not lead automatically to manufacturing or wealth generation or secure domestic supply. The US example indicates that the benefits of successful R&D are accruing to manufacturing in other jurisdictions – on a massive scale. The US' experience implies that countries that develop new treatments end up

[78] Reuters: How Pfizer has shifted U.S. profits overseas for years. Tom Bergin and Kevin Drawbagh. November 2015. Link.

[79] The Royal Society, the British Academy, the Royal Academy of Engineering, and the Academy of Medical Science. Investing in UK R&D, October 2020, updated January 2021. Link.

also having to import them – not because they are cheaper to make overseas, but because tax opportunities mean it's more profitable to manufacture them in other countries.

The UK is vulnerable to this trap. It's a fact little commented on that R&D into the UK's pharmaceutical industry peaked at 40 per cent of total manufacturing R&D expenditure in 2010.[80] This easily outstripped R&D in any other sector of UK industry — at the time and since. Yet 2010 was also the year that turnover and GVA peaked in UK pharmaceuticals manufacturing, before commencing a five-year dive. This half decade was precisely the period when ultra-high R&D spending *should* have delivered a manufacturing dividend. Turnover eventually recovered in 2019, but GVA still hasn't. Ten years later, the UK's pharma manufacturing industry is no more wealth-generating for the UK economy than it was in 2010.

Some hard thinking is necessary because pharmaceuticals is still the top recipient of R&D investment in UK manufacturing.[81] If GVA in the UK's pharma industry in 2019 was still below the level of 2010, then what exactly has high investment bought in the intervening period, except high-paid research jobs? Could it be that global pharma is exploiting high-spending R&D budgets in countries like the US and the UK, and then cashing in by shifting both the associated profits and the manufacturing to low tax jurisdictions like Ireland? The assertion requires patient investigation. But the fundamental point that Government needs to grasp is that R&D in a particular sector does not necessarily lead to increased manufacturing.[82]

Perhaps there are industries where increased R&D is directly linked to increased output, but pharmaceuticals is not one of them. This begs the question: is there something unique about the pharmaceuticals industry? In one aspect it is unusual: activity is concentrated in a small number of global companies. According to the industry body MakeUK, GVA in pharmaceuticals in the UK is concentrated in a very small number of companies, and that degree of concentration is only exceeded in the petroleum industry. This makes pharma a curious industry for the UK. It is dominated by a very small number of companies that are almost all huge global corporations. This means the opportunities for transfer pricing are greater than in other industries.

Perhaps it is pertinent to characterise pharmaceuticals companies as top-grade financial engineers with greater scope than most to exploit differences in tax regimes. One of the insights thrown up by the pandemic was the torturous trans-national supply chains that global pharma companies set up for themselves to manufacture vaccines. But no-one appeared to enquire why it was necessary for drug supply chains to wander across so many borders – though of course that does increase the scope for transfer pricing. Security of supply consideration means that in some medicines, the UK Government will want to straighten them out. It will be interesting to observe if there is pushback from global pharma, not least because straightened supply chains eliminate the scope for moving profitability across borders.

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[80] Make UK. Sector Bulletin. Pharmaceuticals. Page 14. Link.
[81] Make UK. Sector Bulletin. Pharmaceuticals. Page 14. Link.
[82] Nor is the macro-level evidence compelling. In a fascinating paper written for the Institute for Fiscal Studies in 2000 – specifically on R&D and its relationship to economic growth – the author noted that the UK had the lowest R&D intensity of the G5 countries at the start of the 21st century. Yet in the following two decades, UK GDP growth outstripped Japan by 1 ppts per year, and Germany and France by 0.5 ppts per year, according to World Bank data. Using OECD data, the author also reported that the UK had the highest rate of R&D to GDP among the G5 back in 1974. And if that's not a cautionary warning, then nothing is. The OECD reports that at the end of 2019, the level of R&D spending in the UK was below the average for both the OECD and the EU 27, as well as China, Japan, Korea and the US. But raising it in the expectation that this will lift UK growth is to work from assumption.

In any case, Ireland's history with pharma R&D is again instructive, in a cause-and-effect sense. That country's huge pharma industry progressed *from* manufacturing *into* research and *not the other way round*. Back in 2011, Ireland's pharma industry had enjoyed a rapid decade of growth, though from a relatively small start. Pharma's share of total manufacturing employment had jumped from 6.9 per cent in 1998 to 14.8 per cent in 2011. Up until that point, multinational corporations had invested very little in discovery and clinical trials, according to academic commentary at the time.[83] Science Foundation Ireland – the statutory body for funding basic and applied research in science – had nurtured a growing body of Irish scientists and pharma startups. But as of 2012, one academic reported that 'the number of startups that have brought drugs to the clinical trials stage is, as yet relatively small.'[84]

Writing in *Future Science* in 2012, academic Chris Van Egaraat suggested that 'one of the main challenges for the medium term will be to diversify from manufacturing activities into higher value-added R&D functions.'[85] This is exactly what the Irish pharmaceutical industry has done since. But that movement into R&D *followed* manufacturing success; it didn't trigger it.

So, what should the UK Government do?

The UK Government is already equipped with an industrial strategy for life sciences,[86] and all the usual calls for industry to work more closely with academia and for health services to partner in smart procurement. The challenge is that this is nothing new, globally. Virtually every other developed country wants to be a pharma powerhouse as well, and they all embrace much the same initiatives. In the wake of the pandemic, every major economy will seek to increase security of supply for vital medicines and pharmaceutical products. The problem for the UK is that it is fighting an adverse trend in pharmaceuticals manufacturing that is already a decade old.

The UK has some advantages. The Government is now investing specifically in pharmaceuticals manufacturing, not just R&D. The Vaccines Manufacturing Innovation Centre (VMIC)[87] at Harwell will become operational in early 2023, marking the moment the UK moves back into vaccines manufacturing. It will focus on the 'how' not the 'what' of pharmaceuticals production. For example, an initial £65 million from the industrial strategy fund was intended to help VMIC master the manufacturing aspects of pharmaceuticals, not the pure science. This could help UK companies to efficiently manufacture vaccines at a variety of scales and establish a competitive advantage. Ireland's example indicates this is a smart move.

Also relevant is the medicines manufacturing innovation centre (MMIC) in Scotland. This is a joint venture between the University of Strathclyde, UK Research & Innovation, Scottish Enterprise and founding industry partners, AstraZeneca and GSK, as well as the Centre for Process Innovation. Its aim is to ensure that 'the UK is a technology and innovation leader in pharmaceutical manufacturing.' Again, the timing is propitious. Specifically, it will explore new techniques for personalised medicine manufacturing, which threaten to up-end current pharma supply chains. These supply chains are tuned to produce tens of millions of identical products with no end-user

[83] Future Science: The State of the Irish Pharmaceuticals Industry. Chris Van Egeraat. 2012, Future Science: Future Med. Chem. (2012) 4(9), 1039–1041.
[84] Ibid. Page 1040. Link.
[85] Ibid. Page 1041.
[86] GOV.UK. Industrial Strategy Life Sciences Sectors Deal 2, 2018. Link.
[87] VMIC has been founded by three academic institutions, The University of Oxford, Imperial College and London School of Hygiene and Tropical Medicine.

differentiation whatsoever. So, the companies that master supply chains for personalised medicines will clearly shake up the industry.

This analysis should be a wake-up call. The UK can invest in institutes and centres, and pour money into R&D. But if it can't shift the investment calculus for global pharma so that it's more profitable to manufacture in the UK, then there's no reason why the current adverse trend should change. Dependence on overseas pharma supply will increase, and the profits from UK science will accrue on balance sheets in other jurisdictions.

It will all come down to tax

To reverse the current trend in pharmaceuticals manufacturing, the UK Government has no option other than to make it more profitable for global pharma to manufacture in the UK as compared to Ireland, and possibly Belgium and the Netherlands as well. Change that equation, and the investment will come back. Neglect it, and nothing will change, except overseas plants will reap the benefit of UK spending on R&D.

US-led attempts to introduce minimum, global corporate tax rates will likely have some effect. The Irish Government has now agreed to increases its rate from 12.5 per cent to 15 per cent. But since the UK is raising its own rate from 19 to 25 per cent, then the balance of advantage in favour of Ireland will actually increase. The tax disadvantage that currently impacts UK pharma manufacturing is heading in the wrong direction. And there is no guarantee that the other provisions of the global minimum corporate tax deal will escape the machinations of tax lawyers.

True, the UK already has a generous system of tax credits for research into pharmaceuticals, and this appears to be aiding small biopharmaceuticals.[88] But the UK's system of tax credits is not competitive against Ireland either. In an excellent recent analysis, 'Making the UK a Science Superpower'[89], author Steve Hughes relates how Pfizer recently selected Ireland over the UK for a pharmaceuticals investment precisely because the UK's R&D tax credit relief rate was almost half of the Ireland's 25 per cent, and because Ireland's tax credit system includes capital expenditure.

The first step is to closely analyse the successes and failures of Trump's attempts to drag pharmaceuticals manufacturing supply chains back to the US from countries that included China, Ireland and Singapore. This will be an ongoing endeavour. But the UK Government has no excuses not to learn from another country that has trodden a similar path. Initiatives from the Trump Presidency included:

- Mandating federal authorities to only buy critical medicines that were manufacturing in the US.[90]
- Streamlining approvals for US-made pharmaceuticals.[91]
- Sponsoring of new advanced manufacturing facilities in the US.[92]
- Changing taxation legislation to discourage offshoring activities, including, for example, the US' 2017 global intangibles low-taxed income (GILTI) laws, and other tax rebate provisions.

[88] European Pharmaceutical Review. What the world can learn from the UK's pharmaceutical industry. Dr Cheryl Teoh, October 2020.
[89] WPI Strategy. Making the UK a Science Superpower. Steve Hughes, February 2021.
[90] Reuters: Trump signs executive order to boost US drug manufacturing. August 2020. Link
[91] CNBC. Trump advisor Peter Navarro slams Big Pharma's lobbying against possible 'Buy America' executive order. March 2020. Link

[92] The Washington Post. Trump takes a first step toward returning medical supply chains to the U.S. July 2020. Link.

There is conflicting evidence on whether the Trump Presidency's policy succeeded. Some commentators reckon that Trump's tax policies actually encouraged global pharmaceuticals companies to continue offshoring.[93] But the Biden Administration has maintained many Trump-era policies that were framed to secure strategic manufacturing assets, so the US is still a case to watch. And the UK can exploit its second-mover advantage status. Because, for four years, the Trump Presidency trod that same path that the UK will have to tread if it wants to revive pharmaceutical manufacturing in the UK. There are clear lessons to learn about how to ensure that British enterprise and British taxpayers capitalise on their investment in pharmaceutical R&D.

The UK does have two cards to play in this battle that don't involve the Treasury foregoing tax revenue. The first is the issue of supply chain security. During the Covid-19 pandemic, the pharmaceuticals industry was adept at pointing out the highly complicated transnational supply chains on which drugs production depends. But pharmaceuticals companies have very good financial reasons for ensuring that supply chains cross as many borders as possible. Besides the opportunities for transfer pricing mentioned above, it also enables them to keep the pressure on tax jurisdictions to give them the best tax treatments possible.

Sadly, the EU has just handed the UK a big reason to unwind some of these long and egregious supply chains. The EU Commission's threat to prevent the supply of vaccines into the UK forces the Government to re-classify some pharmaceuticals manufacturing as a strategic industry. It has no choice. No future UK Government can risk the EU using drug supply as source of leverage in bilateral negotiations. The UK Government now has a duty of care to ensure that critical pharma supply chains are kept in the UK. And the Government is in a position of exceptional strength to make this happen. The public sector consumes 30 per cent of the UK's pharmaceuticals sector's output, either via the NHS or via over-the-counter services.[94] This gives the UK Government a giant's strength to force supply chains back into the UK.

The second asset is Northern Ireland. Under the terms of the Northern Ireland Protocol in the Withdrawal Agreement, the province remains subject to EU pharmaceutical and medical devices legislation.[95] This means that the MHRA is obliged to apply a different set of rules and standards in Northern Ireland as distinct to the rest of the UK. At the time of writing, implementation of controls on pharmaceuticals has been put on hold. But the fundamental problem of how to manage the Irish border for pharmaceutical goods cannot easily resolve itself. Regulation in the UK and EU will inevitably diverge. And drugs are readily smuggled, because they are small, non-perishable, expensive and easy to transport.

Northern Ireland's regulatory challenge can be turned into a manufacturing opportunity, however. Pharmaceuticals produced in Northern Ireland will, in the end, have seamless access to both markets because no other solution is politically enforceable. The UK Treasury could pile tax breaks into pharmaceutical investment and manufacturing in Northern Ireland *without* prejudicing its tax regime in the rest of the UK. And if the UK Treasury didn't want to change the tax regime of the whole of Northern Ireland, it could ensure that whatever freeport is set up in Northern Ireland caters

[93] The Economic Policy Institute. We can re-shore manufacturing jobs, but Trump hasn't done it. Robert E Scott, August 2020. Link.
[94] MakeUK, Pharmaceuticals. Page 4.
[95] Baker McKenzie. United Kingdom: Impact of the EU-UK Trade Cooperation Agreement and Northern Ireland Protocol on life sciences.

specifically to pharmaceuticals companies and includes a minimum corporation tax rate. If it did so, the pharmaceutical industry and its truly supple supply chains would be the very first to take notice. For them, investing in Northern Ireland would be a smart hedge against regulatory UK–EU spats. And where tax breaks go, pharma follows.

If the UK Government allowed Northern Ireland, or a Belfast freeport, to compete aggressively on tax – including corporation tax, R&D tax credits and capital expenditure – then the province could start to do to the Republic what the Republic has done to the UK over the past 20 years. And one huge advantage for Northern Ireland is that reservoir of pharmaceuticals skills and expertise that has mushroomed just across the border.

Chapter 3. Offshore Wind

The 2020s could see the UK could become a leading exporter in a whole new manufacturing sector – offshore wind turbines and associated equipment. The reason is scale. Currently, more offshore wind-generating capacity is being installed in the North Sea than anywhere else in the world, with the exception of China. And the UK is the prime installer.[96] What's more, UK leadership in offshore wind installation is set to continue up to 2030. The potential for leveraging that leadership into new manufacturing is vast.

The UK takes an unlikely lead in offshore renewables

The scale of the UK's global lead in offshore wind turbine installations is breath-taking. But the UK's industrial opportunity lies in the fact that this lead will likely be sustained for at least a decade. The UK currently accounts for 33 per cent of global offshore wind installation, with approximately 9.7 GW of installed capacity.[97] According to forecasts from the Global Wind Energy Council (GWEC), offshore wind installations are set to grow by 18.6 per cent p.a. to 2024, and 8.2 per cent p.a. to the end of the decade. In terms of installing new offshore capacity, the UK ranks second only to China.[98] This is giddy, global growth for any industry.

The UK's premier status as an offshore wind installer is underwritten by the development of two gigantic fields of wind farms: the four GW wind farm on the Hornsea Reef off Hull[99] and the Dogger Bank farm off Newcastle, currently projected to deliver 3.6 GW of power.[100] These two fields alone have encouraged the UK Government to increase capacity targets from 30 GW in 2030 to 40 GW. To meet those goals, investment will accelerate. According to estimates released by the UK's Offshore Wind Industry Council in March 2021, annual investment in UK offshore wind power will average £10.1 billion from 2021 to 2026.[101]

This sustained leadership is a gigantic opportunity for UK manufacturing for three reasons. First, the history of the wind power industry shows that manufacturing follows installation. Denmark began to invest heavily in wind power before any other major country, and today Vestas is the world's biggest turbine manufacturer. The other major manufacturers – Siemens-Gamesa and GE – have also grown on home territory as huge wind farms emerged in Northern Germany, Spain and the US in the early 2000s.

Second, UK manufacturing excels at becoming second and third tier suppliers. The UK doesn't need a rival turbine manufacturing brand to become a global export powerhouse. UK manufacturers could use the current decade to embed themselves as suppliers to the Big Three turbine makers. The UK aerospace industry shows how – and it's worth a minor digression. Aerospace was the UK's second-fastest growing export sector from 2000 to 2019, with a CAGR of 3.4 per cent.[102] Aside from a small number of military platforms and light planes, the UK doesn't make finished aircraft. But the UK is a prime supplier of wings (Airbus), engines (Airbus and Boeing), landing gear, avionics, seats, and literally thousands of sub-components. These suppliers have collectively propelled UK aerospace from fifth spot among UK export sectors in 2000 to second spot in 2019. In 2000, they supplied, 8.1

[96] Global Wind Energy Council, The Global Offshore Wind Report, 2020. Page 11. Link.
[97] Global Wind Energy Council, The Global Offshore Wind Report, 2020. Page 47. Link.
[98] Global Wind Energy Council, The Global Offshore Wind Report, 2020. Page 12. Link.
[99] 4 MW is the estimated capacity for the first three phases of this four-phase project.
[100] Dogger Bank Wind Farm. Link
[101] Offshore Wind Industry Council. Media Release, March 21, 2021. Link.
[102] Radford, Two Tests for UK Trade, 2000-2019.

per cent of UK manufacturing exports, in 2019, it was 12.7 per cent. Their prowess proves that UK engineers are adept at piggybacking onto Tier 1 global brands.

The third reason is that the UK Government has decided to leverage the UK's transient purchasing power into preferential treatment for domestic producers. This is a tricky act, as protectionism inevitably impacts turbine costs and installation rates. The US' first major offshore wind farm is already being jeopardised by Congressional attempts to force developers to create US jobs and use US steel.[103] For the moment, the UK Government appears to have adopted a softer approach, nudging targets for UK content in wind farms from 50 per cent to 60 per cent by 2030. This coincides with the period when the scale of UK investment is at its greatest, compared to the rest of the world.

And by 2030, the global export opportunity should be enormous. GWEC estimates that 205 GW of global capacity will be added over the coming decade, with three quarters added in the last five years of the decade.[104] By then, growth from North America and Asia is expected to outstrip Europe. UK engineers, therefore, have a one-off opportunity to embed themselves in the offshore wind power supply chain while the UK is at the forefront of innovation in a new industry. That's a heaven-sent opportunity to create durable competitive advantage.

The UK is already becoming a supplier of turbine parts

In terms of the wind-turbine structures themselves, UK manufacturing is more-or-less confined to the turbine blades. So far, no established 'big players' in UK industry have chosen to get involved. Rolls-Royce elected to put its energy into developing small modular nuclear reactors and checked out of the wind-power industry a decade ago. The only other potential contributor was electricity generator-maker, Converteam, which was once part of GEC. But this remnant has neither the scale nor the capacity for making the turbine generators or gears. Its energies are currently focused on naval power generators. Besides, its owner, GE, had already become a 'big three' supplier without the help of its recently acquired UK subsidiary.

Only approximately 24 per cent of the value of the offshore wind supply chain is delivered by the wind turbines themselves, but turbines are the principal manufacturing element. This means that the UK's contribution to manufacturing in the industry is currently only delivered via one of the three incumbent suppliers – MHI Vestas, Siemens-Gamesa and GE. Nevertheless, the pace of the North Sea installations is now tilting these companies' interests towards investing in Britain.

Table 3.1: Costs in the offshore wind supply chain

Costs in the offshore wind supply chain		Percentage of lifetime costs
Development		2%
Installation	Turbines	24%
	Balance of plant	20%
Operation and maintenance		40%
Decommissioning		2%

Source: *Offshore Wind Industry Council, Offshore Wind Industry Council Prospectus (Whitmarsh Prospectus), October 2018. Page 19. Link. For a detailed breakdown of all offshore wind farm lifecycle costs, see BVG Associates, Guide to an Offshore Windfarm, January 2019. Link.*

[103] Financial Times: Iberdola warns of 'protectionist' threat to US offshore wind sector. Link.
[104] Global Wind Energy Council (the Global Offshore Wind Report, 2020). Page 14. Link.

The main reason is scale. The size of the wind turbine structures themselves has grown dramatically in the last five years. The latest turbines to be installed on the Dogger Bank are twice the height of Salisbury Cathedral spire.[105] And as the blades have become longer, it has become more economical to build them closer to embarkation points.

Siemens-Gamesa built its first blade-manufacturing plant in Hull in 2016. It has churned out an average 300 blades per year since then. In August 2021, the company announced the facility would double in size, and thereby remain the UK's largest offshore wind turbine-manufacturing facility, employing 1,200 people.[106] In March 2021, GE announced its intention to open a new plant to build even larger 107-metre blades at an old steel works site in Teesside.[107] Meanwhile, the Isle of Wight has deftly transitioned from its marine and aerospace heritage as the base for MHI Vestas, which builds blades for windfarms in Scotland.

But 2021 has been a landmark year for other reasons. It marks the moment when the UK began to become a manufacturing base for turbine elements *other* than the blades themselves. In July, Korea's SeAH Holdings – a steel tube specialist – confirmed plans for one of the world's biggest monopile factories at Hull.[108] Monopiles are the steel tube foundation into which the turbine towers fit, and up until now the UK has been entirely dependent on imported monopiles. This will bring a new manufacturing capability into the UK. In August, Spain-based GRI Renewables said it would also start building the towers themselves in Hull.[109] Both factories will be built within the Able Marine Energy Park (AMEP) on the south side of the Humber. This 331-hectare site will eventually include almost a mile of deep-water quays to expedite the process for loading up the ships that go out into the North Sea and install the turbines.

It's not all about proximity, however: some of these investments result from financial inducements. AMEP is part of the new Humber freeport area. Siting the monopile and tower factories within AMEP is advantageous because they are basic structures made from steel. The UK opted to retain tariffs and quotas on most steel imports in June 2021, and so businesses within the freeport areas gain a national and European advantage because they can import steel tariff-free from the cheapest suppliers on global markets.[110] Cash also changed hands, including via the UK Government's £160 million Offshore Wind Manufacturing Investment Support scheme.

So long as these freeports are big enough (in terms of their physical footprint) and so long as the privileges are valuable enough (in terms of tax, tariffs, planning and employment) then these freeport hubs should help the UK Government achieve its 60 per cent target for UK content. But what are the chances that this new manufacturing industry will become an exporter?

Turning capability into competitive advantage

Turbine blades is the obvious starting point, since that's where UK manufacturing has already made the greatest progress. The UK has an in-built competitive advantage in making the blades because the UK is already a world leader in composite materials, partly through the aerospace industry and

[105] GE Press Release, GE announces Halidade-X, the world's most powerful wind turbine. March 2018. Link.
[106] Siemens Gamesa, Powering ahead in the UK: Siemens Gamesa to double offshore blade facility. August, 2021. Link.
[107] GE Press Release, GE Renewables energy plans to open new offshore wind bland manufacturing plant in Teeside, UK, March 2021. Link.
[108] Yorkshire Post: 750 jobs to be created as South Korean giant SeAH confirms opening of factory on the Humber.
[109] The Engineer. GRI Renewables set to build offshore wind turbine factory in Hull. August 2021. Link.
[110] Reuters: UK to extend quotas and tariffs on most steel imports. Link.

wing-making in particular. And if it makes economic sense to ship 35-metre A380 wings from Port Mostyn in North Wales to Toulouse, it should be economically feasible to ship longer but less-delicate turbine blades from Hull or Teesside to anywhere in Northwest Europe – so long as the cost advantage of English-made blades is wide enough. MHI Vestas already ships blades from the Isle of Wight to the Moray Firth.

Research into building more efficient blades is underway in the UK. Bristol University and the ORE industry catapult already collaborate, via the Wind Blade Research Hub.[111] This includes making wings more recyclable as well as more efficient. Hull University's Aura program supports research and innovation in offshore wind.[112] But as with the UK's pharmaceuticals sector, what matters is *who* exploits the intellectual property (IP) and *where*. To capitalise on UK scientific research into offshore wind, funding will need to secure and protect the resulting IP. If UK funding bodies are not diligent in securing the interests of taxpayers, then UK renewables science will suffer the same fate as US pharmaceutical science (see Chapter 2): that is, its profits will drift offshore, too.

Then there's productivity. UK industry will only become a major blade exporter if local factories progress swiftly from making blades efficiently to finding new methods for the mass-manufacture of ultra-large blades. Process innovation is what kept UK manufacturing competitive as the industrial revolution unfolded in the late eighteenth and nineteenth century. It's also where the UK lost out to gigantic German and American combines in the late nineteenth century, who took economies of scale to staggering new lengths. The UK is now well positioned for process innovation, because all three major competing manufacturers will make their respective brands' largest blades on English soil: Siemens on the Humber; GE on the Tees; MHI Vestas on the Isle of Wight. Factories will compete, innovations will be copied, innovators will jump ship. This is the ideal formula for process innovation. So, while the boom-times last – and demand is guaranteed – UK subsidies should be geared to devising blade-manufacturing and assembly processes that leapfrog those developed so far in Denmark, Germany and the US.

Besides the turbines themselves, other parts of the offshore wind supply chain provide the potential to develop competitive advantage. Power infrastructure is one. The UK already has a presence in this field. For example, JD Cables exports undersea power cables to Germany.[113] But the major opportunity is also the principal challenge that faces all countries that are transitioning to large scale renewable energy – intermittency.

The UK is, or will shortly become, the European leader in integrating highly variable wind power into its grid. The companies that pioneer large-scale, efficient power-storage solutions will have a global market waiting for them. This could result in vast export potential if UK funding and subsidies becomes adept at nurturing viable enterprises — and deftly exiting dud ones. The Singapore Government is proficient at seeding and supporting strategic enterprise and always has been, despite its status as an icon for free trade (see below). This is helpful. In Singapore, the UK Government has somewhere to turn to, to avoid basic mistakes in how to build strategic industries.

And then there's the hydrogen industry. The UK may become the first country in the world where it is viable to use wind power to produce 'green' hydrogen on an industrial scale. Devising, developing, deploying and exporting first-generation hydrogen technology should be within the UK's industrial grasp. This is a natural opportunity for skills and expertise within the UK's declining hydrocarbon

[111] Offshore Renewable Energy (ORE) Catapult, Wind Blades Research Hub. Link.
[112] The University of Hull: Offshore Wind. Link.
[113] Offshore Prospectus. Page 15.

industry, and the closely related chemicals industry on the Humber. What's more, the UK is also home to multiple oil and gas companies – and two global giants – who are already thinking about how to sustain dividends in a green economy.

On a practical level, the freeports on the UK's northeast coast could – if expanded – provide the physical space for commercial experiments in hydrogen production and power generation. They are also close to where the power from the Hornsea and Dogger farms will come onshore. And it is worth noting that the knock-on effects of green energy will rise through industry. Consumers are forcing transparency into industrial supply chains, and they will preference manufactured goods made from clean energy. For example, car batteries – which require huge amounts of energy to make – will inevitably command premium prices if made from clean energy. So will vehicles they are fitted into. Indeed, a new class of 'green' non-tariff barrier is inevitably in the making. This again puts the UK at a potentially huge competitive advantage in the second half of the 2020s. This is when energy from renewables should become markedly more abundant in the UK than in any other major economy in Europe.

Last, there's operations and maintenance (O&M) activities in the offshore wind industry. This is a far more lucrative domain than it appears. And it is potentially far more profitable than any other element in the wind power supply chain. According to the Offshore Wind Prospectus, O&M accounts for 40 per cent of the lifecycle costs of windfarms – as compared to 24 per cent from the turbines themselves. O&M covers multiple activities, from monitoring sensors and inspection robotics to subsea surveys. UK companies have already begun to re-orient existing expertise in offshore oil and gas into O&M activities for offshore wind farms. The UK's aerospace industry is ready-made to develop the drones that will be needed for turbine inspections.

UK industry has huge potential to become a dominant supplier in O&M engineering, technology and platforms. This is because the UK's giant windfarms will trigger the biggest demand for offshore wind O&M in Europe from 2025 onwards. And so, this sub-sector of the offshore wind industry could, potentially, be a gold mine for UK manufacturing as it pioneers many O&M activities for industrial-scale offshore windfarms. And to see how UK industry can best capitalise on the O&M opportunities, the UK Government should learn some lessons from the equivalent industry that emerged to service Australia's gigantic mining industry.

The success of Australian METS

The analogies between Australia's A$200 billion minerals and energy sector and the UK's burgeoning offshore wind industry are uncanny. Just as with the UK, Australia has a huge natural resource but is dependent on overseas enterprise, vehicles and equipment to exploit it. Almost all the heavy engineering used in Australia's gigantic mining industry is imported – from the mammoth trucks that ply the Pilbara iron ore mines of Western Australia, to the half-million tonne gas-processing vessels off Perth. Like UK's offshore wind – at the moment – the industry is dependent on huge levels of foreign investment, and imports of engineering systems and vehicles.

But what Australia has done brilliantly is to nurture prowess in the smart end of mining engineering and technology – a sector locally called mining engineering, technology and services sector (METS). METS is very fast-growing, and it has made Australian mining exceptionally efficient. GVA in METS more than doubled from 2005/6 to reach A$92 billion (£49 billion) per year by 2017/18.[114] Australia's METS exports alone were worth A$27 billion in 2019 (£14 billion), or the equivalent of the

[114] METS Ignited. Sector Demographics Report, 2019. Page 4. Link.

UK's seventh-largest manufacturing export industry. Adjusting for population size, this is the equivalent of the UK's aerospace exports, which is the UK's second-biggest industrial export sector.

Australia's METS shares some of the competitive advantages of successful UK export industries. It is technology intensive and dependent on high levels of R&D. Like the suppliers to UK's offshore wind industry, Australian METS is co-located – often in clusters – with a massive industry that has to stay competitive to survive. It is also highly granulated. There are approximately 90,000 Australian businesses involved in METS, with 6,700 generating revenues above A$2 million per year. And these small companies are outward looking. According to CEO of Austmine, Gibbs Stewart, 66 per cent of Australian METS companies are exporters.[115]

It's this last characteristic that should trigger an alert for British trade policy. In his 2020 publication, *Britain's Export Boom,*[116] Marcus Gibson identified how SMEs were developing world-leading expertise especially in aerospace, auto engineering, biotech and fintech. *Lessons learned* uncovered the same trait via research into trade databases and the ONS' annual business report. For whatever reasons, small businesses are becoming big exporters. Perhaps British entrepreneurs are more at home in small-scale enterprise. In any case, the world is moving their way. Today's unicorn companies exist not because they've mastered gigantic economy-of-scale processes, but because they've figured how to turn an innovation into a commercially viable product and go global before competitors. Agility is beating scale as a source of competitive advantage in emerging industries.

Australian METS is showing just how this happens. Thousands of METS companies are now global exporters in the application of advanced technologies to multiple aspects of mining. These specialisations include mining-specific applications of machine learning, autonomous systems, robotics and artificial intelligence. For example, Caterpillar dump trucks have always ploughed up and down vast mine sites in Western Australia. Now they do it without drivers – thanks to indigenous METS systems. This combination of SMEs, advanced technology and export success is a golden template for Global Britain if it wants to translate leadership in offshore wind installation into new export industries.

Lessons learned from Australian METS

So how can the UK emulate the export success of Australian METS? The first step is the supply chain for skills. Recent comments by the Chief Executive of METS Ignited, the industry association, make the point simply: 'To maintain our global leadership position, we must focus on attracting and developing the future skills of our technology sector, *particularly in regional communities*.'[117]

Australian education and skills training has a natural edge over the UK in terms of technical training. Like universities in South Africa, Australian universities were established for the practical purpose of creating the skills to develop an industrial economy, more or less from scratch. That was their impetus, and they have always been far more vocationally oriented as compared to British universities. Australian universities churn out qualified engineers and agriculturalists because that's what they have always done, and collaboration with industry is natural. Australian universities are attuned to solving challenges in domestic mining and local agriculture.

This is a symbiotic process. For example, the Australian Centre for Field Robotics at the University of Sydney is now one of the largest robotics centres in the world, precisely because of its links with agriculture and mining. Specifically, the Rio Tinto Centre for Mine Automation is part of the

[115] Australian Mining: METS export hubs to drive regional economic growth.
[116] Civitas: Britain's Export Boom and how to encourage it. Marcus Gibson, May 2020
[117] METS Ignited. Sector Competitiveness Plan, 2020. Page 5. Link.

University of Sydney's faculty of engineering.[118] Interesting academic models have emerged. A single academic school – Mining Education Australia – now spans four universities in Western Australia, South Australia, New South Wales, and Queensland. This trans-university school is directly supported by the mining industry and provides vacation placements.[119] Its scale is impressive. The school turns out approximately 855 mining graduates per year. And industry–education tie-ups extend into vocation skills training. Rio Tinto partnered with vocational colleges in Western Australia to offer the first nationally recognised certificates in automation.

British universities are making headway. The Aura collaboration within the University of Hull is building an innovation centre.[120] And Ignite's equivalent in the UK – ORE Catapult – has a remit that extends to foster industry clusters, help regional skills development and aid commercialisation.

But if the UK is to take decisive leadership in developing the O&M technologies that will make the future offshore wind industry efficient – and to create and retain intellectual property – then the best university engineering departments in the country need to take an interest. They will need to be incentivised to work directly with the offshore wind industry. Government education funding should be directed to creating an equivalent school to Mining Education Australia, only in offshore wind power. This will be less difficult than might appear. First, the Warwick Manufacturing Group (WMG) has proved how successful the academic-industrial model can be, if it's led by committed industrialists.[121] And second, the timing is propitious. Today, it's highly fashionable to pursue a career in renewable energy. Britain's top universities should take notice.

Freeports and subsidies

The second opportunity is to evolve freeports specifically to promote the interests of small enterprises. Some of the factors that will increase the competitiveness of businesses operating in freeports will accrue just as much to small businesses as to large ones – especially in terms of the relief from National Insurance that will apply from April 2022.[122] If the physical footprints of the freeport areas on the Humber and the Tees were expanded – and provision made for scores of SMEs to relocate – then the freeport policy would have the best possible chance of nurturing small business. The goal should be that, by 2030, these SMEs are sufficiently established that GE, Siemens-Gamesa and MHI Vestas will permanently absorb them into their global supply chains. They would also be the natural homes for the O&M services companies as they gear up throughout the 2020s.

Then there's subsidies. Given that industrial subsidies are an inescapable fact of international political economy – especially in those UK industries that are high performers – then British policy makers will have to finesse its game. Historically, UK Governments have been dreadful at picking winners. And they weren't helped by UK companies taking to subsidies like the proverbial bottle. But realistically, there is no point in the UK Government blowing hot and cold on offshore wind subsidies. If it's going to use taxpayers' cash to create a new industry, then that is a long-term investment. The challenge is how to ensure the subsidies encourage global competitive advantage, not short-term dependency.

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[118] Rio Tinto Centre for Mine Engineering. Link.
[119] Mining Education Australia. Link.
[120] https://www.hull.ac.uk/special/offshore-wind
[121] In this case, the late Kumar Bhattacharyya.
[122] From 6 April 2022, employers operating in a freeport tax site will pay zero percent Class 1 employer's NIC in relation to newly created jobs with salaries up to £25,000 per annum. KPMG: Freeport National Insurance Contribution relief, May 2021. Link.

As above, the best policy may be to focus it on small businesses and commercialisation. The big players – MHI Vestas, Siemens-Gamesa and GE – are now figuratively on board and should be left to look after themselves (even if their margins are perilously thin) If demand alone isn't sufficient to keep their blade manufacturing in the UK, then something is deeply wrong anyway. For small-scale suppliers, the technology world should serve as a model for how funding is channelled. Accelerator programs have proved adept at helping tech start-ups take concepts to market. And San Francisco-style venture capital rounds could help bring investors and technology companies together once the northeast clusters are in full swing – say in two years' time.

As for subsidies themselves, small-scale programs that disburse one-off grants to hundreds of businesses is inherently less risky than channelling large bundles of money into a few big players with a high dependency risk who become aggressive at the first hint their cash is to be withdrawn. And if the UK can't build the industries it wants without subsidisation, then it can at least learn from the global masters. Free trade Singapore has always backed specific industries, and its economy today thrives off industries that were chosen for strategic reasons – including marketing, pharmaceuticals and aviation. One tactic in Singapore was never to continue a subsidy unless the recipient very quickly proved its ability to compete. This harshness has served the city state well.

In one way, at least, the UK is blessed. The supply industry for offshore wind farms is shaping up as a twin-centre industry: on the Humber and on the Tyne/Wear/Tees. This means the UK can stoke competition between the two, including for subsidies. And the UK should cultivate intense competition. Rivalry appears more effective as a trigger for improving performance in the UK than the esteem of a national champion. Rolls-Royce and Bentley are the perfect modern example (see Chapter 1). Perhaps it's a cultural phenomenon: Cambridge would never have become Cambridge without Oxford.

Scotland's floating wind opportunity

Last, there's a sub-industry to offshore wind that could just be the remaking of industrial Scotland or Northern Ireland: floating wind. This involves building a floating structure for the wind turbine and anchoring it in waters that are too deep for traditional wind turbines. This is probably the UK's greatest export opportunity in renewable energy because the UK has already become a leader in devising the technology. This lead is diminishing as other countries, especially South Korea, move faster into large-scale installation. But if the UK can capitalise on its first-mover advantage, then there's a definite prosect that by 2030, bystanders along the lower Clyde, in the Moray Firth and along Belfast docks might witness a regular procession of huge floating rigs with towering, semi-erect turbines on their way to distant waters.

By any measure, the market opportunity is gigantic for whoever can engineer wind power from deep waters at competitive prices. The GWEC estimates that floating wind will 'come of age' in the 2020s, 'tripling the technical potential for offshore wind across the world.'[123] The Council projects that the countries with the biggest initial opportunities will be France, Japan, Korea, Scotland, Norway, Portugal and Spain – simply because those are the countries that want renewable energy but whose coasts aren't shallow.

The world's first floating wind farm – Equinor's Hywind Scotland pilot – has been generating since 2017.[124] It's located off Peterhead and has consistently demonstrated a high-capacity factor – 57 per

[123] GWEC: Global Offshore Wind Report, 2020. Link.
[124] Equinor: what we do. Link

cent as against a UK offshore average of around 40 per cent.[125] The Scottish Government is clearly confident in the technology. This is despite the fact the projected long-term cost of ownership (LCoE) for floating wind platforms trails the LCoE of fixed offshore platform by a considerable margin. In other words, the day when floating wind platforms deliver energy at a genuinely competitive cost remains some years behind the trajectory currently being traced by fixed offshore wind platforms. The current ScotWind leasing round run by the Scottish Crown Estate was set to auction rights to approximately 7.2 GW of offshore wind power. In January 2021, it announced 25GW of auctioned rights,[126] and 14.6GW of that total was for floating wind. This is a far higher proportion than anything proposed in the rest of the UK.

Scotland's leadership has an added twist. Floating wind platforms are inherently more exportable than fixed turbines because they can be assembled at one yard and simply towed to their final destination. To put them in place they require old fashioned tugs, not vastly complex installation vessels – or the quay-juggling that takes place as these vessels are loaded up with the pre-assembled parts. Floating turbines could also, ultimately, become far larger.

The opportunity for Scotland and Northern Ireland is that the infrastructure required to build the floating element of floating wind turbines is more akin to the steel-welding activities associated with shipbuilding or the construction of oil rigs. Most current designs involve tri-form floating rigs, the construction of which is inherently welding intensive. This contrasts with the steel rolling required to create monopiles, which will only arrive in the UK when the SeAH factory commences production at the AMEP site near Hull in 2023.

The capacity for creating a production line for floating turbine platforms is obvious enough. A recent report examined prospects: the *Scottish Offshore Wind Strategic Investment Assessment,* which was prepared for the Scottish Offshore Wind Energy Council in August 2021.[127] It suggests two sites in the Cromarty Firth as suitable: the old Invergordon site, where Britain's last battleships were dismantled in the 1950s; and Nigg, which was a huge fabrication yard for North Sea rigs during the oil boom. To date, however, Northern Ireland has been sharper in getting into business. One of the few activities observable at Harland and Wolff in recent years has been the assembly of deep-water jackets, which are the frames sometimes used by fixed turbines in relatively deep waters.

The *Strategic Investment Assessment* report is vocal on prospects. Its proposals mirror the initiatives underway across the border: creating clusters; extending port capacity to enable fabrication; and encouraging ports to become the sorts of places to attract manufacturing. Freeports aren't mentioned, but then the base tax incentives that underpin freeports do not lie within the purview of the Scottish Government. At the time of writing, negotiations between Edinburgh and London on the creation of a Scottish freeport have broken down, which may result in just one site gaining clearance from the UK Treasury. Without collateral support from the Scottish Government in terms of planning, this Scottish freeport will be less potent commercially than its English equivalents.

But realistically, the challenges facing Scotland and Northern Ireland are commercial. The industry will only take off with the confident expectation of business. Yet over the past decade, Scotland has acquired a reputation for cancelling offshore wind projects.[128] As the *Strategic Investment Assessment* makes clear, the actual completion rate for offshore projects in 2020 was below the

[125] reNEWS.BIZ: Hywind Scotland Capacity Factor hits 57%. March 2021. Link.
[126] The Scottish Government: Offshore Wind Development. 17 January 2022. Link.
[127] The Scottish Offshore Wind Energy Council: Scottish Offshore Wind Strategic Investment Assessment Link.
[128] Scottish Offshore Strategic Wind Investment Assessment, August 2021. Page 17. Link.

worst-case scenario forecasts made back in 2010. And as the report dolefully explains, 'Not enough thought was given to how to increase the competitiveness of the Scottish supply chain.'[129]

The report's other recommendations match what every other country is trying to do. Consequently, it is hard to see where Scotland's competitive advantage in building floating wind turbines is supposed to come from. One recommendation is '*selling the success of Scottish engineering*'. Whilst Scottish prowess in offshore-oil related engineering is undeniable, this was not essentially an export industry, and it isn't going to create a major new manufacturing industry. What's more, selling Scotland as a centre for maritime engineering when the country's last non-naval shipbuilder has just lurched into public ownership – unable even to build ferries – is a gigantic warning sticker on the bow of every bid for inward investment in Scotland.

So, what to do?

As with the UK's other export-oriented enterprises, there is one central challenge that has to be faced or no amount of good intentions will suffice. For cars, it's subsidies. For pharma, it's tax. In this case, it's skills. Governments in Scotland and Northern Ireland have to face the brutal fact that to build a competitive manufacturing centre for the new floating wind industry, they need to attract world-class maritime engineering capabilities that are also capable of mass production. These capabilities do not exist in Scotland or Northern Ireland today. They died with commercial shipbuilding. If Scotland or Northern Ireland want to nurture manufacturing exports from floating wind, they will need to attract the foremost maritime engineering skills back to their shores. And those skills will have to be crafted into highly efficient workforces. Without those skills, all initiatives will eventually flounder. This is because the resulting enterprises will never be competitive.

As with shipbuilding, the answer lies with Korean and Japanese heavy engineering companies that are simultaneously shipbuilding companies. These companies combine maritime engineering prowess with the ability to mass-produce. They are already making headway in renewables. For example, Korean shipyards are already exporting turbine jackets to Taiwan.[130] Meanwhile, the Korean energy industry is now moving decisively into floating offshore, with a project organised by the port city of Ulsan. By 2030, Korea will probably be the Asian leader in floating wind.[131] It's worth noting that both countries are high-wage economies. And it's no more unlikely that the skills and management techniques exist in Korea to create a globally competitive floating wind-engineering industry than the equivalent should exist in Germany as the foundation of that country's car industry.

And from one brute fact to another. The only thing that will lure those heavy engineering companies to Scotland or Northern Ireland is the confident expectation of significant profit. Freeports are the only realistic vehicle for foreign direct investment (FDI), given the current absence of foreign direct investment (FDI) in maritime engineering in either Scotland or Northern Ireland. Only freeports offer demission from the multiple commercial factors that currently make both Scotland and Northern Ireland an unpalatable prospect for investment in heavy engineering. And whatever cocktail of inducements is made available in English freeports, Scottish and Irish freeports will have to offer *more* because the level of political risk is higher.

There are clear opportunities in Scotland, since the February 2022 announcement[132] inviting bids for freeports clearly mandates the creation of green jobs. It also requires bids to contribute to net zero.

[129] Scottish Offshore Strategic Wind Investment Assessment, August 2021. Page 20. Link.
[130] GWEC. Page 64.
[131] GWEC. Page 64-65.
[132] The Scottish Government: Deal Agreed to establish Green Freeports. February 2022. Link

But for Scotland to attract the engineering expertise needed to become a floating wind-manufacturing powerhouse, then the Scottish Government must be open to creative ideas on terms of employment. The challenge is – roughly – quantifiable. In 2019, making jackets for wind turbines in the UK was estimated to be 10–15 per cent more expensive relative to other countries, such as the UAE and Indonesia.[133] To attract an optimal engineering investor, this gap will have to be eliminated, then turned on its head. And given that metal fabrication and welding is an inherently labour-intensive task, this means that success hinges on the prospects for investors to create highly efficient workforces. Without that, they won't touch it. Why would they? Apprenticeship programs may bridge the gap, but holding fast to traditional shipyard labour contracts will ensure the opportunity passes Scotland by.

As described in Chapter 1, the freeport model is capable of almost infinite variation and could be tuned to help create high-skilled marine engineering workforces. There is no reason why Green Freeports in Scotland or freeport enclaves in Northern Ireland could not be taken to a far deeper level in terms of self-regulation, labour contracts and freedom from taxation. As was the case in Sunderland in 1984, applicants will accept unconventional workplace relations if an employer appears a healthy long-term prospect. And neither devolved Government has much doctrinal capital to lose within the tight confines of a freeport. The freeports could not derange local labour markets because there is almost no marine engineering industry left in either country – save naval yards. And even if vibrant enterprises in freeports started to derange labour markets within their own hinterland, that would be a problem of success, of the sort that ministers should relish.

So, if Scotland or Northern Ireland seriously intends to create a manufacturing industry to deliver floating offshore turbines, then radical freeports within defunct shipyards offer the only viable vehicle. Successful enterprises will need the commercial and engineering skills of companies like DSME and HHI from Korea, or MHI, Mitsui and Japan Marine Ltd. Without those skills, the resulting enterprise will never be globally competitive. What's more, it is safe to assume that those companies will be looking for bases in Europe to replicate their incipient success in Asian water. Yet those Japanese and Korean companies will only invest on a colossal scale if they are confident of commercial success. For that they will need as much control over their operations as the Governments of Scotland and Northern Ireland dare give them. It's just a question of how keenly those devolved governments want to rebuild their maritime engineering industries.

The Falklands Factor

If UK industry can up its contribution to the wind turbine supply chain and master floating wind technologies, then a gigantic export opportunity sits on the horizon. The Falklands Islands have attempted to develop their hydrocarbon resources for over a decade – thus far with limited success. But the archipelago also has abundant wind resources. According to multiple sources,[134] it is one of the few places in the world with average wind speeds over approximately 10 metres per second. Most of the land surface of the islands is uninhabited. West Falklands covers an area of 4,532 square kilometres (km^2) and has a population of just 200. Lafonia, the sparsely populated southern peninsular of East Falkland, covers a further 2,400 km^2. Together these areas cover precisely the same area as the recent ScotWind auction. Using industry estimates from that auction – which includes calculations from the latest generation of turbines – the theoretical generating capacity for that 7,000km^2 area is equivalent to just over one-third of the UK's *entire,* current power-generating

[133] UK ORE Renewable Energy Catapult. OSW Foundations Strategic Capability Assessment. Link.
[134] Global Wind Atlas. Link

capacity (from all sources). And unlike Scotland's offshore breeze, Falklands' onshore wind is easier to harvest.

The wind-harvesting potential of the Falklands scarcely mattered while the energy could not be stored or transported. But here again, offshore wind technology is changing the commercial calculus. Germany's AquaVentus Project aims to use offshore wind turbines to produce hydrogen[135] by developing Heligoland Island in the North Sea into a hydrogen-production hub. Electrolysing machinery on the platforms of approximately 800 turbines would create the hydrogen from seawater, which would then be piped to Heligoland Island for consolidation, and shipment/piping to mainland Germany. The veteran renewables developer, RWE, reckons that 10GW of offshore wind capacity should be sufficient to generate 1 million tons of green hydrogen. The process would be simpler in the Falklands, because hydrogen production could take place at centralised hubs. Apart from that, the wind-to-hydrogen-via-an-island-energy-hub concept is almost at the demonstration phase.

The AquaVentus project is a perfect pathfinder project for examining potential. Within two years, the Germany North Sea project should establish some of the principal costs involved. This includes the cost of generating hydrogen from offshore wind turbines, and of piping the hydrogen to a central facility. Meanwhile, the transportation piece of the Falklands cost-estimating puzzle is also falling into place. In January 2022, the world's first liquid hydrogen carrier set sail from Melbourne bound for Japan with a full cargo.[136] The shipment is part of a A$500 million coal-to-hydrogen project that will test the commercial viability of producing hydrogen in Australia – ultimately from renewable sources – and shipping it to industrial customers in Japan. And it's worth noting that the distances involved are already large. Melbourne is 4,913 nautical miles from Tokyo. This is almost 60 per cent of the distance from the Falklands to Southampton.

Building infrastructure in the Falkland Islands would be costly. But the international airport is already there (RAF Mount Pleasant), and a new deep-water port has just begun construction in Stanley to service the putative hydro-carbon industry.[137]

These various and timely projects mean that the commercial potential for industrial-scale renewables energy production in the Falklands should rapidly become clear. But what should excite interest is the sheer scale of the opportunity. Unlike the North Sea, there is no obvious upper limit to the power-generating capacity of wind resources from UK territories in the South Atlantic. The sparsely populated land masses on the Falklands outside of the main part of East Falkland alone amount to approximately 7,000 km^2, or 25GW of capacity on crude estimates. Fixed turbines on and around the offshore islands of the Falklands archipelago might increase this capacity by half again. Then there's floating wind. The Falklands Islands sit within a 200-mile radius exclusive economic zone (EEZ). This is an enormous 550,000 km^2 area, itself more than two-thirds the size of UK's *total* EEZ. This, too, is a high-wind area as low-pressure systems whistle round Cape Horn. And the EEZ around South Georgia and its south-eastern dependencies is almost three times as big again, and these territories sit deep in southerly latitudes, beyond 54 degrees. In short, the total wind-harvesting acreage on and around UK territories in the South Atlantic exceeds that of the UK itself many times over.

[135] RWE: AquaVentus. Link
[136] Reuters: World's first hydrogen tanker to ship test cargo to Japan from Australia. January 21, 2022. Link.
[137] World Maritime News, published by Offshore Energy: Falkland Islands to new port in Stanley Harbour. February 2020. Link.

Job creation is hard to estimate because the offshore installation industry is becoming rapidly more efficient. What's more, it's in the UK's commercial interest to pioneer efficiency gains during the 2020s and established global competitive advantage. That way, offshore turbine installation could become an export industry of its own. Nevertheless, a rough estimate is possible from today's mega-projects. Perth-based energy company, SSE – which is one of the principal owner/developers of the Dogger Bank Wind Farm – reckons that all three stages of the 3.5GW Dogger project will, on current estimates, create approximately 3,000 UK jobs in terms of delivery and operation.[138] On the gross assumption that the additional labour required to transport and erect turbines in the Falklands balances the comparative ease of erecting within an archipelago, then the putative, labour-creating value of 25GW of Falklands wind would be 21,400 UK jobs. And that's before UK companies increase their share of the offshore wind supply chain – as they inevitably will.

The calculations presented here are rough deductions from publicly available sources. But the economic potential for Falkland Islands renewables will become ever more attractive as technologies mature. Developing the first 5–10 GW of power would be fairly straightforward since those turbines would be sited on land. The more expensive installations – on offshore islands, in shallow waters and finally in deep waters – would only commence as South Atlantic construction supply chains develop. Hydrogen production could be stepped up in line with predictable generating capacity. In 10 years, the Falklands could be shipping hydrogen to major hubs in South America and Southeast Asia. The islands would finally achieve their dream of becoming an energy exporter. If UK industry maximises its opportunities in the North Sea in the next five years, then it could find a huge export opportunity in the South Atlantic.

[138] SSE Renewables: Hundreds more green jobs created by Dogger Bank wind farm. May 2021. Link.

Conclusions

For the first time in almost five decades, UK governments can develop export policies using all the levers of trade policy available to an independent country. But it is only by examining what other countries do to support and grow exports that the UK can avoid making beginner mistakes and wasting time. The briefest benchmarking exercise of UK policy in multiple sectors shows that most developed countries follow strategies that are similar to those that the UK is tentatively embracing: targeted R&D, business clusters, skills training, enterprise zones and industry-academic collaboration. What's lacking in the UK is decisive action that will change the investment calculus for companies that generate strategically important exports.

To succeed, the UK will need to face hard facts. The first is that Global Britain is not emerging into a global trading environment that is naturally conducive to free trade. In some industries – especially the car and shipbuilding industries – subsidies distort competition to a gigantic extent. As reported in previous papers, the German Government spent €115 billion subsidising its car industry in the decade to 2017, according to Handelsblatt.[139] And since the onset of the pandemic, EU Governments have spent hundreds of billions of Euros supporting their industries. What this means is that even with our most competitive enterprises, UK trade policy and industrial strategy will have to adjust to global realities. Otherwise, our competitive industries will continue to lose investment to offshore enterprises, where subsidies are more easily solicited. In hindsight, this is what happened in the last decade of the UK's EU membership. But now, there's no excuse.

The auto industry will serve as an example. This is because expecting car manufacturing to stay in the UK without either protection, support or non-tariff barriers is naïve. The comparative performance of UK exports of motor-vehicles in EU markets from 2000–2019 was easily the worst of any major UK exporting sector, as revealed in *Two Tests for UK Trade.* This shows the impact that heavily subsidised overseas industries directly have on UK manufacturing. The price paid by UK trade reached £29 billion in 2019. This is the UK–EU deficit in autos, and it's easily the worst sectoral deficit in the UK's manufacturing repertoire. If the UK wants to keep the globally successful part of its auto industry (see Chapter 1) then it has to make hard choices and fight overseas subsidies. Trade deals won't be enough – even for profitable business.

Some UK manufacturing sectors have shown that they are globally competitive over the past two decades. Yet each confronts a threat in global or non-EU trade. For the UK, these top performers are: the auto industry (growing by 6.3 per cent p.a. in non-EU markets from 2000–2019); aerospace (3.6 per cent p.a.); pharmaceuticals (5.3 per cent p.a.); food products (four per cent p.a.); and beverages (3.7 per cent p.a.). All of these sectors managed non-EU growth rates at least one ppts faster than the 2.3 per cent p.a. average growth rate for UK manufacturing exports in non-EU markets during the 2000–2019 period. And in all of them bar food products, the UK now sells more goods outside the EU than in it. Yet each has challenges: cars, from subsidies; aerospace from the pandemic and drop in air travel; pharmaceuticals from differential tax systems; and food products and beverages from excessive tariff rates.

Other hard facts relate to R&D and IP. The evidence from trade and manufacturing data shows that there is no neat, sequential link between R&D and manufacturing success – and especially not in UK pharmaceuticals. There is no point in the UK Government ploughing money into R&D expecting that it will deliver value-add manufacturing afterwards. It won't, unless the UK takes steps to ensure the

[139] Handelsblatt, Germany's pampered car industry. May 2017. Link.

IP stays in the hands of companies who reckon they will maximise profits by exploiting that IP in the UK. The painful trajectory of the US pharmaceutical industry from 2005 onwards shows how rapidly drug discovery in one country leads straight to manufacturing profits in another (see Chapter 2).

These challenges will have to be faced, or the motors of UK export growth over the past two decades will be threatened and opportunities won't be seized. Self-sufficiency will decline, and the UK will become even more dependent on overseas manufacturers for strategically important goods. To succeed, the UK does not have to pick winners. The five sectors mentioned above demonstrated their ability to out-perform in global markets from 2000–2019, even while UK trade policy was determined primarily by the EU. All the UK has to do is to ensure that the discriminatory policies of other nations do not compromise competitiveness and investment in successful British industries. Radical freeports that include tax incentives provide one vehicle to ensure they don't. Freeports could also be used to pilot the sorts of radical deregulation that Brexiteers wanted, but which has so far proved difficult to deliver.

Drugs and tax

Chapter 2 showed a prime example of how competitive UK manufacturing can still get hammered. Ireland's taxation regime discriminates against UK pharmaceutical manufacturing by swerving investment by global companies – including Pfizer – from the UK to the Republic. In doing so, it has helped arrest the growth of what was the UK's fastest growing export industry up until 2010. Attitudes have changed, however. Pharmaceuticals is now a strategic industry. The pandemic shows that security of supply is something for the NHS to worry about. But the UK is fighting an adverse trend that set in a decade ago. By the end of 2019, GVA in UK pharma manufacturing was still below the level reached in 2010.

Nothing substantive will change in UK pharma manufacturing and trade unless UK governments address the tax discrepancy, because tax issues appear to be the decisive factor in how global pharmaceuticals companies arrange their manufacturing supply chains. At the time of writing, Ireland had agreed to raise its base corporate taxation rate from 12.5 per cent to 15 per cent. But the UK–Republic differential is set to widen as the UK raises its rate from 19 per cent to 25 per cent. Fortunately for UK analysts, pharma manufacturing in the US has suffered a similar fate and for identical reasons. So, the diagnosis is not in doubt. Nor is the cure: one way or the other, the UK Government will have to make it more tax-efficient for global pharma to manufacture in the UK as compared to Ireland, the Netherlands or Belgium, and that includes tax rebates for R&D and capital spending.

Clearly, the UK Treasury's ability to reduce general corporate taxation will be limited for the foreseeable future. One solution, therefore, is to combine the advantages of freeports with the special status of Northern Ireland. The UK Treasury could create the conditions – within a special freeport jurisdiction in Northern Ireland – whereby global pharma could invest in pharma manufacturing with tax liabilities significantly below those pertaining in the rest of the UK and the Irish Republic. A freeport in Northern Ireland that permitted a minimum rate of corporate taxation for onsite businesses would not prejudice the UK's 25 per cent future corporate tax rate. And a freeport could also provide tax credits that made Ulster-based pharma manufacturing competitive with the Republic. Meanwhile, the relevant skills to build such an industry already exist just over the border. The resulting pharmaceuticals goods would gain seamless access to both UK and EU markets for the foreseeable future – simply because neither British nor Irish governments have the political will to impose the type of border that would impede the free flow of pharmaceuticals.

Skills and shipbuilding

Shipbuilding is also – now – a strategic industry for the UK. A decisive pivot towards maritime power means that for the coming decades, the Royal Navy is going to be the country's primary ally-winning tool in its security diplomacy. The Prime Minister has already hailed a 'renaissance' in UK shipbuilding. But UK shipbuilding is so uncompetitive it has not built a single ship for export of over 5,000 tonnes for more than two decades – for either civil or military customers.

Again, patterns in UK trade from the last 20 years provide valuable insights. In Bentley and Rolls-Royce Motor Cars, German car companies revived moribund British brands, created highly skilled UK workforces, and powered up exports now worth approximately £3 billion per year. German engineering is pre-eminent in the auto sector; Japanese and Korean engineering is pre-eminent in the shipbuilding sector. So, the solution is obvious: induce successful Japanese and Korean shipbuilders to take over moribund British shipyards. History shows what can be done. Honda, Toyota and Nissan built highly skilled workforces in UK car plants from the late 1980s onwards that became benchmarks for productivity by the late 1990s. Daewoo, HHI, MHI and Japan Marine Limited could do the same. The challenge is creating an investment opportunity that is sufficiently enticing.

The solution lies in a combination of the UK's current naval order book and freeports. By turning some of our remaining or idle shipyards into freeports, the UK Government could provide Korean and Japanese shipbuilders with the commercial incentive to take over or revitalise UK shipyards and bid for contracts to build warships and auxiliaries in the UK. Ownership or long leases on under-utilised yards should include giving Japanese and Korean shipbuilders the freedom to create their own high skilled workforces from scratch, and on their own terms. Meanwhile, freeport status would give the UK and devolved governments the agility to calibrate the precise degree to which new owners would gain regulatory, taxation and employment freedoms. With lower steel and employment costs, a freeport shipyard could substantively reduce the costs of inputs that contribute approximately 40 per cent of the value of complex ships. They could be a flexible magnet for inward investment, when inward investment is the only practicable solution for regenerating lost industry.

This may be a bitter pill to swallow in Glasgow or Belfast. But what have those cities got to lose? Their shipbuilding industries are either dead or dependent on a navy that can't build the hulls it needs at anything approaching competitive prices. Besides, the timing is right. Both Japan and Korea are becoming strategic maritime allies for the UK. Both countries' navies want to work more closely with the Royal Navy. The Royal Navy has valuable technology in submarines and in aircraft carrier capabilities that Korea and Japan want to absorb – quickly. Industrial collaboration in naval shipbuilding is an obvious win for all parties. There are strategic deals to be done with the UK's new allies in the Northeast Asia. And the UK's naval order book – and naval ambitions – are the incentive for direct investment.

Wind and water

Strategic alignment with Japan and Korea would also benefit the UK's ambitions in offshore wind. For the next decade, the UK will likely be the global leader in Europe in the installation of offshore wind turbines. This provides a heaven-sent opportunity for UK companies to embed themselves into the supply chain for wind turbines and supporting equipment – including especially the technologies required for efficient operations and maintenance. And in floating wind, Scotland has a chance to pioneer new forms of renewable energy, as licence winners devise the optimal platform for deep water wind turbines.

But the latter won't happen unless pride is put to one side. The commercial and engineering nous that is needed to build a floating wind platform-construction industry in Scotland sank with the

Clyde's last commercial shipbuilder in December 2019. Fergusons is its final resting place. The only way to resurrect that capability quickly is to invite in the maritime engineering industries that are currently world best. It's almost the same list as for shipbuilding – and they are all Japanese or Korean. A successful bid to take over a shipyard in Scotland that was inside a Green Freeport area could carry a double incentive – the opportunity to bid for naval contracts *and* the opportunity to build offshore floating wind platforms for a fast-growing local market. What's more, the potential export market is effectively the entire northeast Atlantic. A successful Korean or Japanese bidder would have first-mover advantage in Europe. The commercial incentive is there to be crafted if the Scottish Government or the Belfast Administration wishes to grasp this strategic opportunity.

Turning an existing shipyard into a freeport – 'green' or otherwise – will provide the Scottish and Northern Ireland governments with the freedoms to craft the necessary incentives. Freeports also provide the opportunity to contain the necessary derogations within a tight geographical area. The freedom to import steel tariff-free means floating wind turbines could compete effectively with any yard in Europe – so long as the workforce is efficient. And Japanese and Korean shipyards are easily the most efficient marine engineering businesses in the developed world. The prospect of inviting in overseas shipbuilders may be unwelcome. But the past 20 years of UK trade shows that overseas companies can be the vectors for rebuilding near-bankrupt British industries. It's time that the UK's silent slipways opened up to foreign expertise.

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