

Effective Policy Approaches to Sectoral Issues

Industrial Strategy Council



Research Paper

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About the Industrial Strategy Council

The Industrial Strategy Council ('the Council') is an independent non-statutory advisory group established in November 2018. It is tasked with providing impartial and expert evaluation of the government's progress in delivering the aims of the Industrial Strategy. Its membership is comprised of leading men and women from business, academia and civil society.

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Foreword

The economic crisis caused by the Covid-19 pandemic has had a pronounced sectoral impact. The worst-affected industries, such as hospitality, retail and tourism, are experiencing falls in output which threaten their very viability.

Facing such challenges, decisive policy action has been taken by governments around the world to support the worst-affected sectors – what might be called defensive sectoral strategies. These are crucial to support workers, businesses and economies.

Alongside these measures, governments might usefully put in place a set of strategic sectoral interventions, to drive improvements in productivity over the medium term. These policies have been highly effective in a number of countries. The uncertainty caused by the Covid crisis increases the importance of such strategies in the UK.

Based on an extensive review of the evidence, this paper offers a blueprint for how an effective sectoral strategy should be designed. At this crucial time for our economy, we hope the evidence here will support the design of targeted and effective sectoral policy interventions in the UK, pursued at scale and for the long term.



Andy Haldane, Chair
Industrial Strategy Council

Executive Summary

The importance of a sectoral dimension of industrial policy has been recognised for centuries. Historically, the prosperity of developed economies has been built around industries of strategic significance and national legislatures have always taken an active interest in their development. From the so-called Manchester Act in 1736, which paved the way towards growth of the UK's cotton industry, to the creation of the European Coal and Steel Community in 1952, individual sectors have long been recognised for their economic as well as political importance.

The case for a modern sectoral policy

In the aftermath of the Covid-19 outbreak, the case for sectoral intervention is more urgent than ever. The current crisis has a clear sectoral dimension with some industries, such as hospitality, retail, or aviation, facing much greater difficulties than others, such as information and communication. Without appropriate sectoral policy we risk worsening the social and economic impact of transitions between industries.

The shift in the shape of the UK economy is happening in front of our eyes. At the time of writing, 41 per cent of workers in Arts, Entertainment and Recreation, and 29 per cent in Accommodation and Food Services were still on furlough, compared to 12 per cent across all industries. The Covid-19-related redundancy notifications filed with the Insolvency Service are disproportionately skewed towards Accommodation and Food Services, Wholesale and Retail Trade, and Air Transport.

What hides behind these statistics is a danger of missed life chances for many individuals and of lost economic potential for the country.

The government has already recognised that some targeted support is required to respond to an uneven distribution of economic pain, including through a funding package for the culture sector, suspended rail franchises and recapitalised train operators, and the “Eat Out to Help Out” scheme to help the hospitality sector. What is required now is a forward-looking approach to help the worst affected industries transition to the new reality.

But we also must not lose sight of the long-term challenges for the UK economy. Without an appropriate sectoral strategy, the UK is unlikely to achieve the step change in comparative advantage needed to compete globally.

Addressing key societal challenges will put disproportionate pressure on individual sectors and the UK's long-term prosperity will rely heavily on the industries facilitating the application of new technologies. From the unavoidable need to decarbonise the industry, to huge commercial opportunities from technological breakthroughs, a sector focus will be required to deliver a more sustainable and prosperous future for the UK.

For all those reasons we urgently need an ambitious, strategic, and far-sighted sectoral policy.

Towards a successful sectoral policy

While sectoral interventions are needed, experience in the UK and elsewhere shows their success is not guaranteed.

We argue that good results depend on following specific policy design principles, of which a clearly defined purpose, sufficient scale, and longevity are fundamental.

Clarity of purpose

A well-articulated, meaningful, and realistic goal is possibly the most crucial principle of successful sectoral policy. It is the clear aim that determines the most appropriate type of intervention, drives implementation, and allows robust evaluation.

The first step in defining the appropriate aim is choosing between strategic or defensive interventions. A concerted effort to develop long-term comparative advantage is very different to managing the transition of a declining but important sector.

Strategic interventions - characterised by targeting growing industries at the technology frontier and aiming to build or strengthen their comparative advantage – will require close cooperation between the government and the targeted industry, careful analysis of existing industrial strengths, and sufficient flexibility to allow quick adaptation in case of failure. The government will also need to strike a balance between complexity and deliverability, establish clear lines of accountability, and ensure sufficient transparency to avoid policy capture.

Defensive interventions – targeting mature or declining sectors and aiming to protect them from temporary disruption or an uncontrolled decline - should focus on facilitating a smooth transition to a more sustainable equilibrium, rather than on the preservation of the status quo. They should precisely define the end goal of the transition, aim to build support of the incumbents and local communities, and span multiple policy areas (from skills, through welfare, to business support). They will also require alignment with wider economic objectives, careful assessment of the feasibility of policy goals and safeguards to avoid the policy being captured by vested interests.

Scale and longevity

Both strategic and defensive policies will also require appropriate scale and longevity to succeed.

As shown in this report, **UK's main economic peers are pursuing comprehensive, well-integrated and ambitious selective policies.** What characterises the policy approaches of China, France, Germany and Japan are: considerable scale and scope, close integration of sectoral interventions with innovation and mission-oriented

policies, and a significant degree of policy continuity coupled with their steady evolution.

More generally, what stands out in the strategic selective policies of China, France, Germany and Japan is an in-depth understanding of each country's respective industrial strengths and weaknesses, and a very explicit aim to use sectoral support to transform their economies and improve their global competitiveness. The UK needs to match that ambition.

Sectoral policy in the UK

The UK has strong foundations to build on, with many world-leading companies and, in Sector Deals and Grand Challenges, an existing framework for implementing sectoral policy.

The ambitions underpinning both these programmes are commendable and, in many ways, overlap with the design principles outlined in this report. Very close involvement of business organisations in the design and the implementation of the Sector Deals is widely considered to be one of their greatest strengths. In addition, the interplay between Sector Deals and Grand Challenges provides a useful framework for tackling the key societal problems while at the same time supporting economic growth in the UK.

But, while we have not conducted an in-depth assessment of every aspect of the UK's sectoral policy framework, the evidence presented in the report suggests that some of its elements fall short on one or more of the criteria needed to achieve success.

First, while the government should continue to engage with a wide range of sectors, **it should also consider which ones will become the pillars of its long term economic strategy and should base that decision on a well thought-out vision for the economy and for those individual sectors.** A more focussed approach is needed to reconcile the need for sufficient scale and longevity with the inevitable funding constraints. In the chapters below, we set out some of the parameters to consider when making that choice.

Second, **in relation to Sector Deals, we point out in this report that greater ambition, clearer objectives and versatility** might be the areas to consider when thinking about the evolution of this element of the Industrial Strategy.

Sector Deals offer plenty of untapped potential and unlocking it is crucial if they are to deliver transformational change for the UK economy. The need for the evolution of the policy is acknowledged in the text of some of the Deals themselves. The Creative Industries Sector Deal states "this Sector Deal is just the beginning: the first iteration of an agreement that will develop over time."

Sector Deals would benefit from more specific milestones and a clearer sense of what should be achieved within a specified timeframe. Sector Deals have well-articulated

high-level goals, which is “to boost productivity, employment, innovation and skills” in the supported sectors, but provide less detail on shorter-term, operational objectives, as well as on specific market failures that need correcting.

Sector Deals could also offer a more versatile set of interventions, better tailored to the needs of individual industries. They are currently largely driven by R&D funding from the Industrial Strategy Challenge Fund, with over 70% of funds concentrated in 3 out of 10 industries - Life Sciences, Automotive and Aerospace. The R&D focus should continue but should not be treated as sectoral policy’s silver bullet.

Finally, **there could be potential benefits from a closer integration of Grand Challenges and Sector Deals.** While currently there are explicit links between the two programmes, their integration seems weaker than that of similar initiatives in other countries. International comparisons suggest Grand Challenges can serve as a useful prioritisation mechanism for strategic selective interventions, strengthening the case for bringing the two programmes closer together.

Policy conclusions

The Industrial Strategy has potential to deliver and the current policies should be built on rather than dismantled. What is needed now is redoubling of efforts to maximise the impact of these interventions and, in the light of the evidence presented in this report, we propose the following steps forward:

- **Review the current sectoral elements of the Industrial Strategy**, including Grand Challenges and Sector Deals (and the interplay between them), and decide which areas offer the greatest potential for strategic versus defensive interventions. Consider how to best integrate targeted sectoral support with wider innovation policy and the Grand Challenges.
- **Reframe the purpose of each sectoral intervention** and define that in terms which reflect the scale and longevity required for success. Recognise the innovation and evolutionary approach that is likely to be needed in areas where interventions have not been tried before (e.g. services).
- **Choose which strategic and defensive priorities will be the focus for the next 10 years.** Reflect these decisions in the emerging recovery plan and ensure the greatest possible prioritisation to galvanise activity in those areas.
- **Establish the leadership and governance structures that anticipate the required scale of intervention and the importance of longevity** and have sufficient capability to implement the policies effectively.

Section 1: Policy design principles

The Industrial Strategy provides a long-term policy framework aimed at raising the UK's productivity, competitiveness and individuals' earning power.¹ As well as including economy-wide policies, in the areas of skills, infrastructure, innovation and the business environment, it also re-established the Government's commitment to selective policies in the form of the Sector Deals.

While sectoral policies are now a fact of economic life in the UK, the debate about the merits of targeted interventions has not been settled. Recognising the difficulties in designing effective selective policy, this chapter discusses the policy design principles on which a set of successful modern selective policies can be built, implemented and assessed.

¹ HM Government (2017). *Industrial Strategy White Paper: Building a Britain Fit for the Future*.

Horizontal vs vertical – the case for selective policies

Chapter summary:

- *Economy-wide (horizontal) policy is a necessary but not sufficient condition for optimal economic outcomes.*
- *The case for sectoral policy is based on:*
 - *the complexity of modern economies requiring horizontal policies to be supplemented by more targeted interventions (sector-specific obstacles to growth),*
 - *disproportionate importance of some sectors or technologies for the wider economy, and*
 - *long-lasting negative consequence of an uncontrolled industry decline.*
- *There are two fundamental types of selective policy: strategic and defensive.*

Governments have generally chosen to adopt a mix of horizontal (economy-wide) and sectoral policies, and the UK Industrial Strategy is no different in this respect, treating the two approaches as highly complementary.

The consensus in the economics profession has been that horizontal policies have an advantage of limiting market distortions and resource misallocation which might occur when only specific industries or types of economic activity are being supported. These interventions range from infrastructure provision, to education and skills policy, to general innovation subsidies.

Nevertheless, it has been recognised in the literature that sectoral policies can usefully complement the horizontal ones.

The case for selective policies rest on three key factors: 1) a significant variation in economic conditions across sectors that makes one-size-fits-all policies insufficient, and the existence of sector-specific obstacles to growth (such as market failures), 2) disproportionate importance of some sectors or technologies for the wider economy, 3) the disruptive character of the economic adjustment process and, consequently, the need to avoid negative social consequences of uncontrolled decline of individual industries.

Due to the complexity of modern economies, sector-blind interventions might not be able fully to remove the obstacles to growth in some sectors. For example, Malerba et al. (1997) show how industries differ with respect to technological regimes

shaping their patterns of innovations and industrial organisation.² This results in a diversity of obstacles to growth across industries. Some industries face market failures in, for example, capturing knowledge (e.g. lower-tech traditional sectors such as agriculture or textiles where improved production processes can be easily imitated by other players), but others do not (high-tech sectors, e.g. automotive), and, therefore, some would need greater incentives to innovate than others. Differing technological and organisational regimes are crucial for understanding how innovation may best work across sectors and highlight that one policy may not fit all. **At the core of this approach lies the idea that the effects of these differences on innovation, diffusion and production need to be studied on a case by case basis and therefore require targeted policy approach (Malerba and Orsenigo (1997)³, Pavitt (1984)⁴, Aghion et al. (2005)⁵).**

Some of the examples of sectoral heterogeneity affecting policy approach, as laid out in the ISC's Sectoral Landscape report, are: the degree of sector's reliance on capital, the relative importance of tangible versus intangible capital, the relative importance of R&D and technology adoption, the sector's distance from the productivity frontier, the dispersion of productivity performance within a sector, location and sector's skills requirements.

In addition, **some sectors play a disproportionate role in the functioning of entire economies.** The most pressing societal challenges, such as rapidly ageing society or the need to decarbonise the economy, will require a sector-specific response. The energy generation, manufacturing and transport sectors will have to bear the brunt of the greenhouse gas emission targets and advances in life sciences will be needed to facilitate the transition to societies with a much higher average population age. Similarly, the future long-term prosperity of the UK will rely heavily on the industries which facilitate the spread of new technologies such as AI or personalised medicine.

Finally, **sectoral policy is justified if it helps avoid negative social consequences of an unmanaged collapse of an industry.** This rationale has traditionally been based on the idea that some factors of production are not perfectly mobile and cannot easily adjust to a rapid market disruption - a sudden collapse of a sector, especially if it is large and geographically concentrated, risks leaving permanent scars on individual workers as well as entire regions. This is particularly important now, when, as a result of the Covid-19 crisis, some of the largest sectors in employment terms are facing unprecedented difficulties. The potential prolonged disruption of industries such as

² Malerba, F., Breschi S. (1997), *Sectoral Innovation Systems: Technological Regimes. Schumpeterian Dynamics. and Spatial Boundaries*, in: *Systems of Innovation Technologies, Institutions and Organizations*, Edited by Charles Edquist

³ Malerba F., Orsenigo L. (1997) *Technological Regimes and Sectoral Patterns of Innovative Activities*, *Industrial and Corporate Change*, Volume 6, Issue 1, 1997, Pages 83–118

⁴ Pavitt, K. A. R. (1984) Sectoral patterns of technical change: towards a taxonomy and a theory. *Research Policy*, 13, 343-73

⁵ Philippe Aghion, Nick Bloom, Richard Blundell, Rachel Griffith, Peter Howitt, (2005) *Competition and Innovation: an Inverted-U Relationship*, *The Quarterly Journal of Economics*, Volume 120, Issue 2, May 2005, Pages 701–728

retail or hospitality, which often provide employment for workers who cannot move easily between professions (e.g. the young) or serve as main employers in deprived areas, risks permanently damaging future prospects of those most vulnerable groups or locations.

This justification is controversial as even the proponents of an active industrial policy admit that **there is a clear tension between economic dynamism and industry protection**, and that they might lead to the preservation of a suboptimal market structure. (Andreoni and Chang (2020))⁶ **Therefore, it is crucial to recognise that the role of a defensive policy is not to prevent the working of the market, but rather to facilitate an orderly transition to the new equilibrium.**

Much less controversially, **sectoral policy can help fundamentally viable businesses to survive an impact of large idiosyncratic shocks** - an experience of many businesses currently struggling with the consequences of the Covid-19 crisis. In this case, government intervention can prevent an unnecessary loss of productive capacity by providing temporary financial support helping the industry to go through the difficult period. The bailout of the US automotive industry in 2009 (discussed in next section in more detail) is an example of a successful intervention of that kind.

Types of sectoral policy

The implication of the previous section is that there are two basic types of selective policy: **strategic and defensive**.

Warwick (2013) defines strategic policies as aimed at frontier industries and closely associated with the view of industrial policy as a means of increasing productivity through promoting high-value sectors. Defensive policies are targeted at mature or declining sectors and aim to protect them from temporary disruption or an uncontrolled decline.⁷

This distinction is also apparent in a selective policy classification proposed by Weiss (2011).⁸ On the one hand, Weiss identifies a group of interventions aimed at facilitating restructuring of uncompetitive activities (such as temporary financial assistance, temporary import tariff protection), and on the other, interventions aimed at promoting high productivity activities, promoting positive externalities and attracting foreign investment (including state venture capital funds, state procurement policy, export subsidies and import tariffs, directed credit and incentive packages for foreign investors).

Thus, the first step towards designing a successful selective policy is understanding these two very distinct types of interventions and adjusting the policy approach accordingly.

⁶ Andreoni A., Chang HJ (2020), *Industrial Policy in the 21st Century*, Development and Change 51(2): 324–351. DOI: 10.1111/dech.12570, International Institute of Social Studies

⁷ Warwick, K. (2013), "Beyond Industrial Policy: Emerging Issues and New Trends", OECD Science, Technology and Industry Policy Papers, No. 2, OECD Publishing

⁸ Weiss (2011) op. cit.

The impact of sectoral policies

Chapter summary:

- *While there is a well-established theoretical case in favour of sectoral policy, empirical evidence of its effectiveness is mixed.*
- *Economic literature offers examples of both successful and failed past interventions.*
- *The inconclusive evidence on the positive impact of selective policies highlights that their success is heavily dependent on the policy design and specific circumstances in which the intervention is implemented.*

While there is a well-established theoretical case for selective policy, verifying it empirically is fraught with difficulty.

First, most empirical analyses published to date look at “old-style” sectoral interventions, largely top-down, centrally-orchestrated industrial policies, and are not directly applicable to the modern approach to sectoral policy advocated in this paper. Second, evaluating the past success of selective industrial policy is extremely difficult as it is unrealistic to offer a single agreed upon counterfactual and most studies do not fully account for the long-term impact of interventions.

With these limitations in mind, below we report on some of the empirical evidence on the impact of selective policies.

Several studies point to little short-term effect of government interventions on the performance of the targeted sectors and a number of individual case studies point to outright policy failures.

Beason and Weinstein (1996) examined the link between industrial policy and sectoral Total Factor Productivity (TFP) growth in Japan⁹ in the period 1955-1990. They failed to establish that preferential policies contributed to the rate of capital accumulation in targeted sectors or their TFP growth. Similarly, Lee (1996) finds a lack of impact of Korean industrial policies on sectoral capital accumulation or TFP growth.¹⁰

Pack (2000) analyses the scale of the impact of sectoral policies on manufacturing TFP in Japan and Korea and finds that even if the impact was positive, it was not large. The estimates show that industrial policy could contribute up to 1 percentage point to the manufacturing growth rate in the central scenario, which translates to an

⁹ Beason, Richard and David E. Weinstein. 1996. Growth, Economies of Scale, and Targeting in Japan (1955-1990), *Review of Economics and Statistics*, 78: 286-95

¹⁰ Lee, Jong-wha. 1997. “Government Interventions and Productivity Growth in Korean Manufacturing Industries,” *Journal of Economic Growth*. 1:3 391-414

approximately a 0.3 percentage point increase in total GDP growth out of a rate of roughly 9 percent a year.¹¹

The literature also offers a well-documented account of failed individual interventions. The UK's attempt to create a national automotive champion, culminating in the creation of British Leyland, is one of the better-known sectoral policy failures. As reported in Broadberry and Leunig (2013) the British-owned producers tended to see their share of UK production decline both individually and collectively as they merged to form the national champion.¹²

More recently, the attempt by the US government to support domestic manufacturing of solar panels ended in failure when, having received \$539 million in guaranteed government loans in 2009, Solyndra, California-based company that manufactured solar panels, went bankrupt only two years later. (Weiner, 2012)¹³

On the other hand, there is a body of evidence which paints a much more positive picture of sectoral interventions.

In a review of US government's R&D efforts to advance energy-efficient and fossil-fuel technologies going back to 1970s, the National Research Council examined 17 R&D programs in energy efficiency and 22 programs in fossil energy funded by the U.S. Department of Energy. It found that they yielded significant economic, environmental, and national security benefits - an estimated \$40 billion from an investment of \$13 billion.¹⁴

Wu et al., (2019) conducted an econometric evaluation of the Chinese Five Year Plans (strategic planning documents) over the period corresponding to the 9th – 12th FYPs (1996 - 2015). **They found that the interventions significantly improved short-term (limited to the duration of the programme) output of the targeted sectors and that the results appear to be statistically robust.** However, the study did not establish a persistent effect of the interventions.¹⁵

Pack and Saggi (2006) remark that while their analysis of Korean industrial policies failed to detect clear short-term impacts of policy, it might miss the longer-term positive effects. While the impact of Korean government's policies on TFP growth in the period during which major promotion occurred (1973-85) might not

¹¹ Pack, H. 2000, "Industrial Policy: Growth Elixir or Poison?" World Bank Research Observer, 15:47-68

¹² Broadberry S., Leunig T. (2013) The impact of Government policies on UK manufacturing since 1945, Government Office for Science, Future of Manufacturing Project

¹³ Weiner R. (2012), "Solyndra, explained" [published on 1st June 2012 in the Washington Post]

¹⁴ National Research Council. 2001. Energy Research at DOE: Was It Worth It? Energy Efficiency and Fossil Energy Research 1978 to 2000. Washington, DC: The National Academies Press. <https://doi.org/10.17226/10165>.

¹⁵ Wu Y., Zhu X., Groenewold N. (2019) The determinants and effectiveness of industrial policy in china: A study based on Five-Year Plans, China Economic Review, 2019

be clear, it could be argued that the subsequent success of Korean firms in the electronics industry might be attributed to those very interventions.¹⁶

There are also examples of individual successes of defensive sectoral interventions. The decision to nationalise Rolls-Royce in 1971, after it fell into financial difficulties due to a misjudged contract signed with Lockheed at the time, is generally considered to have been wise. Pemberton (2017) calls the decision "judicious and pragmatic" and Crafts (2018), while more cautious about attributing the subsequent success to government intervention, states "the sale of Rolls-Royce realised £1.36 billion for the government compared with net subsidies of £0.83 billion over the previous 20 years and Rolls-Royce went on to become the highly profitable, second-largest producer of civil-aircraft engines in the world."¹⁷¹⁸

Similarly, the government-driven restructuring of the three largest automotive manufacturers in the US (GM, Chrysler, and Ford) has had a positive impact on the sector. Not only did the intervention prevent the imminent collapse of the industry, it also led to an increase in its efficiency and profitability. As cited in Klier et al. (2013), the Congressional Oversight Panel found that in 2012 GM and Chrysler were both more viable firms than they had been in December 2008 and that the industry's improved efficiency had allowed automakers to become more flexible and better able to meet changing consumer demands, while still remaining profitable.¹⁹

In summary, the lack of conclusive evidence on the positive impact of selective policies underlines that their success is dependent on the individual circumstances of each intervention. In simple terms, selective policy can bring net benefits, but only if a number of conditions are met. A good example of that is the case of electronics industries in Mexico and South Korea – both countries began assembling electronics in the early 1980s, yet only Korea has managed to generate truly commercially successful products (Maloney and Valencia (2016)).²⁰

This leads us to consider in more detail what factors contribute to the success of sectoral interventions.

¹⁶ Howard Pack, Kamal Saggi, *Is There a Case for Industrial Policy? A Critical Survey*, The World Bank Research Observer, Volume 21, Issue 2, Fall 2006, Pages 267–297, <https://doi.org/10.1093/wbro/lkl001>

¹⁷ Pemberton, H. (2017). *UK industrial strategy, redux: Reinvention or a return to the 1970s?* *Juncture*, 23(3), 202-208.

¹⁸ Crafts N., (2018), *Industrial Policy in the Context of Brexit*, FISCAL STUDIES, vol. 0, no. 0, pp. 1–22 (2018) 0143-5671

¹⁹ Klier T., Rubenstein J. M. (2013), *Restructuring of the U.S. Auto Industry in the 2008-2009 Recession*, *Economic Development Quarterly*

²⁰ Maloney, W. F., and F. Valencia. 2016. *Engineering Growth: Innovative Capacity and Development in the Americas*. Mimeo, World Bank and Bonn University

Towards a successful sectoral policy

Chapter summary:

- *The success of any sectoral policy relies on clearly defined objectives, as well as appropriate scale and longevity, adequate capability within government to deliver the policy and the right level of collaborative leadership within industry.*
- *Strategic policies depend on skillful management of uncertainty involved in choosing sectors to be targeted and on efficient implementation. Key principles include:*
 - *facilitating the flow of information between industries and the public sector,*
 - *making an efficient use of market signals when implementing the policy,*
 - *diversifying the risk of targeting the wrong sector through targeting broader groups of activities and ensuring a degree of policy flexibility,*
 - *allowing a degree of experimentation coupled with a robust evaluation process,*
 - *clearly defining parties accountable for delivering results,*
 - *striking a balance between complexity and deliverability of policy, and*
 - *designing policies robust to political economy considerations.*
- *Defensive interventions will require:*
 - *facilitating smooth transition rather than perpetuating the status quo,*
 - *defining the end goal of the transition,*
 - *securing popular support for the policy,*
 - *looking beyond the targeted sector and offering a comprehensive policy package,*
 - *long-term focus and alignment with wider objectives,*
 - *considering the viability of the sector and feasibility of policy aims, and*
 - *avoiding policy capture.*

After decades of limited sectoral policy success and in the face of mixed empirical evidence on their effectiveness they come with a long “read before use” list. **The**

section below considers what conditions need to be met in order to minimise the risk of sectoral policy failure.

General design principles

Setting clear objectives

In many ways the need for clearly defined objectives is obvious and self-explanatory. The reason why this principle is reiterated here is the very complex and risky nature of selective policies that is the topic of much of this report.

The need for clear objectives presented here is the flip side of a wide range of potential problems that could be addressed through selective intervention. It is a reminder that selective policy is shaped by the specific context in which it is being introduced.

Defining specific objectives helps: a) deal with the complexity of the problem by focussing attention on the most relevant information, b) decide what needs to be done both in the public and the private sectors; c) design a robust monitoring process, allowing timely exit when necessary.

First, **detailed policy goals will determine what kind of information is needed to ‘solve’ a sectoral issue**, and therefore, narrow down the field of information to be obtained by government.

Second, as already highlighted elsewhere in this report, vertical policies can be used to address a wide variety of problems and, therefore, **the clarity about the ends is needed to determine the most appropriate means**. For instance, defensive policies will require a different approach (e.g. conditionality and time-limited character) than a strategic policy (e.g. long-term funding structures). Similarly, different types of market failures will also call for different approaches, as discussed in more detail in the section on economic rationales (page 31). Crucially, it also has to be recognised that, ultimately, it is individual businesses who will implement the policy and they will need a clear understanding of policy aims in order to meaningfully engage with the government and to adapt their behaviour as required.

Finally, **without clear objectives it is impossible to monitor the progress of the policy in any meaningful way**. (Weiss (2011))²¹

Scale and longevity

It would be wrong to assume that large and expensive policies will guarantee positive outcomes but it is the case that appropriate scale is necessary in order to make a material change to sector’s potential, especially in the field of R&D and innovation. The international examples of successful sectoral policies are a case in point. The whole host of programmes to improve energy efficiency initiated by the

²¹ Weiss (2011) op. cit.

Department of Energy received \$13 billion (~£9.9 billion) in public funds over 22 years, or approximately \$600 million (~£450 million) per year. The return from this programme is estimated to have been more than double the invested sum. Tesla, received a \$465 million (£380 million) loan from the US Department of Energy as it initially struggled to secure investment.²² Japan invested \$1.5 billion (~£1.1 billion) in hydrogen R&D strategy between 2013-2018 (~£200 million/year), although in this case it is still not clear if that investment will pay off.

There is little doubt that successful policies require patience. Examples include the Japanese government's longstanding commitment to supporting new technologies in the automotive industry, going back to the 1970s. In China, there is consistent evidence showing that since 1996 **sectoral policies introduced by successive Five-Year Plans** managed to stimulate growth of the targeted industries. Similarly, Germany is currently adopting the third iteration of its High-Tech Strategy which was launched originally in 2006. The importance of scale and longevity is discussed in more detail in Section 2.

Adequate government capacity

One of the key conclusions one can draw from the literature is that **the desirability of sector-specific support is conditional on a well-developed government capacity** and an institutional framework that will allow correctly identify, design, and implement sectoral interventions.

Governments face an immense informational challenge related to learning about the needs of individual sectors and identifying optimal ways to intervene. The location and the magnitude of market failures are highly uncertain, and the problem is compounded by measurement limitations.

But even when these informational obstacles can be overcome or reduced, the state then needs to invest a considerable amount of resources in implementing the policy in a manner which avoids distortions and institutional capture.

Falck et al. (2011)²³ suggest that the key political-economy obstacle to successful delivery of any sector policy is the inability of government to experiment and end failing interventions. Phasing a policy out is extremely. Hence, avoiding policy capture is a crucial success factor for any selective intervention (Weiss (2011))²⁴

²² Mazzucato M. (2017), *Mission-Oriented Innovation Policy Challenges and Opportunities*, RSA Action and Research Centre

²³ O. Falck, C. Gollier, L. Woessmann: Arguments for and against Policies to Promote National Champions, in: O. Falck, C. Gollier, L. Woessmann (eds.): *Industrial Policy for National Champions*, Cambridge MA 2011, MIT Press, pp. 3-9

²⁴ Weiss (2011), op. cit.

Principles for strategic interventions

Dealing with imperfect information

The issue of how governments collect and process information becomes paramount when designing a selective policy. Identifying relevant market failures to be corrected in a complex economic environment and then deciding what is the best way of addressing those issues requires detailed knowledge of the industry to be supported and the wider system within which it operates. There are a number of ways in which governments can manage this information shortage.

First, it is crucial to establish a governance structure to facilitate the flow of information between industries and the public sector. This is one of the most strongly emphasised elements of a modern industrial strategy. As it is the private sector that is likely to better understand its specific business needs, governments need to embed private actors in its policy making. The literature recommends establishing a governance framework to build dialogue between public and private sectors to resolve information asymmetries.

For example, Rodrik (2004) advocates the establishment of “public-private coordination councils”, which could seek out and gather information on investment ideas, achieve coordination among different state agencies, push for changes in regulation to eliminate unnecessary transaction costs, and generate a package of relevant financial incentives for new activities when needed.²⁵

On the other hand, relying on industry information risks losing sight of wider goals. This brings us back to the importance of well-defined objectives and scale. When talking to businesses, governments need to know what questions to ask and what they are trying to achieve.

Furthermore, for the policy to succeed, governments need to be able to measure the impact of the policy in a meaningful way, which in many cases will mean relying on sectors to provide information on key performance indicators. This is one of the key policy ‘design problems’ going beyond the initial formulation stage. For the policy to be successfully implemented and monitored, not only will the baseline evidence be required, but also an articulation of exactly what evidence will be required at different stages of implementation as the policy develops.

Second, the government will have to make an efficient use of market signals when implementing the policy. First, when the exact benefit from intervention (e.g. the size of an externality) is not known, the cost of supporting an industry should provide the lower bound of what kind of benefit should be expected. To make an

²⁵ Rodrik, Dani, Industrial Policy for the Twenty-First Century (November 2004). Available at SSRN: <https://ssrn.com/abstract=617544> or <http://dx.doi.org/10.2139/ssrn.617544>

obvious point, governments should always assess if the intervention (especially large scale) is good value-for-money.

More importantly, **one could argue that selective policies should focus on deep comparative advantages.** The example of this principle is the steady evolution of Korea's industry from a starting point of household appliances to memory chips, to semi-conductors. Harrison and Rodriguez-Clare (2010)²⁶ and Lin (2012)²⁷ stress that supporting non-competitive sectors can slow down the speed of accumulation of physical and human capital. Similarly, in relation to cluster policy, Porter (2000) suggests that government should not attempt to create clusters "ex-nihilo" but to focus on locations that have already passed a "market test".²⁸

Third, governments should diversify the risk of targeting the wrong sector through targeting broader groups of activities and ensuring a degree of policy flexibility. Even very detailed information will not eliminate the risk of supporting a wrong sector as by definition the choice about exact design of support policy will involve a judgement about the future. Consequently, **one of the key tasks for government is to try to minimise the risk of making a wrong choice.** Maloney et al. (2018) suggest that one way of diversifying that risk is by including horizontal elements in sectoral interventions – for example supporting broader sectors or product groups, rather than trying to promote one specific product. The idea here is to attempt to develop product "platforms" – "setting up petri-dishes of technologies, skills and expertise from which new products might emerge."²⁹

This conclusion can also be drawn from the assessment of the Japanese policy to support the development of electric cars (see Annex A) – the success of the policy **has been due to a relatively flexible policy enabling the development of a number of alternative solutions to challenge the dominating internal combustion engine technology.**

Fourth, governments should allow a degree of experimentation coupled with a robust evaluation process. As highlighted by Maloney et al. (2018) not only does a well-designed evaluation process reveal information on what interventions work but also serves as a disciplining device for all involved parties. It is crucial to consider where is the implicit market failure to be targeted and whether there exists evidence that the proposed solution will be effective? It is also critical for successful sectoral policies that industries and firms participating in the intervention learn throughout the policy implementation process and that is possible only with an evaluation process in

²⁶ Harrison, Ann and Andrés Rodríguez-Clare. 2010. "Trade, Foreign Investment, and Industrial Policy for Developing Countries." In Dani Rodrik and Mark Rosenzweig, editors: Handbook of Development Economics 5, The Netherlands: North-Holland, pp. 4039–214

²⁷ Lin, Justin. 2012. The Quest for Prosperity: How Developing Economies Can Take Off. Princeton, NJ: Princeton University Press

²⁸ Porter, M. E. 2000. "Location, Competition, and Economic Development: Local Clusters in a Global Economy." Economic Development Quarterly 14 (1): 15–35

²⁹ Maloney W., Nayyar G. (2018), *Industrial Policy, Information and Government Capacity*, The World Bank Research Observer

place. What is also important for evaluation is to narrow it down as much as possible to just a tractable number of indicators to be monitored.³⁰

Managing policy implementation

The difficulties involved in sectoral policy do not end at the design stage and governments need to recognise the challenges involved in the implementation of sectoral policies.

First, governments should clearly define parties accountable for delivering results, and introduce some form of “carrot and stick” to ensure incentives for successful delivery are in place. Cherif and Hasanov (2019) and others have argued that a crucial element of the success of sectoral industrial and technology policies in South East Asia was strict accountability combined with high level of market competition.³¹ That meant that no support was given unconditionally although performance was not necessarily measured on very short-term basis, and the state encouraged competition (both domestically and internationally) in order to make sure that government support does not harm firms’ competitiveness. In addition, firms receiving support were expected to export, had to invest heavily in R&D and innovate to compete on international markets.

Second, governments should consider ‘efficiency’ of their projects – i.e. choose those whose design maximises social return while minimising stress on governance. An illustrative framework presented in Maloney et al. (2018) shows that there is a **trade-off between the return on sectoral policy and its risk related to its complexity**. While the benefit of an intervention might increase with its scale and complexity, the risk of unsuccessful implementation or unintended consequences increase as well.

One approach to managing that trade-off would be complexity minimisation: careful identification of what are truly necessary complementarities, and which may be sequenced, thereby altering the goals of the program, or identifying alternate providers of the complementarities. To be clear, the consequence of this approach might be having to choose a much less ambitious project, but, at least in theory, one that is more likely to deliver results and minimise the waste of public resources.

Third, governments should design policies robust to political economy considerations. As already highlighted above, avoiding capture from vested interests is a serious challenge in relation to sectoral policies. Therefore, policies should from the outset include mechanisms that will mitigate the risk of extending the life of a policy beyond what is economically necessary by, for example, including sunset clauses on

³⁰ Maloney W., Nayyar G. (2018), op. cit.

³¹ Cherif R., Hasanov F. (2019), *The Return of the Policy That Shall Not Be Named: Principles of Industrial Policy*, IMF Working Paper

funding arrangements, ensuring adequate transparency and allowing for independent scrutiny.

Principles for defensive interventions

As already acknowledged above, there is a clear tension between economic dynamism and the protection of industries. Therefore, learning from past successes and failures, we propose additional principles that can help mitigate the risk involved in implementing defensive policies.

Transition support. An industry experiencing financial problems, be it of temporary or more fundamental nature, will, in most cases, be required to adapt to the new reality to secure its longer-term viability. For this reason, it is useful to think about a defensive intervention as transition support. The government should make sure that its support incentivises the sector to take all the necessary steps in order to adjust to the new reality, whether it means changes to its operating model or drawing up a plan for a gradual capacity reduction. There is a real risk the support measures create moral hazard and inhibit necessary adjustment and the policy should try to avoid that. Conditionality accompanying financial support is an important instrument allowing the transition to happen but government can also provide and play a coordinating role in the negotiations between different industry actors (and between the workforce and the management) as well as provide subsidies incentivising capacity reductions.

Define the long-term goal of the transition. Depending on the circumstances, the end goal of a defensive intervention can vary from a complete phase out of a sector, through capacity reduction coupled with technological upgrading, to a move higher up the value chain. Consequently, the focus of an intervention might be either to reskill and reemploy the workforce, or to incentivise investment in new technologies, or to encourage the existing firms to thoroughly reform their business models and innovate. In practice, it is probably always the mixture of those (and other) aims and the main task for policymakers is to decide on what to put the emphasis. It is also instrumental not to lose sight of the long-term aims of the transition. The restructuring of the East German shipbuilding industry in the early 90s is an example of an intervention where, while the short term goals might have been achieved (preventing the imminent collapse of the entire sector and a loss of up to 50,000 jobs), the longer term aims (finding a market niche that would safeguard the industry from international competition) hasn't been given sufficient thought and resulted in continued uncertainty about the viability of the industry.³²

³² Heseler H. (1993), *Sectoral restructuring: the East German shipyards on the path to the market economy*, Cambridge Journal of Economics, Vol. 17, No. 3 (September 1993), pp. 349-363

Secure buy-in of the industry and local actors. It is inevitable that policies promoting economic transition will encounter opposition from the incumbents. The reasons for the opposition are in many cases understandable and can include the inability to recoup the sunk cost of past investments, costly investment needed for upskilling and technological upgrading, or simply risk-aversion. The Korean government's well-meaning attempt to slow down the decline of its textile industry in the early 00s, by switching from mid-stream activities (dyeing and weaving) to higher value downstream ones (apparel and design), failed because the industry was reluctant to give up on their current specialisation.³³ Therefore, governments need to anticipate and understand this inertia, and employ a considerable amount of political skill to gain acceptance for their plans.

Look beyond the targeted sector - adjust the intervention to local conditions and offer a comprehensive policy package. The transition-focus of defensive policies also means having to anticipate and support changes in the economic environment surrounding the declining sector. Defensive policies will need to consider such issues as the capacity of the local labour market to absorb surplus workers, the attractiveness of the area for new businesses, the skill level of both the surplus workforce and the wider population or the connectedness of the area to other markets. Therefore, a defensive intervention should offer a package of coordinated measures targeting a range of issues, from skills, through welfare, to entrepreneurship.

Alignment with wider objectives. It is essential for governments to align the objectives of a defensive sectoral policy with government's wider aims, in order to avoid cases when even a well-meaning policy stands in contradiction with other aims such as environmental protection, improved social and health outcomes, regional development or technological upgrading.

Viability of the sector and feasibility of policy aims. The policy should make a careful assessment of the viability of the supported industries before deciding what intervention would be most appropriate. As shown by the cases of Rolls-Royce's nationalisation and the US auto industry bail-out described in the previous section, the decision to support the industries was justified in the light of an idiosyncratic character of the shock that could be expected to be only temporary in nature, as well as by the firms' sufficiently strong fundamentals. Other elements of the viability test to be considered are the longer-term technological potential of the industry and its importance for the wider economy, especially from the point of view of innovation promotion. Finally, governments should consider if the intervention can realistically improve the situation of the sector.

³³ Cho M., Hassink R. (2009), *The Limits to Locking-Out through Restructuring: the Textile Industry in Daegu, South Korea*, Regional Studies, Volume 43, Issue 9, 2009

Avoiding policy capture. Perhaps the greatest risk in using defensive sectoral policy is that it can very easily be taken hostage by interest groups who will demand support even when there is no economic justification for it. It has been shown (see Baldwin (2009)) that mature industries, and those are most likely to be recipients of government support, are efficient at lobbying government and that, from the political economy point of view, politicians have very little incentive to resist them. In simple terms, it is much easier to lobby in favour of existing jobs at risk of disappearing, than for the new ones.³⁴

For this reason, it is crucial for governments to be transparent about what their defensive interventions are trying to achieve, to set out clear rules and metrics to measure the progress of the policy and to build in binding exit clauses in order to moderate the risk of prolonging the policy indefinitely.

³⁴ Baldwin R., Robert-Nicoud F. (2009), *Industrial Policy: Why Governments Pick Losers*, CentrePiece, Autumn 2009

Choosing sectors

Chapter summary:

- *Strategic interventions should focus on sectors most likely to have a systemic importance for the wider economy.*
- *When choosing which sectors to support policymakers should consider:*
 - a. *the industry's growth prospects,*
 - b. *whether it produces technologically demanding "questions" (problems which, when solved, unlock new technological or market opportunities),*
 - c. *whether it makes a good export market, and*
 - d. *the extent and the quality of linkages to other industries.*
- *When it comes to defensive interventions, governments should only intervene where a long-term interest on the economy is at stake. Factors to consider when choosing sectors for defensive intervention include:*
 - *mobility of factors of production,*
 - *geographical concentration,*
 - *capacity of the local labour markets to absorb workers from the declining industry, and*
 - *maturity of the industry relative to its international competitors.*

While this paper does not intend to judge which UK industries should be targeted by government policy, it presents views from the literature on general principles that should be considered when making that choice.

Strategic industries

We first look at different considerations involved in picking a sector for strategic intervention. Libicki (1989) outlines a number of factors that help determine which industries should be classified as strategic.³⁵

He stresses the transformational and systemic character of some industries. Strategic industries foster the systematic application of knowledge to generate more and better outputs from inputs. According to Libicki, what is crucial is that some industries promote technological development better than others, and consequently have greater importance for the wider economy.

³⁵ Libicki M. C., (1989) *What makes industries strategic*, The Institute for National Strategic Studies

Strategic industries are those whose "products and processes alter or transform the goods and production arrangements throughout the economy, that is they alter the choices open to firms and the very nature and definition of the markets." In this context, the book also emphasises the importance of the wider supply chains by pointing out that the linkages from buyer to seller are the key transmission mechanism of technological development.

The notion that support should prioritise the industries with a disproportionate significance for the economy is echoed elsewhere in the literature.

Maloney et al. (2018) suggest that governments should support target industries with positive externalities and export potential.³⁶ They also call for focussing on existing market strengths – e.g. by exploiting existing comparative advantages - and avoiding trying to create industries, cluster or products "ex nihilo". Similarly, Cherif and Hasanov (2019) use the example of the successful South East Asian economies to argue that sectoral policies should support sectors with export potential.³⁷ The sentiment that government's goals should be to foster the kind of technological change which is going to have a broad impact in different sectors was also echoed by the members of the Productivity Insights Network at a workshop organised by the ISC.

Finally, Libicki suggest that the concept of a strategic sector can be operationalised by considering to what extent an industry's markets and technologies predispose it to be strategic and how does its actual performance live up to its potential. In practice, the factors that policy-makers should be taking into consideration include: a) an industry's growth prospects, b) whether it produces technologically demanding "questions" (problems which, when solved, unlock new technological or market opportunities) , c) whether it makes a good export market, and d) what is the extent and the quality of linkages to other industries.

Naturally, these four questions are just the tip of the iceberg of the difficulties involved in choosing appropriate industry and it brings us back to the issue of the capacity governments need to bridge the information gap. To implement selective policies successfully, governments require both a very clear understanding of whether there is an intrinsic comparative advantage, and the likely market for the product, as well as to have detailed information on the magnitude of the market failure relative to other distortions.

Defensive industrial policy

Aiginger (2014) states that "**governments should only intervene where they have a long-term interest** (not just short-term goals such as saving jobs in distressed regions or during the depths of a recession); it [the intervention] has to be connected

³⁶ Maloney et al. (2018) op. cit.

³⁷ Cherif and Hasanov (2019) op. cit.

with societal needs. Industrial policy should benefit society as a whole, not just individual companies.”³⁸

This statement, although intended as a warning against the risks of defensive policies, implicitly suggests that as long as they protect the long-term interest of the economy and ensure the society as a whole benefits, defensive interventions are justified. Consequently, **the choice of a sector to be supported defensively will depend on the assessment of the potential damage done by its disorderly decline.**

More specifically, Hillman (1982) points out that **the case for supporting declining industries rests on the immobility of factors of production.**³⁹ This logic suggests that the scale of negative social consequences from an uncontrolled industry decline is likely to be greatest when factors of production employed are least able to transition to new economic activities. Therefore, the industries where workers are least likely to retrain and/or move to different locations or activities should be where sectoral policy can avoid the greatest damage.

The target sector will also be determined by the capacity of the area where the industry operates to absorb the surplus workers. The lower the ability of the local labour market to absorb them, the stronger case for transition support.

Another clear factor in choosing an industry for defensive support is a long-term viability of an industry. A support for a struggling industry is less contentious if a strong case can be made that its long-term viability is not under threat.

One way of thinking about the question of long-term viability is by using the maturity-based framework for thinking about industrial policy developed by Livesey (2012).⁴⁰ According to that framework, one of the key factors that should guide decisions about the shape of a sectoral intervention is industry’s maturity relative to the maturity of the same industry in other countries.

Livesey’s approach suggests that the greatest demand for defensive approach will be in home industries which are mature or declining but whose international peers are emerging or growing. This is where the pressure to slow or prevent structural change or to promote more orderly adjustment to competitive challenges from emerging economies will be greatest. The decision in favour of support will still have to be made on a case by case basis but will be influenced by industry’s importance for the science base, supply chains and labour markets.

The case where the need for selective industrial policy is least urgent and a horizontal approach is best is where sectors are either mature or declining both at home and globally. According to Livesey (2012) in such cases horizontal policies

³⁸ Aiginger, K. (2014), *Industrial policy for a sustainable growth path*, WWW For Europe, Policy Paper no 13

³⁹ Hillman A. (1982), *Declining Industries and Political-Support Protectionist Motives*, American Economic Review, 1982, vol. 72, issue 5, 1180-87

⁴⁰ Livesey F. (2010), *Rationales for industrial policy based on industry maturity*, Centre for Industry and Government

allowing free entry and exit, upgrading the general level of skills and other capabilities, and enabling resources to move easily between sectors are most suitable.

Sectors vs technologies

Chapter summary:

- *Selective policies can target individual sectors, but also sections of the economy spanning multiple sub-sectors (e.g. creative industries) or technologies.*
- *Selective policy targeting technologies is commonly used internationally.*
- *Technology-based policy is crucial as:*
 - *diffusion of technology is not always automatic and government intervention might be required to facilitate or accelerate it, and*
 - *innovation is the key driver of long-term economic growth in developed economies.*

Warwick (2013) points out that, in practice, **selective policies involve different overlapping sectors and/or different firms along the supply chain, or can target specific technologies or tasks rather than industries**.⁴¹ A selective industrial policy can be designed with any one of these dimensions in mind, or some combination of them.

Technology has been a focus of selective policy both in the UK and internationally (see ‘International comparisons’ section). In his 2012 speech to the Royal Society, the UK Chancellor of the Exchequer identified eight technologies in which the UK should strive to become a leader.⁴² The list has been refined since⁴³ to include big data and computing, satellites and commercialisation of space, robotics and autonomous systems, life sciences, regenerative medicine, agri-science, advanced materials and nano-technology, and energy and its storage.

The focus on specific technologies stems from a realisation that innovation is one of the key drivers of growth in developed economies, and that the UK has a large research potential with little support for the commercialisation of research. The challenge for the UK is to reap full economic benefit from its scientific excellence and capability.

⁴¹ Warwick K. (2013) op. cit.

⁴² Osborne, G. (2012). Speech by the Chancellor of the Exchequer, Rt Hon George Osborne, MP to the royal Society. Retrieved from: <https://www.gov.uk/government/speeches/speech-by-the-chancellor-of-the-exchequer-rt-hon-george-osborne-mp-to-the-royal-society>

⁴³ Willets (2016) Eight great technologies, Policy Exchange

In addition, **selective policies based on technologies are becoming popular because they have a potential to generate positive externalities for the wider economy.**

Finally, **technology-based selective policy can promote diffusion of new technologies**, by reducing costs, increasing information, reducing protection, overcoming obstacles related to technology lock-in and speeding up commercial application. It has been long recognised the process of technology diffusion and adoption across the economy is not automatic. Hall (2004) suggests that the rate and manner in which new technology affects economic welfare is to a large extent determined by their diffusion.⁴⁴

⁴⁴ Hall, B. H. (2004) *Innovation and Diffusion*, NBER Working Paper No. 10212

Economic rationales

Chapter summary:

- *Choosing a clear aim of sectoral policy requires identifying key obstacles to growth in a given sector.*
- *Market failures remain a useful disciplining device when designing selective policies.*
- *Traditional market failures commonly identified in the literature include:*
 - *failure to exploit economies of scale,*
 - *insufficient spatial concentration (agglomeration benefits),*
 - *knowledge spill-overs and low appropriability,*
 - *coordination failures, and*
 - *barriers to infant industries.*
- *The approach to selective policies based on market failures has its limitations: it is focused on the economy “as is” as opposed to “as it could be” and puts disproportionate weight on the governments’ ability to tackle market failures.*
- *Dynamic, system-based approaches focus on the importance of networks in the economy and emphasize governments’ role in catalysing a long-term technological change.*

Two key ideas in this report so far are that the clarity of purpose is the key success factor in sectoral policy and, linked to that, that there is considerable heterogeneity across sectors in terms of their economic environments and needs. In this section we go a step further and show that the decision about specific goals of a selective intervention can be usefully framed as a choice about the most significant obstacles to growth in each industry, or in other words, market failures. This framework is not the only way one can think of the purpose of selective intervention, but we believe it is a useful first step in deciding what intervention is most appropriate.

Static: Market failures

This section is based on the idea that identifying market failures as a justification for selective intervention remains a useful disciplining device, and the first guiding question for policymakers should be whether there is substantial

evidence that a market failure exists in the production of a particular good, or in factor markets. (Maloney (2018)).⁴⁵

Traditionally, the argument for promoting particular sectors has been based on, so called, Marshallian externalities. These are local externalities that lead productivity to rise with the size of the industry. They may arise for a number of reasons not captured by the market price of a good, including local industry-level knowledge spill-overs, input-output linkages, and labour pooling. Over the years, economic literature has, identified a wider range of failures that could be addressed by selective interventions.⁴⁶

In order to give an overview of the most common sector-level growth obstacles and to indicate their relevance for choosing the most appropriate approach to sectoral policy we discuss in this section the following market failures: returns to scale, agglomeration economies, knowledge spill-overs and low appropriability, coordination failures, and barriers to infant industries.

The relevance of returns to scale to selective policy is best demonstrated by the development strategies of Asian countries going as far back as 1970s. The industrial strength of South Korea, Japan, and now China have been built through a very deliberate attempt to reach efficient scale of selected industries, of which the car industry is the classic example. More recently, the attempted merger of Siemens and Alstom, leading German and French engineering companies, has also been driven by the logic of economies of scale – the supporters of the merger claimed the scale is required for the firms to compete with international peers. That said, it should be stressed that decreasing returns to scale can also be an obstacle to growth – for example, there is some evidence that excessive concentration of R&D activity leads to diminished outputs.⁴⁷

Agglomeration economies is another common justification for selective intervention. There is convincing evidence that spatial concentration of economic activity leads to increased efficiency and a number of countries, including the UK, have been trying to incentivise agglomeration. The most radical example that comes from China where in 2000 the government of the Guangdong province launched a program under the slogan “one city-one product” to encourage the spatial agglomerations of enterprises all focused on the production of one specific item. Closer to home, the Independent Review of the Creative Industries proposed a policy to promote creative clusters around the country as a way of boosting the industry’s productivity – the policy which is now one of the key elements of the Creative Industries Sector Deal.

⁴⁵ Maloney et al. (2018) op. cit.

⁴⁶ Dated back to Alexander Hamilton’s Report on Manufactures of 1791, according to Peneder, M., 2017. Competitiveness and industrial policy: From rationalities of failure towards the ability to evolve. Cambridge J. Econ. 41, 829–858

⁴⁷ Los B., Verspagen B. (2000), *R&D spillovers and productivity: evidence from US manufacturing microdata*, Empirical Economics, Vol. 25; Graves S. B., Langowitz N. S. (1993), *Innovative productivity and returns to scale in the pharmaceutical industry*, Strategic Management Journal

Barriers to knowledge spill-overs is another example of a market failure, particularly relevant in the context of strategic interventions in mature economies. In this case, selective policy can be used to compensate for under-investment in (and, thus, under-production of) certain activities when their providers do not reap the full benefits from their efforts. This can be the case when the outputs from investment (e.g. new knowledge or process) can be easily captured by competitors. There is evidence from the British Isles that such knowledge spill-overs exists, and that intervention can make a positive difference. Wakelin (2000)⁴⁸ highlights a significant contribution of high value-added sectors in the UK, e.g. mechanical engineering to generating innovations used in other sectors, and Hewitt-Dundas and Roper (2009) showed that public support for innovation in the manufacturing sector in Ireland and Northern Ireland did have a positive effect on the wider economy.⁴⁹

Next on the list are coordination failures. These types of failures occur when new investment requires simultaneous inputs from different parties but where no party has an incentive to move first. This is relevant where large-scale investments with high initial fixed or sunk costs are needed or where an industry is 'locked-in' to an old standard when it would be beneficial for all to move to a new standard. The recent attempt by the South Korean government to support its failing textile industry in the Daegu province is an example of the difficulty of overcoming the lock in. In early 00s the industry incumbents were still specialising in mid-stream textile production such as weaving or dying and reluctant to try to move to higher value activities (e.g. design) despite increasing international competition. The government coordination was required in that case to initiate this process of transition.⁵⁰

Finally, selective interventions have often attempted to safeguard infant industries from international competition. Chang et al. (2013) highlight that young companies accumulate capabilities only over time and in an unpredictable way, through a long and costly process.⁵¹ Capability accumulation needs some indivisible inputs (thus high fixed costs) that small producers cannot provide on their own – whether in R&D, machinery, or worker training. Government protection targeting small businesses, or a sector dominated by small businesses, might help raise their productivity. Fujiwara (1991) showed that Japan's export competitiveness in a number

⁴⁸ Wakelin K. (2000), *Productivity growth and R&D expenditure in UK manufacturing firms*, Research Policy

⁴⁹ Hewitt-Dundas N. and Roper S. (2009), *Output Additionality of Public Support for Innovation: Evidence for Irish Manufacturing Plants*, European Planning Studies

⁵⁰ Cho M., Hassink R. (2009), op. cit.

⁵¹ Chang, H-J, Andreoni, A. and Kuan, M. L. (2013) „International Industrial Policy Experiences and the Lessons for the UK“, in *The Future of Manufacturing*, UK Government Office of Science, London: BIS.

of technology-intensive industries, particularly in the electronics sector, was mainly attributable to the infant industry promotion strategy.⁵²

For more details on each of those market failures please see Annex D.

More recently the market failure approach has been expanded to include rationales related to the systemic nature of innovation, as well as the need to tackle long-term societal challenges.

Limitations of the static approach

It has been long recognised in economics that the traditional approach based on market failures is a necessary but not sufficient condition for a successful growth intervention. In practice it is very difficult to precisely identify specific market failures. In addition, the emphasis on market failures has a narrow focus, ignores longer-term, dynamic effects of interventions (e.g. when policy is needed to create new markets; it is focused on the economy “as is” as opposed to “as it could be”) and puts disproportionate weight on the governments’ ability to tackle market failures (the gains from intervention might not outweigh the associated costs of governmental failures – such as capture by private interests (nepotism, cronyism, corruption, rent seeking), misallocation of resources (“picking losers”), or undue competition with private initiatives (crowding out)).

Mazzucato (2015) identifies four key limitations of the approach based on market failures:⁵³

- **directionality** – there is no guarantee that markets will produce a desirable outcome even if market failures are identified correctly
- **static character** – the market failures approach uses static evaluation methods, while some economic issues are dynamic in nature
- **organisation and resources** – the market failure-based approach presupposes that government intervention should be as limited as possible and, therefore, makes dealing with large scale societal issues difficult
- **risk and rewards** – in many cases the market failure approach leads to socialisation of risks but not of rewards.

⁵² Okuno-Fujiwara, M. (1991). Industrial Policy in Japan: A Political Economy View. In P. Krugman, Trade with Japan: Has the Door Opened Wider? (pp. 271 - 304). Chicago: University of Chicago Press.

⁵³ Mazzucato M., (2015) *Innovation Systems: From Fixing Market Failures to Creating Markets*

Dynamic: systems and missions

From the criticism of the market-failure-based policies sprung a rich literature on the modern approaches to industrial strategy which emphasise the complexity and the systemic character of the innovation process, and which see the role of the government not just as a “corrective mechanism” but also as a “catalyst” of industrial growth.

Principles of a system-based approach

In simple terms, system-based approaches focus on the importance of networks in the economy and emphasise governments’ role in catalysing a long-term technological change.

Warwick (2013) suggests that in contrast to more traditional approaches to sectoral policy, which view knowledge as homogeneous and believe that it can disseminate instantly, the systems approach suggests that knowledge is context-specific, tacit and does not spread easily.⁵⁴ For example, Nelson and Winter (1982) observed that corporate behaviour was often determined by rules and routines learned within the corporate framework and passed on from one generation of managers to another.⁵⁵

An implication is that the national system of production and innovation is made up of networks of both formal and informal connections between relevant institutions.

Therefore, according to the system-based approach, **the role of industrial policy, hand-in-hand with innovation policy, is to create and develop institutions to promote networking and collaboration and to devise strategies to make best use of these institutions.**

In addition, Freeman (1982) argues that productive specialisation is also related to the capacity of shaping new markets and technological capabilities.⁵⁶

On that basis, the state has a role to play in influencing the dynamic allocation of resources and to scope for future technologies in which to invest, before firms have an incentive to do so (Martin and Irvine (1984)⁵⁷). The OECD (1999) suggests policies to strengthen innovation systems including the promotion of firm

⁵⁴ Warwick, K. (2013). *Beyond Industrial Policy: Emerging Issues and New Trends*. OECD Sci. Technol. Ind. Policy Pap. 57, OECD

⁵⁵ Nelson, R. R. and S. G. Winter (1982), *An Evolutionary Theory of Economic Change*, Cambridge: Harvard University Press

⁵⁶ Freeman, C., 1982. *Innovation and long cycles of economic development*, in: international seminar on innovation and development at the industrial sector. Campinas.

⁵⁷ Irvine, J. and Martin, B. R. *Foresight in Science*. (Frances Pinter (Publishers), 1984).

networking and clustering, diffusion of technology, increased labour mobility, encouraging of institutional ties and research collaboration promotion, among others.⁵⁸

The systemic approach highlights the variation across industries and countries in how the involved actors are connected to each other. Nelson (1993) suggests that tailored sectoral-technological policy enables national industries to stay ahead or catch up through differentiated learning processes. Therefore, **the government has a role in reinforcing a link between industry members.**

As indicated above, system-based approaches are very closely associated with policies focused on innovation and on adoption of specific technologies.

Box 1: Case Study – State agencies in Japan

Freeman (1987) notes the crucial role of state agencies in Japan – such as the Ministry of International Trade and Industry (MITI) – in shaping the direction of technical change and the dynamic allocation of resources of private actors. He argues that the identification of long-term strategic goals and support from the state agency was possible thanks to an institutional framework that enabled and promoted private actors to proactively work towards the attainment of these goals.

Freeman also shows that interventions evolved over time, shifting from energy, steel and chemicals during the post-war period to computer, telecommunications and semiconductors after the 70's. This narrative interprets the success of the Japanese economy in catching-up as a result of the early realisation of the crucial importance of the 'knowledge economy', the need to invest in Information and Communication Technologies and in their diffusion throughout the Japanese economic system.⁵⁹

Mission-Oriented

The mission-oriented approach builds on the principles presented above and uses them in a specific context of societal challenges. Mission-oriented innovation policy was introduced in the 1980s as technology policy linked to specific projects of national strategic relevance, such as building technological capabilities for military uses (Ergas, 1987)⁶⁰, or in areas where firms did not have enough market incentives to participate (Vanuccini and Cantner, 2018). Mazzucato (2016) thus contrasts the rationale of the mission-orientated approach of creating markets, with that of fixing market failures. She **suggests that governments, by playing a leading role at different levels and stages of the missions and deciding the direction of innovative efforts, mobilise a range of economic actors and resources from both**

⁵⁸ OECD (1999), *Managing National Innovation Systems*

⁵⁹ Freeman, C. 1987. *Technology Policy and Economic Performance: Lessons from Japan*, London, Frances Pinter

⁶⁰ Ergas, H. Does Technology Policy Matter? *Cent. Eur. Policy Stud.* (1987).

public and private actors, in order to attain the mission's specific objectives.⁶¹ Mission-orientated policy shapes new markets as the public sector pushes forward specific technologies and socio-technical solutions.

More recently, mission-orientated policy has focussed on addressing a range of long-run failures or grand societal challenges characterised by both high levels of uncertainty and unknown demand-side such as global warming (Vanuccini and Canter, (2018)⁶², Foray, Mowery, and Nelson (2012), Bloom, van Reenen and Williams, (2019)⁶³). It is concerned with both the intensity of innovative activities and their direction in order to attain societal goals (MOIIS-IIP (2019), Vanuccini et al. (2018)⁶⁴, Mazzucato (2018)). Some of the most urgent social problems, such as the ageing population and global warming, are intergenerational problems, but present generations *vis-à-vis* the future generations have less incentives to change behaviour upon longer term disruptive effects (e.g. drastically change consumption habits or labour-leisure choices that reduce today's welfare). The state, by revealing future demand for products and promoting certain types of technologies, leverages private innovative efforts in particular directions. Therefore, the state has a role to play in addressing long-run market failures and intergenerational inconsistencies.

Box 2: Case Study – Germany's Energiewende

Germany's Energiewende mission-oriented policy models the implementation of an integrated strategy that addresses several sectors and technologies, and enables bottom-up learning processes.

The Energiewende provides direction to transformation in production, distribution, and consumption across sectors in response to missions of fighting climate change, phasing-out nuclear power and increasing energy efficiency. For example, the policy has placed pressure on the steel industry to lower its material content through the use of a 'reuse, recycle, and repurpose' strategy.

In its 6th Energy Research Programme, the German Federal Government outlined the principles and focus of its funding policy on technologies that could contribute to the objectives of the Energiewende.⁶⁵

⁶¹ Mazzucato, M. From market fixing to market-creating: a new framework for innovation policy. *Ind. Innov.* 23, 140–156 (2016).

⁶² Cantner, U. and Vannuccini, S. Elements of a Schumpeterian catalytic research and innovation policy. *Ind. Corp. Chang.* 27, 833–850 (2018).

⁶³ Bloom, N., Van Reenen, J., Williams, H., 2019. A Toolkit of Policies to Promote Innovation. *J. Econ. Perspect.* 33, 163–184.

⁶⁴ Cantner, U. and Vannuccini, op. cit.

⁶⁵ Kuitinen H., Velte D. (2018), *Case Study Report. Energiewende, Mission-orientated R&I Policies: In-depth Case Studies*, European Commission

Section 2: International comparisons

Chapter summary:

The key lessons from sectoral policies of China, France, Germany, and Japan analysed in this report include:

- *Sectoral initiatives are based on an in-depth understanding of each country's respective strengths and weaknesses, and are integrated with wider policy objectives, usually related to the innovation policy, missions and grand challenges.*
- *The system of sectoral support operates at a number of levels (from long-term visions, to ad hoc support) and spans a wide range of industries, technologies and missions.*
- *Interventions are implemented through medium to long-term initiatives which ensure policy continuity but also their steady evolution and improvement.*
- *Support for the manufacturing sector is one of the key objectives in all four countries.*
- *Grand visions are accompanied by specific objectives.*

The purpose of this section is to present an overview of key lessons from sectoral interventions adopted in other developed economies.

We have chosen to focus on four countries: France, Germany, China, and Japan. The first two were chosen as UK's closest economic peers, both in terms of geography as well as size and the level of development. China and Japan, while bigger and more dissimilar in terms of economic structure, were included due to their legacy of active involvement of government in the economy.

The national initiatives analysed here include:

- **China:** 12th and 13th Five Year Plans, Made in China 2025 Strategy
- **France:** Nouvelle France Industrielle (NFI) programme (2013)⁶⁶ and its successor Industrie du Futur (IdF) (2015)⁶⁷; we also refer to the Programme d'investissement d'avenir (PIA) launched in 2010
- **Germany:** three generations of High-Tech Strategies (2006, 2010, 2018) and the "Made in Germany: Industrial Strategy 2030" document

- **Japan:** a series of initiatives related to the Society 5.0 agenda including: the 5th Science and Technology Plan, Investment for the Future Strategy and the New Economic Policy Package (2017), Connected Industries Tokyo Initiative 2017, the New Industrial Structure Vision/Future Vision Towards 2030s and individual sectoral initiatives (e.g. the New Strategic Roadmap for Hydrogen and Fuel Cells)

We discuss dedicated sectoral policy initiatives where appropriate. Please see Annex A for more information on each of the schemes.

Key lessons from international comparisons

Drawing lessons from other countries' experience must come with a caveat that policies in every country are a result of their unique circumstances. However, this does not mean we cannot try to identify those features of international schemes which, to a lesser or greater extent, can be applicable in the UK. Below we list common themes a from across the four economies which can inform the UK's sectoral approach.

The four countries' sectoral initiatives are based on an in-depth understanding of their respective strengths and weaknesses, and are integrated with wider policy objectives, usually related to the innovation policy, missions and grand challenges.

The blurred lines between typical sectoral interventions and wider economic policy is a feature of all the cases analysed here. On the one hand, this makes it difficult to define what exactly constitutes sectoral policy, but, on the other, shows that policy delivery through broad grand vision is now standard practice in developed economies.

Germany's High-Tech Strategy is a case in point. Although conceived as a broad innovation strategy, rather than an individual sector support programme, the initiative does identify specific industries and technologies to be supported. Its most recent incarnation, the High-Tech Strategy 2025 is built around 6 grand challenges (Health and Care; Sustainability, Climate Protection and Energy; Mobility; Urban and Rural Areas; Safety and Security; Economy and Work 4.0) and 12 missions.

Similarly, France built its programme of manufacturing industry support around missions first identified in the Nouvelle France Industrielle programme and then updated in the Industrie du Futur scheme. IdF identifies '9 industrial solutions' that provide responses to key economic and social challenges. These include: Data Economy; Smart Objects; Digital Trust; Smart Food Production; New Resources; Sustainable Cities; Eco-mobility; Medicine of the Future; Transport of Tomorrow.

⁶⁶ New Industrial France: Building France's industry future (2013), www.economie.gouv.fr/nouvelle-france-industrielle

⁶⁷ EU Commission (2017), France: *Industrie du Futur*, Digital Transformation Monitor

Also Japan's current economic policy has roots in innovation policy (the 5th Science and Technology Plan) and is also built around technological themes known as the “connected industries”: Automated Driving and Mobility Services, Manufacturing and Robotics, Plant/Infrastructure Safety Management, Biotechnologies and Materials, Smart Life.

Even China, which identifies 10 more traditional industries to be supported in its Made in China 2025 Strategy (new information technology, numerical control tools, aerospace equipment, high-tech ships, railway equipment, energy saving, new materials, medical devices, agricultural machinery, power equipment) underlines technological upgrading as one of the overarching goals of the strategy.

All the strategies reflect, to a lesser or greater extent, the overarching economic national interest of each of the countries. In Germany and France, it is the attempt to protect their respective manufacturing industries against international competition by securing comparative advantages in new technologies. For Japan, it is the need to restructure the economy over-reliant on big conglomerates and to secure the future of a resource-poor economy and a rapidly ageing society. In China, it is the determination to decrease reliance on international investment and move the economy higher up the value chain.

The system of sectoral support operates at a number of levels (from long-term visions, to ad hoc support) and spans a wide range of industries, technologies and missions.

In general, Germany and France have, at least until very recently, relied more on broad-based approaches to selective policy. The successive High-Tech Strategies in Germany and the IdF programme are both grand-vision-type schemes which use selective interventions as delivery tools. That said, both Germany and France have never completely withdrawn from involvement in their key industries. The subsidies that both countries (alongside the UK) provided to Airbus over the last three decades prove the point.⁶⁸ More recently, in response to the Covid-19 crisis the French government has announced a support package of €8 billion aimed at the automotive industry, while Germany hinted at the need to overhaul the EU competition law in order to allow the creation of national and European champions.⁶⁹⁷⁰

⁶⁸ https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds316_e.htm

⁶⁹ Mallet V., *Emmanuel Macron injects €8bn to fuel French car industry revival*, Financial Times, 26 May 2020

⁷⁰ Federal Ministry for Economic Affairs and Energy (2019), *Made in Germany: Industrial Strategy 2030*

China and Japan also adopt a mixed approach, with comprehensive strategies alongside more direct support for individual industries, but perhaps put more emphasis on the latter. In Japan, the strategic framework is provided by the concept of “connected industries” (see above), but the government also separately intervenes in its key industries. For instance, as part of its Hydrogen strategy the Japanese government provides a subsidy of up to 2 million yen (~£14,500, approximately a third of the 2018 market price) in addition to significant R&D support for project across the wider hydrogen supply chain. Perhaps unsurprisingly, China publishes strategies for individual industries going as far as introducing specific production targets (e.g. Energy-saving and new-energy auto industry plan (2012-2020))

As already indicated in the previous section, the strategies in all countries target a broad set of sectors, technologies, or missions.

Interventions are implemented through medium to long-term initiatives which ensure policy continuity but also their steady evolution and improvement.

All countries we looked at have maintained a degree of continuity in their policies over the last decade.

Germany launched its High-Tech Strategy in 2006, updated it in 2010 and 2018, and have most recently incorporated these strategies into the “Made in Germany: Industrial Strategy 2030” document.

Japan has a longstanding tradition of government support for key industries. One aspect of that is the powerful role played by the Ministry of International Trade and Industry or the 1999 Basic Act on the Promotion of Core Manufacturing Technology in the previous paragraph. More recently, the Japanese selective policy evolved through a series of documents starting from the 5th Science and Technology Plan (2015), through to the Investment for the Future Strategy and the New Economic Policy Package in 2017 and the New Industrial Structure Vision published in 2018.

France's current policy evolved from the PIA scheme (Programme d'investissement d'avenir, which is a more general innovation support programme similar to the Industrial Strategy Challenge Fund) launched in 2010. More specific selective support is being implemented through the Nouvelle France Industrielle (NFI) scheme published in 2013, which was then rebranded in 2015 the Industrie du Futur (IdF) programme.

China's policy evolves through its successive Five-Year Plans.

Support for the manufacturing sector is one of the key objectives in all four countries.

The focus on manufacturing to a great extent reflects much greater reliance of the analysed countries on the manufacturing industry as the source of economic growth. However, it also indicates the belief shared in all those countries that it is manufacturing where the new technologies such as AI or robotics will bring significant competitive advantages.

Thus, the Chinese 12th Five Year Plan included a separate chapter on technological upgrading of key manufacturing industries and advanced manufacturing covers 6 out of 10 priority areas in the Made in China 2025 strategy. The French IdF scheme was specifically designed to modernise the country's manufacturing base by promoting more widespread adoption of new technologies. In Germany, High-Tech Strategies have a very strong manufacturing focus, and the National Industrial Strategy 2030 has a specific aim to increase the share of manufacturing in domestic production to 25%. As for Japan, Manufacturing and Robotics has been singled out as one of the key "connected industries". In addition, on the basis of the 1999 Basic Act on the Promotion of Core Manufacturing Technology, every year the Japanese government has to submit to the Parliament a report on measures it took to promote manufacturing technology (White Paper on Manufacturing Industries (Monodzukuri)). Each year the report identifies a detailed set of key challenges and proposes actions to tackle them.

Grand visions are accompanied by specific objectives.

While the strategic schemes analysed here will often present very broad ambitions, they also set out a number of very specific shorter-term goals in order to drive implementation.

Cunningham et al. (2013) stresses that the success of the first German High-Tech Strategy relied to a great extent on precise measures, clearly defined actions; clear links to other policy initiatives and clear targets and milestones.⁷¹

In Japan, while the official documents related to the Society 5.0 agenda offer mostly only high-level aims, the dedicated sectoral interventions do present a very clear vision and a set of goals it wants the industry to achieve. For example, the Japanese government's hydrogen strategy aims to reduce the price premium for fuel cell vehicles over hybrid vehicles from ¥3m (\$27,690) today to ¥0.7m by 2025. It also sets a target of 200,000 fuel cell vehicles on the road by 2025 and 800,000 by 2030, fuelled from a network of 900 filling stations, up around nine-fold from today.

⁷¹ Cunningham P, Edler J., Flanagan K., Laredo P. (2013), *Innovation policy mix and instrument interaction: a review*, Nesta Working Paper No. 13/20

Unsurprisingly for a command-economy, China's sectoral policy relies most heavily on targets. Made in China 2025 strategy is built around the aim of raising domestic content of core components and materials to 40 percent by 2020 and 70 percent by 2025. The Strategy introduces a series of targets on domestic market share of specific products. For example, it envisions producing 50% of industrial robots domestically by 2020 and 70% by 2025.

The objectives of the French IdF schemes are less well articulated but its automotive sector strategy pledges, for example, to have one million all-electric and plug-in hybrid vehicles in use by 2022.

Section 3: The UK approach to selective policy

Chapter summary:

- *It is too early to pass judgement on the impact of the sectoral elements of the 2017 Industrial Strategy. That said, the circumstances require to start the conversation about their future iterations.*
- *Sector Deal and Grand Challenges, which provide the framework for selective interventions in the UK, serve an important role for the future of the UK economy.*
- *Sector Deals' undeniable strength is that they created a platform for cooperation between government and the industry.*
- *Greater ambition, versatility, and clearer objectives are the areas to consider when thinking about the evolution of the Sector Deals.*
- *There could be potential benefits from a closer integration of Grand Challenges and Sector Deals.*

A paper published by the Department of Business, Innovation and Skills in 2012 set the scene for the revival of the UK sectoral policy based upon close partnerships between industry and government. This new attitude towards industrial policy culminated in the explicit recognition of the importance of sectoral policies in the Industrial Strategy White Paper in 2017. As well as including economy-wide policies, in the areas of skills, infrastructure, innovation and the business environment, the Industrial Strategy re-established the Government's commitment to selective policies. This chapter considers the UK's approach to selective policies, including an in-depth case study on the Creative Industry Sector Deal, and suggests potential avenues for its further development.

Current policy context

After a period of active government involvement in the economy in the 60s and 70s, and the subsequent era of privatisation and hands-off approach, the interest in sectoral industrial policy has been reignited in the aftermath of the

global financial crisis. Having seen the growth rate of productivity fall sharply over the last decade and facing increasing competition from developing economies, many developed countries, including the UK, decided to reengage in selective industrial policies in an attempt to raise aggregate productivity.

“Industrial strategy: UK sector analysis” report published by Department of Business, Innovation and Skills in 2012 set the scene for the revival of the UK sectoral policy.⁷² It suggested that as businesses are self-organised into sectors, and with national economic data organised accordingly, policies lend themselves to be sector-facing. It highlighted that to meet policy goals, the Government requires strong dialogue with specific sectors. The paper pointed out that government policy can carry risks and lead to distributional issues, which sectoral policy can be effective at offsetting. A strong government dialogue with business sectors and sector leaders was also characterised as potentially having a significant impact on global investment decisions and helping drive confidence in the UK as a sustainable location to access global markets. Finally, it suggested that sectoral interventions can allow for policies to be tested on a smaller scale minimising the risks and can lead to wider policy adjustments.

The design principles of the 2017 Industrial Strategy’s selective policies reflect many of the arguments set out in 2012. The following chapters consider the elements of sectoral policy presented in that document.

Sector Deals

Sector Deals have been designed under the business environment objective of the Industrial Strategy as the primary instrument for selective policy. They are defined as long term partnerships between government and the industry aimed at boosting productivity, employment, innovation and skills in the UK sectors.

The Sector Deal approach differs from past UK policies in that the proposals for interventions come from industries themselves, showing evidence of strong collaboration and engagement across the whole breadth of the sector. The Sector Deals are bespoke and tailored to meet the needs of their sector. Some Sector Deals have included funding from the Industrial Strategy Challenge Fund, however funding from the ISCF is neither a requirement nor a given for Sector Deals.⁷³ The sector deal approach is built on the notion that many of the issues are best understood in a sector-specific context and that a more constructive dialogue with business can be had at a sector level, where a clear case for addressing sector-specific issues can

⁷² BIS 2012 Industrial strategy: UK sector analysis, <https://www.gov.uk/government/publications/industrial-strategy-uk-sector-analysis>

⁷³ BEIS response to select committee

be made. Sector Deals are expected to encourage competition and avoid sectoral favouritism.

Ten Sector Deals have been published to date. See Annex C for more information.

Grand Challenges

Grand Challenges are mission-orientated policy programmes set out to put the UK at the forefront of the industries of the future, ensuring that the UK takes advantage of major global changes, improves people's lives and the country's productivity. Each Grand Challenge also addresses specific problems in the form of missions.

While Grand Challenges don't focus exclusively on sectors (they are cross-sectoral by nature, and target groupings of technologies and sectors), they are based on the principle of providing selective support for economic activities that are deemed to be strategic and, therefore, are included in this discussion. We consider them relevant as, on the one hand, they are a response to the economic theory that calls for a more systemic approach to industrial policy and, on the other, they are now a common element of selective policies in many developed countries.

The current four grand challenges - AI and data, ageing society, clean growth and future of transport - aim to focus the attention of the public sector on long-term societal problems and galvanise the private sector to help solve them, while at the same time capitalising on arising economic opportunities.

There are multiple links between Grand Challenges and individual Sector Deals, although mostly on a case-by-case basis rather than as a consequence of a premeditated policy design.

Strengths and weaknesses of the UK sectoral policy

It is still too early to pass final judgement on the impact of the sectoral elements of the 2017 Industrial Strategy, and we acknowledge that the Government has been working on a detailed evaluation framework for the entire Sector Deals programme. That said, the section below highlights some of the strengths and weaknesses of the policy design we have identified. We hope this will help inform the discussion on the evolution of the sectoral policy in the UK.

Strengths

It should be acknowledged that **Sector Deals have generally been welcomed by the business community.** In particular, the government's insistence on a very close involvement of sector representatives in the formulation of the deals has received many plaudits. From the start, Sector Deals were defined as partnerships between the

government and the industry on sector-specific issues aiming to: a) provide private actors in the industry the confidence to make substantial investments for the long term, b) build on UK's existing strength, c) enhance performance through collaboration between different actors, d) align different policies, and e) create sector-wide-institutions.

The fact that the Sector Deals have set up an institutional framework to facilitate dialogue between government and the industry has also been noticed and complimented by the academic community.

The 2019 Select Committee report on Sector Deals highlighted broad support for the Government's approach to public-private collaboration, but also pointed to some practical difficulties involved in the process. The Select Committee states that the creation of sector councils (bodies representing the sector) has been welcomed by sectors, even those without a deal such as retail, and continues to be valued by those with a deal. For example, the evidence obtained by the Committee from the representatives of the hospitality sector at the time highlighted that the industry believed a sector body had an important role to play in raising productivity.

The Select Committee report points out that sectors that have secured a deal to date have either already had or have created sector councils that enable businesses and Government to work in partnership, such as the longstanding Automotive Council, the more recent Construction Leadership Council and Offshore Wind Industry Council, and the new AI Council.

One of the few criticisms of this model highlighted in the Select Committee's report is the failure of some sector councils to represent the full breadth of their industries (e.g. by an inadequate representation small businesses).

Finally, it has been recognised in the ISC 2020 Annual Report that Grand Challenges are an effective approach for tackling the global mega-trends and to ensure greater coordination of a wide range of government policies. The government's approach (which builds on UK's existing strengths, relies on close collaboration between different actors, promotes coordination of different government policies and uses specific goals (missions) as a disciplining mechanism) is in line with many of the best practice principles identified in this document. The value of Grand Challenges as a selective policy stems from the fact that they can create a system of long-term support for industries which will play crucial role in the economy of the future, and will help diffuse new technologies across the economy.

Weaknesses

Ambition and scale

While it is difficult to make a precise comparison between selective policies in different countries, **it does seem that compared to the German, Japanese, French and**

Chinese equivalents described in this report, the UK's sectoral policy is less ambitious and less comprehensive.

In very broad terms, the strategic initiatives of the four analysed countries seem to put greater emphasis on attempting to transform their economies, prepare them for the next industrial revolution and improve their global competitiveness.

Japan provides a good example of this very deliberate integration of sectoral policy with a long-term economic and societal strategy. Japan's overarching aim is a transition to what is called "Society 5.0" - the next stage of societal development, akin to the transition from an industrial to a digital society, defined as "a super smart society where new technologies integrate cyberspace and physical space to bring prosperity to people". As a way of achieving this vision, the government identifies and targets 5, so-called, "connected industries" (Automated Driving and Mobility Services, Manufacturing and Robotics, Plant/Infrastructure Safety Management, Biotechnologies and Materials, Smart Life) instrumental to facilitating the transition to Society 5.0

But Japan aims high even when it comes to more traditional sectoral support, as in the case of the automotive industry. Not only does the government provide financial support (mainly in the form of R&D investment) but **also presents a very clear vision and a set of goals it wants that industry to achieve.** For example, the Japanese government's hydrogen strategy aims to reduce the price premium for fuel cell vehicles over hybrid vehicles from ¥3m (\$27,690) today to ¥0.7m by 2025. It also sets a target of 200,000 fuel cell vehicles on the road by 2025 and 800,000 by 2030, fuelled from a network of 900 filling stations, up around nine-fold from today. Japan has been supporting the development of hydrogen fuelled vehicles for several years now and dedicated approximately \$1.5 billion (~£1.1 billion) to the hydrogen R&D strategy between 2013-2018.⁷⁴

As for Germany, while its High-Tech Strategy (HTS) is not a direct equivalent of the UK's Sector Deals (as it is an innovation strategy with strong selective elements) it is instructive how it combines the aim of increasing innovation, with the orientation on societal missions and selective support with specific technologies.

As a policy, the first HTS was both well-designed and well-implemented. As suggested by Rammer (2009), the factors behind the *High-tech strategy* which were crucial for its success included: high-level political support (including awareness in all the ministries involved to engage at highest level); **increased funding; close partnership between the relevant actors** (each Federal ministry had a separate unit to link to the Federal Ministry of Education and Research); **well defined interventions**, clear to all actors; **continuity with existing activities**; and **robust evaluation process** (including yearly evaluations; reporting system for the

⁷⁴ Nagashima M. (2018), *Japan's Hydrogen Strategy and Its Economic and Geopolitical Implications*, Centre for Energy

different technologies and industries; a continuous dialogue between industry and stakeholder; and a high level expert group reporting to the Chancellor).⁷⁵

€6 billion (~£5.3 billion) has been invested in R&D as a result of the strategy between 2006-2009, the largest amount public investment in R&D in Germany since reunification. In comparison, the UK allocated over £5.5 billion across 11 sector deals to be spent over a 10-year period (much of which was concentrated in the Life Sciences, Automotive and Aerospace industries). The comparison is less unfavourable if we use the total R&D spending announced in the 2018 Budget, £7 billion over 5 years, but still is slightly lower on an annual basis (£1.8 billion vs £1.4 billion).

The French sectoral policy in many ways is most similar to that adopted by the UK. It underscores the importance of the cooperation between government and interested parties, puts strong emphasis on SME's, adopts a flexible definition of a sector, targets both low and high-tech sectors and allocates funds through open call. **Yet, one area where France is trying to outcompete other countries is its automotive industry.** For example, the French plan to support the adoption of electric vehicles earmarked €700 million to help develop a battery production industry compared to £246 million (~€270 million) invested through the ISCF Faraday Battery Challenge.

Objectives

Sector Deals' lack of clarity about short to medium term goals is, without a doubt, an area for improvement. This point has been made both by the House of Commons' Business, Energy and Industrial Strategy Committee, and by the members of the Productivity Insights Network attending a workshop organised by the Industrial Strategy Council.

At a workshop organised by the ISC the members of the Productivity Insights Network (PIN) stressed that **while the Deals comprise many policies which on their own can be beneficial to the recipients, it is less clear whether they form a coherent package of measures with a specific policy goal.** They suggested that there is no underlying law on the best systems-failures or on the logic of the intervention. It was stressed that the policy would benefit from very specific milestones, a clear sense what should be achieved within a specific timeframe. That would improve the policy as it would serve as a disciplining device for the sector and a safety valve for the government – if by a specific point in time no progress is made on the aims of the policy the government could use that to stop funding or transform the policy and, consequently, minimise the losses to the taxpayer.

⁷⁵ cited in Cunningham et al. (2013)

PIN members also suggested **that clear objectives matter for the delivery of the Deals at a number of levels**: sectors need to know what exactly is being attempted in order to adjust their behaviour and encourage individual businesses to participate, while the government needs that clarity in order to be able to choose appropriate metrics and to monitor the progress of the deal.

In addition, **a series of interviews conducted as a part of this project looking into the details of the Creative Industries Sector Deal revealed a mixed picture in relation to the sector's understanding of the objectives of the Deal**. On the one hand, there seems to be an agreement that the industry broadly understands the high-level objectives of the Deal, focussed on increasing productivity and jobs growth. On the other hand, it has been pointed out that there is much less clarity at a lower, more detailed level, and that not all parts of the sector are engaged with (or in some cases even familiar with) the policy.

Another form of the lack of clarity has been pointed out by the BEIS Select Committee who remarked that the criteria for Sector Deals are not specific and called for greater transparency in that regard. This seems to be an unintended consequence of the 'open door' approach, i.e. an attempt to encourage a wide variety of sectors to prepare a deal, which drove the Sector Deals agenda in its early days, and also exemplifies the government's reliance on industry's view for policy formulation.

Once again, close involvement of interested parties in the policy design process is not in itself an issue. However, in an ideal scenario, the industry involvement should be matched by a very clear steer from the government about what the Deals are trying to achieve.

Versatility

As pointed out in the Sectoral Landscape report accompanying this work, due to large differences in the economic environment and needs across sectors, sectoral policies need to be versatile and tailored specifically to the needs of each industry.

The Sector Deals signed to date include both high-value frontier industries (e.g. aerospace), lower-productivity catch up sectors (e.g. tourism and construction), as well as one technology-specific sector deal (AI). The variety is not a problem in itself, and should in many cases be encouraged, but it provokes questions about whether the current approach reflects the full diversity of those sectors.

While the close collaboration between the industry and the government should, in theory, result in a well-tailored policy, the Select Committee report points to a relatively uniform approach to funding. The bulk of resources available through the Sector Deals come from the Industrial Strategy Challenge Fund and are aimed at supporting innovation. The report points out that "the Government is seemingly focussed on sectors in which R&D investment rather than policy changes can make

an achievable difference”. The report also quotes Richard Warren of UK Steel who stated to the Committee that Sector Deals were “fundamentally a transformational R&D fund” and largely “activities that were ongoing anyway and a big slug of money for R&D.”

The Creative Industries case study presented below seems to confirm that the UKRI funded schemes (Creative Industries Clusters programme and the Audience of the Future challenge) are the strongest elements of the Deal.

In addition, Sector Deal funding has been very concentrated in a handful of high-value sectors. Out of £1.1bn of ISCF funding allocated across 11 deals, £500 million was designated for the Life Sciences sector.

This is not to say that the Deals should deprioritise R&D funding. Rather it is a call for more careful consideration of the Sector Deals’ aims and the best instruments to achieve them. As pointed out in the Sectoral Landscape report, R&D investment does indeed influence the productivity level of high-tech frontier sectors, but might be less effective for industries lower down the productivity scale, where, for example, technology adoption might play a much more important role.

The link between Sector Deals and Grand Challenges

Grand Challenges have been designed as a long-term programme and it is too early judge the effectiveness of this policy. That said, **we take this opportunity to reiterate some of the issues related to the implementation of the Grand Challenges highlighted in the Industrial Strategy Council’s 2020 Annual Report.**

As pointed out before, the government has made a start but not significant progress in galvanising public, private and academic support for action around the Grand Challenges. In part as a result, the progress towards implementing these plans has been modest.

More importantly, the huge potential of the Grand Challenges as a policy framework has not been fully realised yet.

First, GCs can offer a delivery mechanism for an extremely complex set of policies needed to tackle the most pressing societal issues. Second, they can serve as a strategic prioritisation framework, helping identify the UK’s long-term comparative advantages and, therefore, providing direction for the growth policy. Third, GCs can make it easier to coordinate necessary actions of a wide range of actors inside and outside of governments. Finally, they can help build consensus around key long-term economic priorities for the UK and, therefore, secure greater policy continuity.

We believe Grand Challenges can still be used more effectively on all these fronts and policy continuity is key to reaching their full potential.

An important aspect of that untapped potential is the current lack of formal integration between Grand Challenges and Sector Deals. International evidence shows sectoral interventions in other countries are to a much greater degree driven by overarching policy objectives, usually expressed in the form of missions. Grand Challenges can to a much greater extent provide the basis for identifying strategic priorities for the Sector Deals. Conversely, the Sector Deals can be a useful delivery mechanism for the ambitions of the Grand Challenges.

Case study: Creative Industries Sector Deal

In order to better understand the policy design process behind the Sector Deals and the impacts they will have on the industries involved we have conducted a series of interviews with stakeholders involved in the creation and implementation of the Creative Industries Sector Deal. We have chosen the Creative Industries Sector Deal as we believe it exemplifies the new approach to selective policy in the UK - one that reaches beyond the traditional sectors and focusses on fostering collaboration both within the industry and between the sector and the government. It was also due to the unique character of the creative sector, which, unlike more traditional industries such as automotive, is much more fragmented and does not have a long history of government support. Finally, the Creative Industries Sector Deal was one of the earliest deals published by the government - it has now been over 2 years in operation making it easier to comment on the implementation process and some of its early impacts.

It should be noted that this case study does not attempt to assess the impact and the effectiveness of the Deal, nor does it offer a representative account from all parties included in creating and implementing it. The aim of the case study is to highlight some of the defining features of the Deal to start a conversation about the extent to which the current approach to Sector Deals meets the objectives of both the government and the industry.

Background information

Published in March 2018, the Creative Industries Sector Deal set out to improve productivity and growth prospects of the sector and, to that end, committed £150 million and proposed a number of crucial non-spending commitments. The main aim of the Deal included: i) building creative industry 'clusters' around the country, ii) increasing investment in R&D and innovation, iii) promoting greater access to finance, exports and protection of intellectual property, and iv) addressing skills needs and improving diversity.

The key objectives and policies in the Deal were to a great extent influenced by the 2017 Independent Review of the Creative Industries led by Sir Peter Bazalgette.

The key policies announced in the Deal included: i) the Creative Clusters Programme (an ISCF scheme aimed at creating university-industry partnerships to drive sector's R&D investment across the UK), ii) Cultural Development Fund (to encourage towns and cities to invest in culture and creative industries), (iii) Audiences of the Future Challenge (an ISCF scheme promoting investment in new technologies such as virtual reality), iv) Creative Industries Trade and Investment Board (to support the aim to increase creative industries' exports by 50% by 2023), v) Creative Scale-Ups programme (supporting growth of small businesses in the industry by improving access to finance), vi) Creative Careers Programme (aiming to improve advice on careers in the creative sector).

Industry profile

As a high growth sector with significant exports and employment potential it is not surprising that Creative Industries has been chosen as one of the recipients of government sectoral support.

That said, the creative sector poses a significant challenge for policy makers from an operational point of view, and thus offers a good example of the informational challenges governments need to overcome when designing sectoral policy. The fragmented structure of the sector makes it difficult to coordinate actions of its members and to target interventions effectively. The industry comprises a wide range of sub-sectors, from crafts to gaming, which, while sharing many common characteristics, are also very heterogeneous and have very different needs. In addition, the vast majority of firms in the sector employ under 10 employees, and freelancing is a widespread mode of employment, further increasing sector's fragmentation and diversity. All this makes evidence gathering challenging and can require considerable analytical resources – the Deal addressed this issue by setting up the Creative Industries Policy and Evidence Centre which provides bespoke analysis on the sector.

In addition, as the industry relies on content and intellectual property as its source of revenue, in contrast to more tangible outputs of traditional industries, it has unique policy needs (e.g. a well-functioning IP regime) and is often less well understood by both policy-makers and investors than traditional sectors. It is also worth noting that the industry requires a complex institutional ecosystem to thrive - from local arts centres to elite schools, from creative to digital skills, from sustained public funding (e.g. BBC funding) to private (often overseas) investment, from physical infrastructure (live music venues and film studios) to a fit-for-purpose IP regime. All this creates significant challenges when it comes to designing and implementing policy that will have real impact.

On the other hand, Creative Industries present a strong case for government intervention targeting industry-specific market failures for the benefit of the wider economy. The fragmentation of the sector points to the need for greater collaboration both within the industry, as well as between the industry and other actors, such as universities, which can be encouraged by the government. The prevalence of small firms and a unique character of their outputs act as an informational barrier to investors which the government intervention can help overcome. Finally, the potential for generating spill-overs (from new digital technologies to international soft power) suggest the investment in the industry can present good value for money.

Achievements to date

There was an almost unanimous agreement among the interviewees that the Sector Deal helped to bring the sector together, provide it with 'one voice', makes the communication between the government and the industry more efficient, and provides a good platform to build on for further government-industry collaboration. A widely expressed opinion was that the Deal has rationalised the discussions with the government and gave the Creative Industries Council (CIC), established in 2011, greater coherence and greater agency in influencing policy decisions. The interviewees believed that in the absence of the CIC a much narrower range of views would be represented in discussions with government. It is also clear from the interviewees' accounts that, as intended, the Council played a very active role in formulating policies that became the basis for the Deal. The Independent Review of the Creative Industries led by Sir Peter Bazalgette, which heavily influenced the Deal, was written in a close collaboration with the industry through the involvement of both the CIC and the Creative Industries Federation.

Furthermore, the participants of the case study generally expressed positive views on implementation of the current commitments. In most cases, good progress on the roll out of key policies has been acknowledged. In particular, positive views were repeatedly expressed in relation to the two ISCF programmes (Audiences of the Future and Creative Clusters). These two schemes were considered to be of great importance to the sector as they promoted R&D investment, which, in the participants' view, was relatively small in the past. It was also suggested that the schemes prepared the sector to absorb more funding, leveraged new private investment, and improved collaboration between the industry and universities.

It has also been acknowledged that the deal includes other commitments which have a potential to transform sector's fortunes, some of them as, or even more, important as the spending programmes. The aim to increase sector's export by 50 per cent by 2023, work on better provision of skills (for example better coordination of creative apprenticeships) and better IP regulation were all mentioned as the commitments where the Deal can make a genuine contribution to sectors' future growth.

Overall, while all interviewees admitted that it's too early to judge the final impact of the deal, their views give some support to the hypothesis that the government can play a positive role in supporting growth of sectors such as Creative Industries. The Sector Deals seems to have improved collaboration between different parts of the industry and between the industry and the government. There are also early signs that the Deal is addressing some of the more fundamental market failures constraining its growth, such as underinvestment in R&D.

Room for improvement

Several interviewees acknowledged that the ambition of the deal is constrained by its scale. One interviewee pointed out that the deal offered £150 million in funding to an over £100 billion industry. Several stakeholders remarked that the proposals in the Deal can be considered to be pilot projects. For instance, the £80 million Creative Industries Clusters Programme was based on the original proposal from the Bazalgette review which called for a fund of £500 million. Similarly, in her recent speech Caroline Dinenage, Creative Industries Minister, referred to the Creative Scale-Up programme as a pilot project. In a sense, this is also acknowledged in the Deal text itself which states "this Sector Deal is just the beginning: the first iteration of an agreement that will develop over time."

Predictably, the scale puts a limit on the coverage of the deal. The participants acknowledged that, while the main schemes of the Deal were useful for the industry, they did not affect all sub-sectors in equal measure, and that, therefore, there might be scope for making the deal more far-reaching. Some interviewees also expressed the view that smaller firms might not be as engaged in the Deal's policies as larger ones.

The interviewees contrasted the relatively modest scale of the Deal with the enormous challenges currently facing the sector including the impact of Covid-19 and the potential negative consequences of Brexit. However, it should be acknowledged that the interviews took place before the Government's announcement of £1.57 billion support package for the cultural, arts and heritage institutions (i.e. including but not exclusive to creative industries).

Two participants also expressed the view that the visibility of the Deal could be improved. Most interviews gave a clear sense that there is a broad understanding of the high level aims of the deal (increasing productivity and growth of the sector) among industry representatives but some suggested that lower down the industry pyramid there might be less clarity on, or in some cases a complete lack of awareness of, what the Deal is trying to achieve and what is expected from individual businesses. One industry participant remarked that one cannot expect to learn much about the Industrial Strategy from trade press and that there is no sense that the Deal had galvanised the industry.

Summary

This case study confirms that the Creative Industries Sector Deal has been seen by the industry as a move in the right direction and a policy with a potential to bring about positive changes to the sector. It is believed to have already improved industry collaboration and to be a promising vehicle for the government to address some of industry's key market failures. However, the study also highlights that the ambitions of the Deal are constrained by its current scale and reach.

Nevertheless, it is worth stressing that the Deal can offer a useful testing ground, and potentially a template, for other service-focussed interventions. The Sectoral Landscape evidence review, published alongside this report, highlights that services offer significant economic opportunities due to their scale, their increasing potential in generating high-value outputs and the UK's leading position relative to other countries.

At the same time, services have not been a traditional target of strategic selective interventions and there is modest experience to draw on when designing service-focussed growth policies. This means a degree of experimentation will be needed to arrive at a successful framework for selective intervention in services.

That is where the Creative Industries Sector Deal (and other service-focussed deals, such as Tourism) offer a real opportunity for the future - by becoming a pathfinder in developing a template for successful service sector intervention it could strengthen UK's competitive advantage in this increasingly important sector.

That will require the government to recognise the potential of this novel approach, pay it more policy attention, and accept the risks of the learning process. It will also require industry leadership to deliver on the stated ambitions of the Deal by presenting a clear vision, rallying relevant actors to support it and by skilfully managing the process of prioritisation of the most promising ventures.

Conclusions

One of the key messages of this report is that designing a successful sectoral policy is a complex undertaking. Both historical experience and empirical evidence give a mixed picture on the effectiveness of past selective interventions. The complexity of the economic environment means that choosing sectors to target, market failures to correct, and policy instruments to use is an immense informational challenge. Finally, the difficulties involved in implementing sectoral policies mean that even a well-designed intervention does not guarantee success.

Nevertheless, economic theory and international practice both suggest that selective policy has an important role to play in the management of the economy. Therefore, the key question is how to implement these policies in a way that maximises returns and minimises the risk of failure.

This report brings together some of the key sectoral policy design principles. We suggest that clearly defined policy objectives, sufficient scale and longevity, a robust governance framework, focus on industries and technologies with systemic significance and adequate government capacity to implement, monitor and phase out the policy when needed are crucial ingredients of success.

These principles will be of particular importance in the coming months and years when in the aftermath of the Covid-19 outbreak many industries will turn to the government for support. When responding to those calls it will be crucial for the government to understand what it is trying to achieve with each policy package, what long-term benefit it can expect, whether it has the capacity to deliver its aims and how the support will be phased out when necessary.

This report also suggests that, while the UK's current approach to sectoral policy has many positive elements, there is also much that can be improved. We point out that **greater ambition, clearer objectives, greater versatility and strengthened policy coordination** might be the areas to consider when thinking about the evolution of the sectoral elements of the Industrial Strategy.

Finally, **we show that the UK has much to learn from international examples of sectoral policies.** In the face of intensifying international competition, we would encourage a continued study of other countries' approaches to sectoral support.

Annex A. International comparisons: background information

China

Historical perspective

The Five-Year Plan for Economic and Social Development of The People's Republic of China (FYP) officially adopted since 1953, is the main instrument outlining the development strategy and objectives for economic and social policy in China. According to Heilmann & Shih (2013), industrial policy is explicitly considered an instrument of economic reform, counting on a dedicated bureaucratic body since 1988.⁷⁶ After several institutional changes over the past decades, the selective approach to industrial policy regained significant momentum from the 10th FYP (2001-2005) onwards. Given that the 13th FYP (2016-2020) is currently being implemented, we focus on the previous 12th FYP (2011-2015).

The FYP constitutes a comprehensive guide for the Chinese industrial policy, containing a number of policies with associated rationales, domains of action and instruments. Arguably, one of the core elements in the 12th FYP is the explicit encouragement of economic transformation and structural change. The plan sets as target increasing the share of services in GDP by four percentage points a major shift of relative importance in the domestic economy from fixed assets investments to consumption from 35% to more than 50% of GDP in 2015; and the promotion of breakthroughs in strategic emerging sectors in addition to restructuring specific manufacturing industries (Holz, 2018).⁷⁷

Recent policies

The selective approach to industrial policy in China regained significant momentum from the 10th Five Year Plan (FYP) (2001-2005) onwards. Given that the 13th FYP (2016-2020) is currently being implemented, we focus on the previous 12th FYP (2011-2015) to discuss the characteristics of the Chinese sectoral policy.

⁷⁶ Heilmann, S. & Shih, L. The Rise of Industrial Policy in China, 1978-2012. Harvard-Yenching Inst. Work. Pap. Ser. (2013)

⁷⁷ Holz, C. A. Industrial policies and the changing patterns of investment in the Chinese economy. China J. 81, 23–57 (2018)

Arguably, one of the core elements in the 12th FYP is the explicit encouragement of economic transformation and structural change. Most importantly from the sectoral perspective, the plan aims to promote breakthroughs in strategic emerging sectors in addition to restructuring specific manufacturing industries.

Below we focus on two key sectoral initiatives outlined in the 12th FYP: (i) the plans to improve and promote manufacture, (ii) promotion and development of new strategic emerging industries (SEIs).

Plans to improve and promote manufacturing (Chapter 9, 12th FYP)

Nine industries were selected in the plan and specific aims identified for each of them (Holz, 2018)⁷⁸:

- **equipment manufacturing** (promotion of production techniques, quality upgrading and fostering green technology, information technologies and a switch to numerical controls);
- **shipbuilding** (technological upgrade of different types of vessels, promotion of liquified gas containers, acceleration of independent design and manufacture of mobile marine production systems and drilling platforms);
- **automotive** (development of new products and production systems, support for innovation in battery technology, motors and materials);
- **iron and steel** (focus on railway applications, support of various product and process innovation for varieties of steel);
- **non-ferrous metals** (focus on aerospace and electronics applications, support for process innovation and waste management);
- **building materials** (support for product innovations with focus on special types of glass, production with green technologies and waste management);
- **petrochemicals** (improving quality standards, investments in complex projects such as integrated refinery, coal electrification and carbon dioxide utilization);
- **light industries** (batteries, plastics, home appliances and others);
- **textiles** (promotion of hi-tech industrial fibres and support of circular economy initiatives)

The rationales for intervention explicitly mentioned in the document included: **strengthening comparative advantages, agglomeration externalities and technological upgrading**. Accordingly, involved policy domains and instruments range from directed industry support (e.g. sectoral-based subsidies) to improved **technological capabilities** via directed foreign investment (e.g. through FDI

⁷⁸ Holz, C. A. (2018), op. cit.

catalogues) and selection mechanisms (e.g. ad-hoc policy for SMEs, incentives for corporate restructuring).

The policy explicitly focuses on strengthening product development capabilities, encouraging brand development, firm restructuring and corporate mergers. The scheme also aims to grow the SME-base via measures including tax incentives and the expansion of financing. What is also characteristic about the plan is the setting of very detailed goals for each industry (e.g. encouraging development of specific products). This highlights China's push to increase the competitiveness of the manufacturing industry.

Promotion and development of new strategic emerging industries (SEIs) (Chapter 10, 12th FYP).

Regarding new strategic emerging industries (SEIs), seven broad sectors were identified by the State Council in 2010. These were chosen as Chinese officials in hope they will become the backbone of the next phase of industrial modernisation in China.

- **energy conservation** and environmental protection technologies;
- **next generation information technology** (mobile communication networks, IoT, software and information development);
- **biotechnology** (R&D and industrialization bases for biopharma and biomedical engineering products, support for application platforms and building of databases);
- **high-end equipment manufacturing** (development of intelligent control systems, spatial infrastructure frameworks, high-class machinery and equipment);
- **new energy** (new-generation nuclear power equipment, infrastructure and promotion of biomass, solar and wind energies)
- **new materials** (R&D and industrialization of carbon fibres, semiconductor, superconductive, high-performance and nanometer materials, and applications for aerospace, infrastructure and transportation); and
- **new energy automobiles** (R&D and commercialization of hybrid and pure electric vehicles, promote industrialized applications).

The plan's most immediate impact was to signal to Chinese government agencies at all levels that future government policies on issues as broad ranging as taxation, human resources, and research and development (R&D) must support SEI development.

As for the design and implementation of the SEIs, financial subsidies and tax rebates are the main incentive for companies to conduct R&D and commercialize innovations.

What is crucial, not all funding will come from central government. The plan will rely on a combination of **funding from various funding sources** – including central government, local government, and private enterprises – to promote SEI technology and product development.

Local governments determine where subsidies will go according to local SEI supportive policies and will decide their own methods for allocating funding.

Additionally, the **National Development and Reform Commission (NDRC) has issued a guiding catalogue of key product and services** that are restricted, permitted or encouraged through foreign investment, domestic private investment and public procurement. It has been argued that the catalogues are a crucial policy tool in the Chinese scheme of industrial planning, significantly affecting the economic activity and rising major issues between foreign and local actors.

Wu et al., (2019) conducted an econometric evaluation of the FYP over the period corresponding to the 9th –12th FYPs. **Taking as unit of analysis the four-digit manufacturing sector level, the authors suggest that the policy significantly improved short-term output of the targeted sectors, a result which appears to be statistically robust.** However, the authors suggest that the net welfare effects of the industrial policy require further analysis.⁷⁹

Generally, the FYP provides the directionality and guiding principles for the sectoral policies while the detailed design is defined in separate plans elaborated by relevant ministries and high-level councils. The details of the implementation of the policies is then largely left to local governments (Sun et al., 2014).⁸⁰

The Chinese Auto Sector Case Study

According to the International Organization of Motor Vehicle Manufacturers, China is currently the world's largest automotive producer and the world's largest market for automobile (2017). To a large extent, Chinese production serves the domestic market and exports auto parts, while exports of manufactured vehicles have remained relatively low in comparison to that of countries such as Germany, Japan, the United States or Mexico (Atlas of Economic Complexity, 2017). **The Chinese car industry is relatively new when compared to those countries, and it**

⁷⁹ Wu Y., Zhu X., Groenewold N. (2019) The determinants and effectiveness of industrial policy in china: A study based on Five-Year Plans, China Economic Review, 2019

⁸⁰ Sun, R., Wu, J. & Liu, B. (2014) Analysis of Strategic Emerging Industrial Policies on the Level of Central Government in China. Open J. Soc. Sci. 02, 76–80

has been argued that its development is the result of an array of industrial policies implemented over the past five decades (Yi, Ying and Xueling, 2017).⁸¹

The government intervention is a long-standing feature of the automobile industry that has survived different political and business cycles, starting with the very first Five-Year Plan for the period 1953-1957.

More recently, the following policies have shaped the auto industry in China:

- **Automotive readjustment and revitalization plan (2009).** The plan comprised seven goals (Donnelly et al. 2010) (including a target to boost output to 10 million units and maintain a future growth rate of 10% until 2012, and to significantly improve industry's R&D performance).
- **The Blueprint for Industry Transformation and Upgrade (2011-2015),** aimed at reinforcing the Government's goal for developing strong domestic innovation capabilities in addition to establishing a recognised domestic brand.
- **The foreign investment catalogue (2011)** which groups foreign investment into four categories – encouraged, permitted, restricted and prohibited – and determines the extent to which sectors/technologies are promoted through tax incentives, regulations for public procurement and other incentives that might vary regionally. Foreign investment in automobile was changed from “encouraged” to “restricted”, while alternative-energy vehicles was moved to “encouraged” (Tang, 2012).⁸²
- **Energy-saving and new-energy auto industry plan (2012-2020)** which sets new directions for the industry, including focus on developing innovations to improve energy efficiency and on EV technologies.

As reflected by different forms of interventions including tariffs, ad-hoc regulations for foreign investments and massive state-backed financing for firms, government policy has tackled industrial organization by successive restructuring of state-owned companies, technological development by promoting international joint ventures and market orientation by influencing the business strategy of domestic producers. (Donnelly et al., 2012)⁸³

⁸¹ Yi, C., Ying H., Xueling G. (2017), *Development and Structure of the Automotive Industry in China*, in: *The Automotive Sector in Emerging Economies: Industrial Policies, Market Dynamics and Trade Unions*, Friedrich Ebert Stiftung

⁸² Tang, R. China 's Auto Sector Development and Policies : Issues and Implications. Congr. Res. Serv. (2012).

⁸³ Donnelly, T., Collis, C., & Begley, J. (2010). Towards sustainable growth in the Chinese automotive industry: internal and external obstacles and comparative lessons. *International Journal of Automotive Technology and Management*

More specifically, the following instruments have been used in the most recent plan (*Energy-saving and new-energy auto industry plan (2012-2020)*⁸⁴):

- **EV Technological Innovation Program** (support for R&D on key core technologies such as batteries, lightweight designs and key materials) ; changes on the architecture of the R&D/Innovation system (encouraging cross-industry alliance and technology and testing platforms, sharing of databases and integration of information)
- **Accelerating the demonstration and application** (stimuli for energy-saving and new energy vehicles application; demonstration and pilots for EV private usage)
- **Building charging infrastructure** (building the slow-charging stick and fast-charging facilities; battery recycling and re-usage)
- **Standards and market-access management:** financial support (credit, loans and other financial product innovation measures); tax incentives; industry-oriented market environment measures; personnel training and international collaboration support for research and development.

The plan promotes the production and adoption of EVs with the following targets:

- **Sales of EVs and plugs-in hybrid cars to reach 0.5 million** by 2015 and 5 million by 2020 (cumulative).
- **Increase production capacity of EV** and plugs-in hybrids cars to reach 2 million units per year.
- **Enhance passenger car fuel economy:** 6.9 liter/100km by 2015 and 5.0 liter/100km by 2020.
- **Rank ahead internationally in new energy automotive,** battery and key components by 2020.
- **Significant enhancement of charging infrastructure** and facilities required for the operation of EV and plugs-in hybrids.
- **Improvement of management practices** and a system of technical standards for companies and products on marketing, services and battery recycling systems.

In terms of planning and implementation, an inter-ministerial committee is in charge for coordination and coherent integration of the various instruments. According to Hove and Sandalowe (2019) they consist mainly of: subsidies tailored to different types of cars and nonfinancial incentives such as city license plate exemption and urban traffic regulations (e.g. access to restricted traffic zones, special parking access and lane access on congestion zones).

⁸⁴ <http://policy.thinkbluedata.com/node/58>

France

Historical perspective

The *dirigisme* – or “high-tech colbertism” (1950s-1980s) – constitutes the heyday of the sectoral policies in France, dominated by the *Grand Projects* and ‘national champions’⁸⁵.

According to Ansaloni & Smith (2018) the *dirigisme* emerged along key transformations in the realm of economic policy in the aftermath of WWII.⁸⁶ Most notably, the role of the Ministry of Finance moved beyond treasury and financial responsibilities to an active management of the economy by means of indicative planning and targeted industrial policy. Second, as discussed by Cohen (2007), French politicians and business leaders reacted to the traumatic experience of the war with the view that France needed industrial and social development.⁸⁷

In this context, *Grand projects* were designed to provide the basis on which a handful of internationally successful French firms emerged. The combination of subsidies and captive markets and the transfer of technologies developed in public research labs, helped promoting French firms to positions of global leadership in high-tech sectors such as nuclear power, high-speed trains, and digital telephone switches (Levy, 2008).⁸⁸

They were characterized by six main features (Cohen, 2007):

- Through “**offensive protectionism**” (grants, procurement policies and protection from foreign entry) the state created the means to accumulate capabilities in specific sectors of interest.
- **Bringing together different actors related to the sectors** (public servants, industrialist, users) and making them accountable for success.
- **Flexible operationalization by the state**, such as in differentiated financing schemes
- **Provision of initial capital investment**, when absent, to then move away once firms were capable of self-sustaining investment.

⁸⁵ The ‘national champions’ have been broadly defined by Hayward (1995) as “an enterprise responsive to its national government’s need and entitled to its national government’s support”.

⁸⁶ Ansaloni, M., Smith, A., 2018. The neo-dirigiste production of French capitalism since 1980: The view from three major industries. *French Polit.* 16, 154–178. doi:10.1057/s41253-018-0061-1

⁸⁷ Cohen, E., 2007. Industrial policies in France: The old and the new. *J. Ind. Compet. Trade* 7, 213–227. doi:10.1007/s10842-007-0024-8

⁸⁸ Levy, J.D., 2008. From the Dirigiste State to the Social Anaesthesia State: French Economic Policy in the Longue Durée. *Mod. Contemp. Fr.* 16, 417–435. doi:10.1080/09639480802413371

- **Convergence of policy and industry objectives.**
- **Mobilisation and commitment of the working class** to the purposes of the state-entrepreneur and the national interests represented by the 'national champions'.

The *Grand projects* focused on in the following sectors: oil industry, nuclear power generation, aircraft manufacturing (civil and military), space, telecommunications, railway.

Most of the public support during 70s and 80s was directed towards uncompetitive firms, in declining sectors, such as coal, chemicals, steel, furniture, among others (Levy, 2008).⁸⁹ Firms received subsidies and public credit to delay lay-offs and associated social upheaval.

The focus on inefficient industries, and the failure of policy to support growth and jobs, led to a U-turn on the policy of state support. As explained in the opening paragraph of Levy (1990): "The mid-1980s witnessed a retreat of the French state from many of its traditional dirigiste practices. Industrial policy budgets were slashed, financial markets deregulated, price controls lifted, and all manner of restrictions on hiring and firing eliminated."⁹⁰

Despite changes, the role of the state was still significant over the 1980s-1990s period (Clift, 2013)⁹¹: procurement favoured French firms, the state discretionally funded specific industries, and large corporations such as Renault and Michelin were bailed-out. This period is better described as an adaptation stage rather than a change in the state-led paradigm (Ansaloni & Smith, 2018).

Recent policies

France has a longstanding tradition of active state involvement in the economy. However, French selective policy has evolved over the years from a top-down support of individual firms or sectors to a more broad-based and bottom-up approach.

Modern sectoral strategy in France

The most recent period (2000s onwards) has been characterized by attempts from the state to regain means of steering the economy and boosting economic dynamism following the 2008 financial crisis with a number of sectoral industrial policies.

⁸⁹ These sectors obtained substantial support from the state during Mitterrand's government, whose approach to *dirigisme* has been labelled as "voluntarist" given its claim that "there are no condemned sectors; there are only excessively old factories and equipment" (Levy, 2008, p.421).

⁹⁰ Levy J. D. (1990), "*Dirigisme*" revisited, French Politics and Society, Vol. 8, No. 1

⁹¹ Clift, B. (2013), Economic Patriotism, the Clash of Capitalisms, and State Aid in the European Union. J. Ind. Compet. Trade 13, 101–117

According to the Beffa Report (2005) cited in by Cohen (2007), **this new phase sees the role of the state as a ‘catalyst’ rather than the ‘benevolent tyrant’ of the *dirigisme* period, which is reflected in the focus on collaborative strategies between different actors.**⁹² While during the *Grand Projects* sectoral policies were explicitly designed for the “national champions”, the latest recent wave of industrial policies has avoided support to large companies and to a large extent it has been explicitly directed towards SMEs. It has been argued that this change is also in line with the general European policy framework (Mustar, 2016).

The PIA (*Programme d’investissement d’avenir*), launched in 2010, was initially aimed to develop four “high-potential” sectors (higher education and research, industry and SMEs, sustainable development and the digital sector) and was later expanded to cover also the food and tourism industries. Arguably, the very concept of sector is broader and used in a more flexible way in these policies with respect to earlier waves, moving away from the industrial based policies of the *Grand projects*.

Among the policies enacted in the third period, the **PIA combines different types of funding (subsidies, allowances and loans)** different criteria for design and implementation (from promoting particular technologies, to seed funds and centers of research) and **an allocation based on competitive calls for projects** (Mustar, 2016).⁹³

The PIA’s design differs substantially with respect to previous French sectoral policies (Mustar, 2016). Namely, **funds are allocated through open calls rather than in a top down manner or through integrated scientific public institutions.** Funds are assigned by evaluated, international expert juries, which deliberately challenges institutional barriers between research laboratories, universities, other higher education institutions and industry.

The Nouvelle France Industrielle launched in 2013 included investments of public-private partnerships in order to develop specific projects for **technological upgrading**. By 2015, the program was redesigned under the name of ***Industrie du Futur (IdF)***, which can be defined as **selective on the basis of its focus on specific technologies, although these are supported across the French industry (with a focus on SMEs) mainly using horizontal instruments.**

Nine “theme-based” areas of focus have been put forth as “industrial solutions for key markets” in order to modernise the French industry. These areas or priority markets are coordinated by project leaders from industry as follows: transport; smart objects

⁹² Cohen, E., 2007, op. cit.

⁹³ Mustar, P. Industrial policy in France: in search of lost time. *Econ. e Polit. Ind.* 43, 305–313 (2016), See <https://uk.ambafrance.org/Investments-for-the-Future-Programme> for more details

and IoT; new resources; medicine; digital trust and security; sustainable cities; data economy; smart food production; eco-mobility.

The *IdF* designed **cross-cutting (mainly horizontal)** programs around five aims:

- develop IoT-related cutting-edge technologies;
- financial and strategic support for industrial adaptation;
- employee training for current industrial workforce and forward-looking studies on new skills;
- reinforcement of international cooperation setting standards and alliances for technological development;
- promoting French industries of the future through international business fairs, commercialization and marketing efforts (Larosse, 2017).⁹⁴

Through alliance between different stakeholders, the private sector leads the implementation of projects in a bottom-up approach. The government provides funding through different instruments **including loans for SMEs, tax aid for investment in relevant technologies, subsidies for staff training, and call for projects.** The different funding instruments are managed by the public investment bank Bpifrance. Importantly, the funds are conditioned on the private sector investing at least the same amount provided by the state.

Case study: Aerospace and Airbus

In 1946 the National Office for Aeronautical Studies and Research (ONERA) was created, to coordinate a range of aircraft manufacturers and research groups in aeronautical studies scattered across France,¹⁶ with the purpose of conducting military and civil R&D in aeronautics. In the context of Grand projects, ONERA served as the public research laboratory in charge of pushing the technological frontier. In this regard, from the late 1940s to 1980s, ONERA achieved major advances in both basic and applied research which were introduced in different military and scientific fields, alas, breakthroughs with commercial applications were limited.

At the same time, the Ministry of Defense through the Délégation Générale à l'Armement (DGA), procured through three national champions, following the Grand Project formula in generating critical technological capabilities and considerable production capacity via procurement.

Following the wave of public sector reforms in 1982-1983, ONERA went through important organisational changes, moving towards active collaborations with

⁹⁴ Larosse, J. Analysis of National Initiatives on Digitising European Industry. France: Alliancia Industrie du Futur. (2017).

universities and other CNRS laboratories, in addition to transferring results for industrial purposes as one of its core missions. Here, it was intended that ONERA positioning was that of a bridge between the network of research and the French industrialists.

The subsidies on research for civil programmes were reduced and slowly the core of the industry support changed towards market-driven interventions. Although the main civil aircraft and helicopter manufacturer, Aérospatiale, remained state-owned, the firm increasingly followed its own goals rather than the French state directions. Targeted interventions weakened also as the European integration framework advanced.

The civil aviation market eventually displaced the military in importance, inducing strategic alliances and industrial reorganization in the industry. This process eventually led to the consortium of several European firms forming today's Airbus Group. The Airbus project integrated French, German, UK and Spanish-based firms with the aim of competing with the US aircraft manufacturers by produce larger airplanes for long-distance journeys. In the case of France, Aérospatiale represented nearly 38% of the initial Airbus project and thus French public funds were essential in making the consortium operational.

As the company completed successful projects and grew worldwide, the public financing decreased for antitrust concerns and Aérospatiale's principal assets were absorbed by the Airbus consortium. After major changes in governance in the early 2000s, the Airbus Group is today a private firm and although the role of the state in the industry is quite limited, as of today Airbus still counts on public funds by means of the Repayable Launch Investments.

In line with the Grand Projects and the strategic rationale of the intervention, in the early stages the state had a strong direct role: market protection from foreign competition, industrial restructuring directly sponsored by state investments, subsidies for technological investment and development, and direct investment in research through the ONERA.

The Ministry of Defense through the DGA (Délégation Générale à l'Armement) had power over the entire industry, thus occupying a central role not only in leading strategic decisions and setting goals in research programmes but also influencing choices of technological development, product manufacturing and internal operations of private enterprises. More concretely, the DGA organised procurement plans with an "arsenal logic", i.e. an array of monopolies or duopolies (the "national champions") linked to particular products that benefited from procurement: state-owned SNECMA provided manufacturing engines; state-owned Aérospatiale provided civil aircraft and helicopter manufacturing; privately-owned Dassault and Breguet (later acquired by the former) produced aircrafts and missiles for military programmes.

Although the Airbus initiative lacked an overall timeline with specific milestones, a strong monitoring system at the finer project level was in place (Domini & Chicot, 2018).⁹⁵ At the higher level, a governing body was in charge of making strategic and commercial assessments as the project evolved. The nature and composition of this body changed through time, beginning with heavy involvement of the state parties via supervisory boards, and later mutating to a more standard corporate scheme with clear defined directors, executive committee, operational executives and commercial committee.

Considering the impact of Airbus in terms of accumulated profits, technological solutions, contribution to European integration, breaking the hegemony of US aircrafts and strengthened European suppliers industry, the case is usually portrayed as the posterchild success of targeted industrial policy (Owen, 2012; Maincent & Navarro, 2006; Domini & Chicot, 2018).⁹⁶ Nonetheless, it is argued that the aerospace sector holds very particular characteristics that explains its success, namely: high fixed costs of production; significant scale economies; and relatively low product differentiation. Interestingly, Neven and Seabright (1995) have shown that the entry of Airbus was profitable in Europe, but it also reduced scale and scope economies of other actors of the market thus preventing lowering prices of planes.⁹⁷

⁹⁵ Domini A., Chicot J. (2018), *Case Study Report. From Concorde to Airbus*, Mission-oriented R&I Policies: In-depths case studies, European Commission

⁹⁶ Owen, G. Industrial policy in Europe since the Second World War: what has been learnt? ECIPE Occas. Pap. 1, 5,20-23 (2012).

⁹⁷ Neven, D. & Seabright, P. European industrial policy: The Airbus Case. Econ. Policy October, (1995).

Germany

Historical perspective

During the post WWII period Germany's industrial policy was mainly horizontal, with the exceptions of state interventions through provision of credit through bank for reconstruction (KfW), and applied research to support companies (e.g. the Fraunhofer institutes). The KfW funded specific firms more than industries (Vitols 1997),⁹⁸ although more recently it funded the Energiewende (Mazzucato and Penna, 2015).⁹⁹ The Government role was usually limited with providing framework conditions delegating the implementation to associations of employers, business and trade unions (Hanckne and Coulter, 2013).¹⁰⁰ The horizontal policies benefitted mainly relatively mature sectors, whereas more strategic sectors such as telecommunications, software and biotechnology benefitted from more direct interventions (Hancke and Coulter, 2013).

Recent policies

High-Tech Strategy

In 2006 Germany adopted the *High-Tech Strategy*. This was the first strategy which involved all ministries to improve the relation between research outcomes and industry (Rammer 2007).¹⁰¹ The overall objective was a *coordinated innovation policy* bridging between science and industry and between technologies and fields of application. More detailed objectives were as follows:

- First, using Germany's potential to become lead market of the future through an innovation friendly markets that attracts private investment in high-tech sectors.
- Second, creating conditions for universities and research institutes to reach excellence at international level.
- Third, making Germany a talent incubator – making careers in science more attractive, providing high-quality scientific training as well as vocational training – as an instrument to build the industry of the future.

To reach the objectives, the strategy proposed coordinated interventions in five key cross-cutting areas: (i) strengthening the interface between research and

⁹⁸ Vitols, S. German Industrial Policy: An Overview. *Industry and Innovation* 4, 15–36 (1997)

⁹⁹ Mazzucato M., Penna C. (2015), *The Rise of Mission-Oriented State Investment Banks: The Cases of Germany's KfW and Brazil's BNDES*, SWPS 2015-26

¹⁰⁰ Hancké B. & Coulter S. *The German manufacturing sector unpacked: institutions, policies and future trajectories* Future. (Foresight, Government Office for Science, 2013).

¹⁰¹ Rammer C. (2007) *Monitoring and analysis of policies and public financing instruments conducive to higher levels of R&D investments*, The "POLICY MIX" Project. 1–47 (2007).

industry; (ii) inducing more private R&D and innovation; (iii) promoting dissemination of technologies; (iv) internationalisation of research, development and innovation; and (v) fostering training and skill upgrading.

The *High-Tech Strategy* focuses on 17 technologies and industries, subdivided into groups based on their capacity to:

- lead to several applications;
- drive transformation of key industries (such as automotive and mechanical engineering, at the core of Germany's strengths);
- increase the competitiveness of such industries in export markets;
- expand Germany's strength as a provider of systems technologies;
- induce spillovers across sectors;
- address pressing challenges.

Technologies and industries which were considered to be driving transformations of industries (cross-cutting technologies group) were: nanotechnologies, biotechnology, microsystems technology (paving the way for intelligent products), optical technologies, materials technologies, production technologies (mechanical engineering and plant manufacturing "Made in Germany").

Industries considered crucial to increase German role in the global economy (innovation for communication and mobility group) included: information and communications technologies (developing Germany's strengths in core sectors and tap new fields of application), automotive and transport technologies (mobility for the future), aviation technologies, space technology (satellites for earth observation and navigation), maritime technologies, services.

Technologies considered crucial to face grand challenges (innovation for safe and healthy life group) included: health research and medical technology, security technologies, plants (new paths for agriculture and industry), energy technologies (reliable, efficient, sustainable), and environmental technologies.

New High-Tech Strategy 2020

In 2010 Germany adopted the *New High-Tech Strategy 2020* with **the objective of directing research and innovation towards global challenges: Climate and Energy, Health and Nutrition, Mobility, Security, Communication**. The strategy builds on the successes of the *High-Tech Strategy* with respect to increasing the interactions between different stakeholders, investing in R&D, fostering key-technologies and creating enabling environment for innovation.

It also defines a new set of 10 “future projects”, among which is “Industrie 4.0” aimed at investing in the 4th Industrial Revolution. The strategy combines different schemes such as:

- *Autonomics for INDUSTRIE 4.0*: priority areas include developing the next generation of machines, service robots and other technologies able to deal with complex tasks autonomously
- *The CyPros* (Cyber-Physical Production Systems) research project consisting of a consortium of actors from science and industry led by Wittenstein AG, initiated in 2012 in order to research and develop a representative spectrum of cyber-physical system modules for production and logistics systems for industrial use.

A feature of the German industrial policy is that **the Government has an overarching ‘enabling’ role**, through crucial institutional organisations such as the training system and the state investment bank, **whereas intra-sectoral networks of companies, trade unions, banks and technical institutions are the leading actors in coordinating the policy implementation**. The quality of this interaction was crucial in determining the success of the German industrial policy (Hancke and Coulter, 2013).

High-Tech Strategy – design and assessment

To attract investment, instruments include modern regulation of intellectual property protection, establishment of standards and norms, and modernised public sector capacities to use the potential of new technologies.

To reach excellence, **6 billion euros has been invested in R&D via the strategy between 2006-2009**, the largest amount public investment in R&D in Germany since reunification.

The specific measures designed for each technology/industry were developed using SWOT analysis and following the basic objectives: thematic R&D funding, creating innovation friendly conditions and links between science, industry and policy sector on connected strategies R&D funding programmes were set up with a timeframe of up to ten years to create long-term strategies in consultation with science and industry. Collaborative projects are especially useful for SMEs, because they can take advantage of the interactions with research institutes, and of global markets as suppliers of the involved large companies.

Rammer (2009), cited in Cunningham et al. (2013), list several success factors of the *High-tech strategy*.¹⁰²

- **high-level political support** (including awareness in all the ministries involved to engage at highest level),
- **increased funding**,
- **close partnership between the relevant actors** (each Federal ministry had a separate unit to link to the BMBF),
- **well defined interventions**, clear to all actors,
- **continuity with existing activities**;
- **robust evaluation** (including yearly evaluations; reporting system for the different technologies and industries; a continuous dialogue between industry and stakeholder; and a high level expert group reporting to the Chancellor).

As a result, the *High-Tech Strategy* has had an important impact: **companies raised their R&D investments by 7.4 billion euros**, in the period from 2005 to 2008; **private R&D investments rose by approximately 19 per cent**; **R&D employment increased** as well; **R&D intensity in GDP achieved 2.7 percent** and 30 percent of companies attributed it to government innovation policies.

Case study: German biotech sector

In 1970's Germany was the first country to implement publicly funded biotechnology programmes, although most of the pharmaceutical companies in Germany were not interested in genetic engineering.

The German Society for Chemical Engineering (DECHEMA) was invited by the Federal Research Ministry to define the policy goals. DECHEMA proposed the support for second generation bioprocessing) but soon after, under pressure from international competition, also the third generation (post-DNA recombination) opportunities were included.

The Research Ministry started closer collaboration with large individual pharmaceutical firms, including BASF, Hoechst, and Bayer. It increased spending and created three 'gene centres', co-financed by the pharmaceutical companies. Moreover, 'Applied Biology and Biotechnology' programme was established which increased the public spending. Still, in comparison to the US, the sector did not achieve a spectacular success.

¹⁰² Cunningham, P., Edler, J., Flanagan, K. & Larédo, P. (2013) *Innovation policy mix and instrument interaction, Compendium of Evidence on the Effectiveness of Innovation Policy*. MIOIR-NESTA: Manchester/London

One of the reasons the Research Ministry's new policies did not spur biotechnology growth in Germany was the uncertain and fragmented regulatory environment. Germany did not have a national approval board. Instead, regional authorities retained power to permit or prohibit production of biotechnological goods. Another reason was the lack of support toward the sector by the public, especially in 1980s. (Adelberger, 2000)¹⁰³

Responses were subsequently developed to correct these issues. In 1989, the government introduced its first version of a national genetic engineering law, sponsored the BioRegio Competition. The Research Ministry needed a technical strategy to revitalise the sector, and a political strategy to compel lower level governments and the private sector to implement it. The Research Ministry thus sponsored the BioRegio Competition that spurred bottom-up initiatives from the private sector and lower level governments in many more regions than those that ultimately won preferential federal support. The Research Ministry also continued to refine its approach to promoting venture capital in Germany. As a result, the biotechnology and venture capital sectors flourished in Germany during the 1990s (Adelberger, 2000).

Japan

Historical perspective

Japanese governments have traditionally pursued a very active industrial policy, spearheaded by the Ministry of International Trade and Industry (MITI) and its successor, the Ministry of Economy, Trade and Industry (METI).

MITI and later METI alongside the Ministry of Finance played a crucial role in the country's industrial development in the post-war period. In the 1950s they protected infant industries from foreign competition and only gradually opened the economy up to foreign trade. Coal, iron, and steel industries were designated as strategic industries in the aftermath of the post-war period and the 1950s. In the 1960s, the targeted industries were capital-intensive petrochemicals, steel, industrial machinery, electrical appliances, and automobile industries. After the oil shocks in the 1970s, high-tech and relatively less energy-intensive electronics, computers, and semiconductors industries received preferential treatment from the government. (Akkemik 2015)¹⁰⁴

¹⁰³ Adelberger, K. E. Semi-sovereign leadership? The state's role in German biotechnology and venture capital growth. *Ger. Polit.* 9, 103–122 (2000).

¹⁰⁴ Akkemik A. K., (2015) *Recent Industrial Policies in Japan*, in: M. Yülek (ed.), *Economic Planning and Industrial Policy in the Globalizing Economy, Public Administration, Governance and Globalization*

MITI's golden era of the 1970s and 1980s was based on the premise that even large Japanese corporations adhered strictly to rules and were often protected from external competition in the domestic market. The so-called 'convoy' mechanism, in which groups of companies were shepherded along to success, worked well for traditional industries such as steel because it optimized capital investment by preventing excessive competition. It also helped develop industries where innovation was tightly linked to scale, such as in the efforts to create an integrated circuit chip.

However, in the 90s and the 00s it became clear that this model was losing relevance in the world of modern industries and much greater international competition. As the Japanese economy stopped growing, reforms in the 1990s onwards started to redefine the role of MITI and the Japanese state in the affairs of industry. MITI was reorganized into the Ministry of Economy, Trade and Industry, or METI — a change that has meant an increased emphasis on cross-cutting policies over sector-specific approaches (Nezu, 2007).¹⁰⁵

These changes in the Japanese approach to industrial policies are generally attributed to growing concerns about the demise of Japanese industries and the loss of world markets to the emerging Asian economies, such as, China and Korea. For example, Japanese firms seem to have failed to capitalise on the rise of the smart phone technologies and computer industries in the 2000s, despite their seeming comparative advantage in those fields.

It has also been recognised that industry structures were becoming more fluid as the walls between electronics and automakers, for example, crumble, which again warrants a more flexible approach to policy making.

The new economic bureaucracy places more emphasis on the role of the private sector in industrial rationalization and restructuring and seems to be more aware of the importance of external relations as an engine of industrial growth.

Therefore, **METI was given a duty quite different than MITI of the past.** Officially, the government announced that the main task of METI is to strengthen the working of the free market principle in Japanese industries. Its role in industrial development seems to be mostly confined to assisting the private firms to enhance their productivity and competitiveness in the era of knowledge economy. METI does not interfere with investments and does not put any supply constraints as MITI did before. **However, METI designates “priority” industries to be promoted.** Officially, METI assumes a strong position in facilitating information exchange and coordination among private firms in the priority industries. That said, it would be inaccurate to say that METI does not intervene in the economy.

¹⁰⁵ Nezu, R. (2007), 'Industrial Policy in Japan', *Journal of Industry, Competition and Trade*, 7(3–4), 229–43

Recent policies

In recent years, sectoral policy in Japan has become an element of a wider agenda aiming to promote new technologies and to address the key societal challenges.

The Japanese government has recognised that the new industrial policy will have to be designed in response to the spread of new technologies, such as automation and the Internet of Things, as well as to long-term societal challenges, such as ageing. These two principles in official communication under the banners of the Fourth Industrial Revolution and the Society 5.0 – two concepts which currently drive economic policy in Japan.

In addition to these long term challenges, the current policy has been influenced by the “hollowing-out” of Japanese industries. The Japanese government realised that there is a number of issues with the industrial structure of the Japanese economy, including: relatively high concentration of economic activity in a small number of sectors (automotive and electronics), a weakness of small businesses and their reliance on large domestic corporates leading to their inability to capture global markets, excessive domestic competition, low profitability of SMEs, and a low start-up rate.

Below we present a succession of official policy documents which together form a response to these economic challenges.

The 5th Science and Technology Plan

Published by the Japanese Cabinet in 2016, **the fifth Science and Technology Basic Plan introduced the idea of Society 5.0 as a guiding principle of the Japanese policy.**

Society 5.0 is described as the next stage of societal development akin to the transition from an industrial to a digital society. It is defined as “a super smart society where new technologies integrate cyberspace and physical space to bring prosperity to people” (The Government of Japan, 2016).¹⁰⁶ The transition will be facilitated by integration of all economic and social activities with the fourth industrial revolution technologies (e.g. automation, big data and IoT). Providing finely differentiated products meeting differentiated needs is one of the aspirations of Society 5.0.

This approach also recognises new economic opportunities related to the adoption of new technologies. The Japanese government hopes that the transition

¹⁰⁶ *Report on the 5th Science and Technology Basic Plan Council for Science, Technology and Innovation Cabinet Office, Government of Japan (December 18, 2015)*

will usher in transformational change in a broad range of industrial structures such as manufacturing, logistics, sales, transportation, health and medical care, finance, and public services.

The Japanese government expects that through a more widespread use of technologies the transition will help to address societal challenges such as the implications of an ageing society.

The plan identifies key technologies which will facilitate the transition (including cybersecurity, IoT system architecture technology, big data analytics, AI, network technology and edge computing) as well as **key technologies in which Japan has strength and can use to build competitive advantage** (including robotics, sensor technology, actuator technology, biotechnology, human interface technology, material/nanotechnology and quantum technology).

Investment for the Future Strategy and the New Economic Policy Package (2017)

The ideas outlined in the fifth Science and Technology Plan were then operationalised in documents published in subsequent years.

The New Economic Policy Package (2017) in large part consists of a series of horizontal policies with three overarching aims: (i) doubling Japan's average productivity, (ii) increasing Japan's capital investment amount by 10 percent by the FY2020 compared with the FY2016, and (iii) and achieving more than 3 percent annual wage increase after the FY2018.

While horizontal policies take centre stage in the New Economic Policy Package, the plan also outlines specific sectoral policies aligned with the wider objectives described above. The document singles out industries and technologies of particular importance to the implementation of Society 5.0. These include:

- automated driving – including the aim to achieve provision of automated vehicles in 2020 and a push to commercialise autonomous vehicles
- health, medical care, long-term care – aiming to develop data and ICT infrastructure for remote and personalised treatment
- financial sector – creating an environment conducive to adopting new technologies in finance
- construction sector – promoting the use of new technologies in the industry
- transportation sector – including greater standardisation, promoting new technologies in shipbuilding and deployment of drones for commercial uses
- agriculture – promoting the use of big data in agricultural production

- tourism – more widespread use of technology in the sector

Connected Industries Tokyo Initiative 2017

The main sectoral component of the ambition to transition to Society 5.0 was set out in the document “Connected Industries” Tokyo Initiative 2017.

The eponymous connected industries are those sectors that deploy the technologies of the Fourth Industrial Revolution in order to create new added value and find solutions to the societal problems.

Five broad sectors designated as connected industries, and the policy objectives for each of them, include:

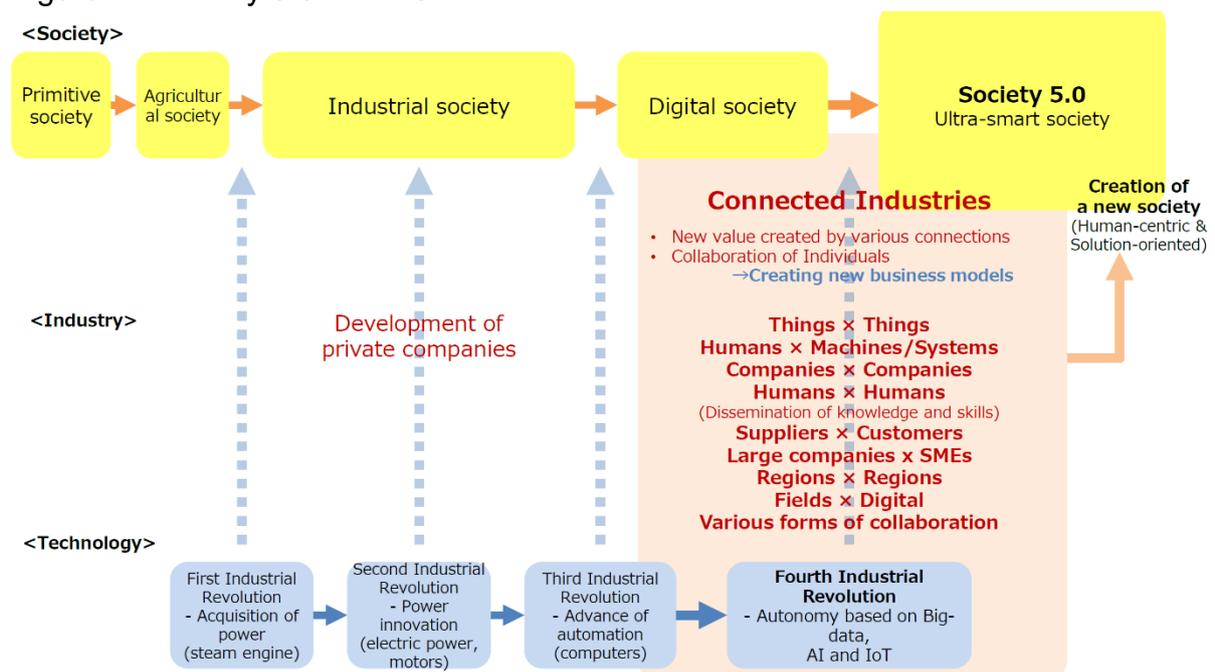
- **Automated Driving and Mobility Services** (identifying approaches to data harmonization, enhancing AI and related human resource development, establishing future vision of mobility service concerning logistics and EVs)
- **Manufacturing and Robotics** (international standardization of data rules including formats, enhancing inter-company collaboration in harmonized fields (e.g., cyber security and human resource development), environmental improvement for the IoT introduction for SMEs, e.g., IoT tools)
- **Plant/Infrastructure Safety Management** (improving technological capability for safety through utilizing IoT, developing guidelines and other common rules for harmonizing data across companies, promoting further reform of the regulation system)
- **Biotechnologies and Materials** (achieving joint utilization of data across companies in harmonized fields, establishing an AI technology platform for commercialization, obtaining public acceptance)
- **Smart Life** (discovering potential needs and materializing possible services, data collaboration through inter-company alliances, developing other rules for further data utilization)

The Japanese government is advancing a wide variety of policy initiatives in cooperation with private sector parties.

The New Industrial Structure Vision/Future Vision Towards 2030s

The most recent document which sets the Japanese government’s priorities for the next decade is the new Industrial Structure Vision published in 2018. It incorporates the ideas from previous documents and provides a longer-term plan for the delivery of Society 5.0. **It designates 4 broad priority areas for the government: mobility, supply chains, healthcare and lifestyle.** The document provides a link between the economic and social objectives of the Society 5.0 strategy.

Figure 1. “Society 5.0” and “Connected Industries”



6

In addition to the long-term vision encapsulated in the idea of Society 5.0, the Japanese government is still deeply involved in the functioning of different sectors.

Case study: manufacturing and automotive industries in Japan

In addition to the long-term vision encapsulated in the idea of Society 5.0, the Japanese government is still deeply involved in the functioning of different sectors. The case studies below provide example of the activities of METI in the domain of sectoral policy.

General manufacturing policy

METI has been actively involved in supporting the Japanese manufacturing industry.

Based on the Basic Act on the Promotion of Core Manufacturing Technology Act No. 2 passed on March 19, 1999, the Japanese government has a duty to support the development of the manufacturing industry. The Act makes the government responsible for formulating basic plans on the promotion of core manufacturing technology,

These reports offer high level of detail in terms of understanding business needs, and cover such areas as: i) basic policy on the promotion of core manufacturing

technology, ii) matters concerning research and development of core manufacturing technology, iii) matters concerning supply of and improvements in skills, iv) growth of the core manufacturing industry, v) promotion of the adoption of core manufacturing technology.

The Act also states that every year the government has to submit to the Parliament a report on measures it took to promote manufacturing technology (White Paper on Manufacturing Industries (Monodzukuri)). Each year the report identifies a detailed set of key challenges and proposes actions to tackle them.

Automotive industry¹⁰⁷

Japanese government played an active role in the auto industry since a least 1970s. It has adopted a comprehensive strategy including R&D, demonstration programmes and market support guided by long-term strategic plans. **The role of the government has been that of a conductor in the development process supplying both R&D support and artificially created niche markets and easing the way for targeted technologies by means of legislation and standards.**

MITI orchestrated the development of the Battery Powered Electric Vehicle (BPEV) industry in Japan in its early phases, offering both R&D support and an initial niche market, together with a long-term targeting. MITI had the ambition of inducing a “virtuous circle” of increasing R&D efforts among companies by establishing R&D consortia in fields of interest for the society.

MITI established a basic market expansion plan for BPEVs in 1976. **This plan was a comprehensive commercialisation plan coordinating government agencies, companies and municipalities in their efforts to expand BPEV development.** Barriers were identified and the relevant actors were called upon to make efforts to remove these barriers through technical development, amending laws and taxes, creating new standards and building a fuel infrastructure.

The MITI also funded company R&D between 1978 and 1996 supporting leading projects. MITI funded programmes are usually long and divided into three phases starting with (i) R&D on basic technologies (ii) demonstration and prototype, and the last phase (iii) production and early deployment. All three phases received government funding. In other words government’s approach was to support R&D efforts at all stages of the process development.

The above market expansion plans have in common that they all present comprehensive plans for the development and commercialisation of the

¹⁰⁷ Based on Ahman M. (2004), *Government policy and the development of electric vehicles in Japan*, Energy Policy 34

targeted technologies. The plans include all the relevant actors identified by the MITI, including industry, universities, local governments, and government agencies. **The aim of these plans is to induce a common vision among the actors and coordinate industry and government policy.**

Paradoxically Japan has been relatively slow to specialise in pure electric battery powered vehicles. However, the market success of the Hybrid EV can partly be attributed to the government support of the BPEV technology. The enabling component, the electric drivetrain, was developed for automotive use within the BPEV programmes offered by the Ministry of International Trade and Industry (MITI). This technology was later utilised in the HEV.

The Japanese Government never offered the HEV targeted support, but the HEV was able to benefit from the technical development and the experiences gained from the sustained governmental support, which was primarily aimed at BPEVs. **The actual outcome of the Government's policy has thus been a relatively flexible policy enabling a number of alternatives (the HEV, the CNGV, the BPEV, and the FCEV) to challenge the dominating internal combustion engine technology and where government policy,** via the MITI, increased the technical diversity by offering both R&D support and support for building initial markets to non-conventional vehicles this has resulted in a system where the sustained efforts created feedback to the R&D process from early market experience and the possibility of accumulating and maintaining knowledge, even when interest and support were low.

The role played by the Japanese Government in the HEV development process (though not intended) resembles much more the interactive model than the sequential linear model forwarded by the MITI. **The long-sustained effort that included R&D, support for infrastructure and market support led to a knowledge base and accumulated experience in the field of electric traction that has contributed to the current fast-growing sales of HEVs.**

The history of BPEVs in Japan demonstrates that “picking winners” in government policy is not easy. Despite a sustained and ambitious policy by the MITI, the development of alternative vehicles did not unfold according to the plan even though Japanese carmakers are now among the biggest BPEV manufacturers.

The success the Japanese approach to the development of new generation vehicles rested on the flexibility, adaptability and cooperation in terms of technical choice, as the technologies meant for BPEV were used to develop hybrids. This increases the chances of a technology surviving the long journey from idea to competitive technology. It also required market support, even in the early phases of development, as gaining experience and building markets is an important complement to R&D.

Hydrogen Strategy

With the electric car technology now slowly entering the mature stage of development the Japanese government has moved to a new frontier with the ambitious set of pledges to develop and popularise hydrogen-powered vehicles. In its **Strategic Roadmap for Hydrogen and Fuel Cells**, METI pledges to work towards establishing a “hydrogen society”. The roadmap set detailed targets and actions needed to reach that goal, including a decrease in the cost of construction and operation of hydrogen-powered vehicles as well as a development of a hydrogen supply chain and distribution network.¹⁰⁸

The government has committed to reducing the production cost of hydrogen by at least 90 per cent by the year 2050, to make it cheaper than natural gas.

In its recent strategy for New Era of Automobiles the Japanese government set a target for adoption of the next generation automobiles, including a 3% uptake of fuel cell vehicles by 2030.¹⁰⁹ The government is also using a range of financial incentives to promote the update of new generation vehicles.

¹⁰⁸ METI (2019). *New Strategic Roadmap for Hydrogen and Fuel Cells*, https://www.meti.go.jp/english/press/2019/0312_002.html

¹⁰⁹ Diffusion Rate of Next- Generation Automobiles: 50-70% of All Domestic Passenger Vehicles by 2030 HEV 30~40%; BEV · PHEV 20~30%; FCEV ~3%; Clean Diesel 5~10%

Annex B. Market failures

Returns to scale

The key argument in favour of selective industrial policy is based on the notion that some industries can improve their competitive position through economies of scale. Government support is therefore justified if an industry faces barriers to growth, which, when overcome, can result in that industry gaining comparative advantage.

Bartelme, Costinot, Donaldson and Rodríguez-Clare (2019) conclude in a study of manufacturing sectors that sector-level economies of scale exist but differ substantially across sectors, ranging from an elasticity of 0.07 to 0.2.¹¹⁰

Box 3: Case Study – South Korean Government’s policies for the auto industry (1970s)

Production of motor vehicles is very sensitive to economies of scale. The minimum efficient scale is customarily affixed at 250,000 units per year for a single production run (Baranson, 1969).¹¹¹ Despite its rapid economic growth, the size of South Korean domestic market for automobiles was too small in the 1970s and 1980s to benefit from economies of scale.

The South Korean government devised a suite of policies aimed at increasing economies of scale through consolidating the market (and correcting a coordination failure, discussed below) and increasing access to foreign markets. Export promotion (through government-led contests) allowed Korean carmakers to increase scale and improve the quality of their cars. The government typically rewarded firms with policy-created rents implicit in credit subsidies, in restrictive production and import licensing on the basis of the export orders that firms received.

As a result of this and other policies, during the 1980s, car production in South Korea increased almost twentyfold, from just over 50,000 to nearly a million vehicles per year (Huang 2002).¹¹²

Agglomeration economies

Agglomeration economies accrue when related economic activities are located in the same geographical cluster. Agglomeration economies are characterised by

¹¹⁰ Bartelme, D.G., Costinot, A., Donaldson, D., Rodríguez-Clare, A., 2019. The Textbook Case for Industrial Policy: Theory Meets Data, NBER Working Paper No. 26193.

¹¹¹ Baranson, Jack (1969). *Automotive Industries in Developing Countries*, International Bank for Reconstruction and Development, Washington, D.C.

¹¹² Yasheng Huang, *Between Two Coordination Failures: Automotive Industrial Policy in China with a Comparison to Korea*. Review of International Political Economy, Vol. 9, No. 3 (2002), pp. 538-573;

economies of scale, knowledge spill-overs, better availability of intermediate inputs, access to relevant specialised knowledge and thicker labour markets. Advantages may be felt by policy intervening to facilitate the establishment of a successful cluster. Such effects are often present in advanced manufacturing and service sectors such as creative industries and financial services (Warwick 2013).¹¹³

Box 4: Case Study – Industrial clusters in Guangdong province, China (2000)

Industrial clusters were promoted in different countries to harness the benefits of agglomeration effects, such as closer integration between suppliers, producers and customers, and more rapid innovation growth (OECD, 1999, Arvanitis and Qiu, 2008).

A radical example of a policy to promote agglomeration benefits comes from China. In 2000, in Guangdong province, the local government launched a program with the slogan “one city-one product” to encourage the spatial agglomerations of enterprises all focused on the production of one specific item. The officially recognized Specialised Towns are entitled to receive funding from the Government in order to promote industrial development, competitiveness, innovation and technological upgrading.

Barbieri et al., 2012 conclude that there is generally a positive correlation between the level of government intervention (measured by Index of Policy Intensity comprising specialised towns, development zones, innovation centres, expenditure/revenue ratios) and the Performance Index (composed of density, value-added, output of new products, export), although they do not offer a definitive judgement on the causal link between the two variables.¹¹⁴

Barriers to infant industries

The literature has long recognised that nascent (or small) industries face much greater challenges than established firms and that government support might be required to facilitate their growth and increase their competitiveness. Chang et al (2013) highlight that young companies accumulate capabilities only over time and in an unpredictable way, through a long and costly process.¹¹⁵ Capability accumulation needs some indivisible inputs (thus high fixed costs) that small producers cannot provide on their own – whether in R&D, machinery, or worker training. Government

¹¹³ Warwick, K. (2013). *Beyond Industrial Policy: Emerging Issues and New Trends*. OECD Sci. Technol. Ind. Policy Pap. 57, OECD

¹¹⁴ Barbieri, Elisa & Di Tommaso, Marco R. & Bonnini, Stefano, 2012. "Industrial development policies and performances in Southern China: Beyond the specialised industrial cluster program," *China Economic Review*, Elsevier, vol. 23(3), pages 613-625.

¹¹⁵ Chang, H-J, Andreoni, A. and Kuan, M. L. (2013) „International Industrial Policy Experiences and the Lessons for the UK“, in *The Future of Manufacturing*, UK Government Office of Science, London: BIS.

protection targeting small businesses, or a sector dominated by small businesses, might help raise their productivity.

The infant industry problem is also related to the concept of industrial commons. It has been recognised in the literature that certain types of innovation require a well-developed manufacturing base. The maintenance of industrial commons necessitates not only the maintenance of a manufacturing base of a certain size and diversity but also various forms of 'intermediate institutions' – industry associations, trade unions, research institutes, and educational institutions.

Box 5: Case Study – Infant Industry protection in Japan (1970s)

Abdelkader et al. (2017) show that many developed economies relied on infant industry protection to increase their competitiveness and productivity.¹¹⁶ In the 1970s, Japan shifted its focus to technology-intensive industries, for example electronics and semiconductors. To promote these industries, Japan utilized tax incentives, R&D incentives, subsidized credit, direct subsidies, purchasing of foreign technology, barriers to entry and competition regulation, consultative system, and administrative guidance. Fujiwara (1991) showed that export competitiveness in a number of technology-intensive industries, particularly in the electronics sector, was mainly attributable to the infant industry promotion strategy.¹¹⁷

Knowledge spill-overs and low appropriability

This rationale rests on a notion that private innovation activity creates greater benefits than those reflected in the price paid for use. Arrow (1962) suggested that private investment in new knowledge is expected to be below the socially desirable level given that economic returns cannot be fully captured by the generator of knowledge.¹¹⁸ **Selective policy can be used to compensate for under-investment in (and thus under-production of) certain activities due to the fact that their providers do not reap the full benefits from their efforts.** Cimoli, Dosi and Stiglitz (2009) discuss the central role of knowledge and capability accumulation for transforming the sectoral structure of an economy.¹¹⁹ Baldwin (1969) suggests firms might find it difficult to capture all benefits of their investment as the acquisition of knowledge involves costs that may not be affordable to the firm, training may diffuse

¹¹⁶ Abdelkader M., Fisher G., Fawzy S., Atallah G. (2017), *Infant Industry Argument: Theoretical Framework and Current Opportunity of Adoption*

¹¹⁷ Okuno-Fujiwara, M. (1991). Industrial Policy in Japan: A Political Economy View. In P. Krugman, Trade with Japan: Has the Door Opened Wider? (pp. 271 - 304). Chicago: University of Chicago Press.

¹¹⁸ Kenneth Arrow, 1962. "Economic Welfare and the Allocation of Resources for Invention," NBER Chapters, in: The Rate and Direction of Inventive Activity: Economic and Social Factors, pages 609-626, National Bureau of Economic Research

¹¹⁹ Cimoli, M., Dosi, G. and Stiglitz, J. E. The Political Economy of Capabilities Accumulation: The Past and Future of Policies for Industrial Development. in *Industrial Policies and Development: The political Economy of Capabilities Accumulation* (Oxford University Press, 2009).

to other firms through the movement of workers, and determining the profitability of a new industry might require a costly investment the results of which may become freely available to potential competitors.

In the UK, based on the analysis of ‘net producers’ of innovations in 18 manufacturing industries (sectors which produce more innovations than they use – their innovations are used by other firms or sectors), Wakelin (2000) highlights the significant contribution of high value-added sectors, including mechanical, electrical and instruments engineering, electronic machinery and chemicals sectors, to generating innovations used in other sectors.¹²⁰

Box 6: Case Study – Support for innovation in the manufacturing sector in Ireland and Northern Ireland (1990s)

Hewitt-Dundas and Roper (2009) studied public support for innovation in the manufacturing sector in Ireland and Northern Ireland. They found that government support had positive additional effects on overall innovation activity in both countries. Their analysis found that without government support the level of innovation would remain below the socially beneficial level. This finding is consistent with the 1992 Culliton Report which found that “without state support and incentives the degree of investment in technology will be less than that is desirable from the point of view of national economic development”.¹²¹

The analysis looked at three types of innovation additionality: extensive additionality (an increase in the proportion innovating plants); product additionality (an increase in the importance of product improvement); and new product additionality (an increase in the importance of “radical” innovation). The results suggest the positive output effects of public support across all three types of innovation additionality.

Ireland’s GDP was around 25% below the UK prior to the policies. Sector specific targets over 3-year periods helped close the GDP gap to 8.6% over 1993 to 2000 and over 425,000 jobs were created.

Coordination failures

Coordination failures may inhibit private actors from investing in a given industry, if this requires inputs from other industries which may not be available domestically or too expensive to import (Hausmann and Rodrik, 2006; Pack and Saggi, 2006; Rosenstein-Rodan, 1943).¹²²¹²³¹²⁴ Governments may undertake initial

¹²⁰Wakelin K. (2000) Productivity growth and R&D expenditure in UK manufacturing firms, Centre for Research on Globalisation and Labour Markets, Research Paper 2000/20

¹²¹ Nola Hewitt-Dundas & Stephen Roper (2010) Output Additionality of Public Support for Innovation: Evidence for Irish Manufacturing Plants, *European Planning Studies*, 18:1, 107-122

¹²² Hausmann R., Rodrik D. (2006), *Doomed to Choose: Industrial Policy as Predicament*,

¹²³ Pack and Saggi (2006) op. cit.

¹²⁴ Rosenstein-Rodan P. N., (1943) *Problems of Industrialisation of Eastern and South-Eastern Europe*, *The Economic Journal*

investment decisions or facilitate dialogues between different industry actors. In other words, as sectors are interconnected and exhibit complementarities in production tasks or demand patterns, the degree of cooperation influences the performance of sectors and the overall economy. **Industrial policy can therefore improve efficiency by articulating the institutional infrastructure, aligning policy packages and incentivising engagement** between competing but interconnected actors in both the public and private sphere (Andreoni, 2017).¹²⁵

Similarly, Rodrik (2008) discusses the case where lack of co-ordination might hinder the industrial development of countries, as **co-ordination between different actors is necessary for large-scale investments with high initial fixed or sunk costs**.¹²⁶

Coordination failure can also occur where actors in a given industry become 'locked-in' to an old standard when it would be beneficial for all to move to a new standard (Swann, 2010).¹²⁷ Moving to a better standard might require co-ordination decisions across many and diverse actors, an outcome that might be beyond the influence of any single actor to bring about. In such cases, government action might bring positive net benefits. In the standards-setting process, helping to provide a context in which otherwise underrepresented groups participate might be a valuable government role in all circumstances.

Finally, **in oligopolistic industries with lumpy investments, simultaneous investments by competing firms may result in excess capacity**, which may push some firms into bankruptcy, which in turn means that the resources invested in them will have been wasted, and, therefore, justifies government intervention.

Box 7: Case Study – South Korean automotive sector (1970s)

In order to coordinate activity to maximise the benefit for the economy, the South Korean Government of the 1970s actively shaped the structure of the automotive sector, recognizing the industry as being too fragmented to be internationally competitive.

In 1974, the Government assigned production licenses to three primary producers in the automotive sector, Hyundai, Kia, and GM-Korea, and restricted access to the market for other companies. The strict entry and exit requirements enabled the South Korean automotive makers to rapidly achieve economies of scale. Huang

¹²⁵ Andreoni, A. *The Varieties of Industrial Policy: Models, Packages, and Transformation Cycles. in Efficiency, Finance, and Varieties of Industrial Policy* (eds. Noman, A. & Stiglitz, J.) (Columbia University Press, 2017).

¹²⁶ Rodrik, D. (2008), "Normalizing Industrial Policy", Commission on Growth and Development Working Paper No. 3, Washington DC

¹²⁷ Swann, G.M.P. (2010), "The economic rationale for a national design policy", Department for Business, Innovation and Skills, Occasional Paper No. 2, August 2010

(2002) found Hyundai's production rose from 71,744 units in 1979 to 123,110 units in 1984.¹²⁸

¹²⁸ Yasheng Huang, *Between Two Coordination Failures: Automotive Industrial Policy in China with a Comparison to Korea*. *Review of International Political Economy*, Vol. 9, No. 3 (2002), pp. 538-573;

Annex C. Policy levers

Governments have a wide range of policy instruments available to intervene in specific industries. They vary in terms of their scope and aims. Multiple attempts have been made in the literature to classify different types of policies used for sectoral interventions. The chapter below presents an overview of different policy levers identified in literature with the aim of highlighting the options available to government when designing selective interventions.

In a detailed report on the modern industrial strategy Warwick (2013) builds on earlier work by Naude (2010), Cimoli et al. (2009) and Weiss (2011) and presents a comprehensive list of horizontal and vertical interventions.¹²⁹

The classification proposed by Warwick (2013) is based on policy domains targeted by the policy, such as product markets, labour markets, capital and credit markets, land markets and technology markets, as well as those focussed based on promoting co-ordination, information flows and institution building.

In the **product market** domain, the author includes interventions which most overtly aiming to promote or protect the targeted industries. These include designating the so called '**national champions**', **nationalising or privatising chosen industries, as well as using direct subsidies, price regulation, preferential trade policy or public procurement to increase outputs in specific industries.**

Policies in other domains are more subtle in that they more explicitly aim to provide an answer to a specific market failure.

In relation to **labour markets**, governments can target sectors but increasing the supply of specific skills through, for example, a targeted apprenticeship and training schemes.

In the **credit market domain**, governments can use state resources to provide financing to sectors considered as strategic and/or where state provision of finance is considered inadequate, by, for example, setting up and specifying a remit for a state-owned investment bank.

With regards to **technology**, government can focus on maximising the benefit from externalities from science and technology by directly supporting research in a given sector financially, introducing regulation that incentivises research activity in that area,

¹²⁹ Warwick, K. (2013), op. cit.

and using state resources (e.g. procurement) to support private actors to encourage greater risk taking involved in developing and applying new technologies.

Warwick (2013) identifies a special category of **systemic interventions**, including clusters, long-term indicative planning and foresight initiatives, that aim to provide an initial spark and coordination for specific sectors or technologies to develop.

Finally, the report also list a range of typically horizontal policies and notes that any one of them can be used selectively depending on the specific aim of the intervention.

The full list of selective policies proposed in Warwick (2013) is presented in the table below.

Domain	Horizontal Policies	Selective Policies
Product markets	Competition and anti-trust Indirect tax Product market regulation Exchange rate policy	National Champions Nationalisation/privatisation Output subsidies/state aids Export promotion Price regulation (e.g. pharma) Public procurement Trade policy Car scrappage
Labour and skills	Skills and education policies Training subsidies Wage subsidies Income and employment tax Management advisory services Labour market regulation	Targeted skills policies Apprenticeship policies Sector-specific advisory services
Capital markets	Loan guarantees Corporate tax/capital allowances Macro/financial stability Financial market regulation	Financial market regulation Strategic Investment Fund Emergency Loans State Investment Bank Inward investment promotion
Land	Planning regulation Land use planning	Enterprise zones Place-based clusters policy Infrastructure
Technology	R&D tax credit Science Budget IPR regime	Green technology Lead Markets Public procurement for innovation Patent Box Selective technology funding

		Centres of expertise
Systems/Institutions	Entrepreneurship policy Scenario planning Distribution of information Overall competitiveness strategy	Indicative planning Foresight initiatives Identifying strategic sectors Sectoral competitiveness strategy Clusters policy

Annex D. Sector deals: background information

Aerospace

This deal considers the sector of design, manufacturing of engines, wings and advanced systems of civil aerospace. Support activities related to the aforementioned.

The main objective is positioning the UK to take advantage of the global move towards hybrid-electric and electric propulsion in aircrafts, and to exploit new markets such as drones and Urban Air Mobility vehicles.

[Read the Aerospace Sector Deal.](#)

Life Sciences (I & II)

This sector is comprised by pharmaceuticals, health tech sectors (medicines manufacturing, biotech, digital technologies), the NHS, charities and government agencies.

Objectives:

- Pioneering treatments and medical technologies are to be produced in the UK, improving patient lives and driving economic growth
- Consolidate the UK as a top-tier hub for life sciences globally
- Transform the prevention, diagnosis and treatment of chronic diseases by 2030
- Create whole new industries over the next two decades in the fields of early disease detection and genomics; digital technologies and data analytics; and in advanced therapeutics.

[Read the Life Sciences Sector Deal.](#)

Artificial Intelligence (AI)

Composition: AI is described as 'the latest advances in tools for processing information and making sense of large quantities of data.' Although the *Deal* is set to improve 'AI as a nascent industry on its own right' along with 'the institutions that support AI in the UK,' the sector is not explicitly defined.

Objectives:

- Making the UK a global centre and the best place to start and grow an AI business and data-driven innovation.
- Leading the world in the safe and ethical use of data
- Strengthening the UK's cybersecurity capability
- Deliver major upgrades to digital and data infrastructure
- Realize the technology's full potential: using advanced algorithmic techniques such as 'deep learning', and in so doing, free up time and raise productivity.
- Promote the adoption and use of AI in the UK and stimulate uptake of AI in the public sector.
- Build, attract and retain an AI skilled workforce and stimulate the access to data that enables the development of AI.

[Read the Artificial Intelligence Sector Deal.](#)

Rail

Composition: The sector is comprised by the railway network, train operators, freight train operators, railway contractors, related institutions such as National College for High Speed Rail, the National Skills Academy for Rail and the National Training Academy for Rail in addition to rail supply SMEs.

Objectives:

- Exploit the opportunities of new rail technologies
- Improve the efficient use of the rail network capacity for passengers and for freight users
- Enhance the experience of railways passengers, increase available services and enhance journey planning
- Enhance the rail industry supply chain

[Read the Rail Sector Deal.](#)

Automotive

Composition: This deal is mainly concerned with automakers, manufacturers of automobiles, related suppliers.

Objectives:

- High contribution in the development of zero-emission vehicles, connected and autonomous vehicle (CAV), and new generation electric batteries, becoming world-leading testing environment for CAVs.
- Continuing to be a sector which provides well paid jobs both directly in vehicle manufacturing and through the supply chain.
- Raising the competitiveness of UK suppliers to match the best in Europe.

[Read the Automotive Sector Deal.](#)

Construction

Composition: The sector is comprised by the construction industry, in addition to contracting, product manufacturing and professional services.

Objectives:

- Better performing buildings that are built more quickly and at lower cost: o 33% reduction in the cost of construction and the whole life cost of assets.
- 50% reduction in the time taken from inception to completion of new build.
- Lower energy use and cheaper bills from homes and workplaces.
- Halve the energy use of new buildings by 2030: o 50% reduction in greenhouse gas emissions in the built environment.
- Better jobs: increase to 25,000 apprenticeships a year by 2020.
- Establish the UK as a leader in the global infrastructure market: o A 50% reduction in the trade gap between total exports and total imports of construction products and materials.
- To use the adoption of digital and the move to offsite manufacturing to strengthen local supply chains across the UK.

[Read the Construction Sector Deal.](#)

Nuclear energy

Composition: The sector is comprised by the UK's civil nuclear sector. It deals with nuclear facilities, more specifically construction of new nuclear and waste and decommissioning infrastructure, expanding nuclear life cycle.

Objectives:

- Creating UK nuclear sector that generates reliable, secure, low-carbon power

- Cost reduction to ensure that nuclear energy remains cost competitive with other sources of low-carbon energy
- Achieving Clean Growth grand challenge.

[Read the Nuclear Sector Deal.](#)

Offshore wind

Composition: The sector is comprised by offshore wind infrastructure, offshore wind technologies, such as turbine production and grid integration.

Objectives

- Making the offshore wind generation an integral part of a low-cost, low-carbon source of energy
- Establishment of a flexible grid system
- Boost the productivity and competitiveness of the UK supply chain, driving growth in the UK's manufacturing base.

[Read the Offshore wind Sector Deal.](#)

Tourism

Composition: The sector is comprised of tourism infrastructure, tourism promotion activities touristic services.

Objectives

- Increasing productivity and investment that will benefit local economies across the country.
- Increasing the number of visitors and correspondingly developing infrastructure to accommodate visitors. Turning the growth in number of visitors into equivalent growth well-paid employment opportunities, through investment in people who work in the sector.
- Increasing the productivity through overcoming the overreliance on the traditional July-September peak season.
- Become globally competitive by using real time data (new Tourism Data Hub).
- Implementation of "International Business Events Action plan 2019-2025" and bringing major international conferences and exhibitions to UK, to put it more general to attract international business events

[Read the Tourism Sector Deal.](#)

Creative industries

Composition: The sector is comprised by film, TV, music, fashion and design, arts, architecture, publishing, advertising, video games and crafts. Power of collaboration

Objectives

- Strengthening its advantage as a creative nation by increasing the number of opportunities and jobs in creative industries and jobs across the UK
- improving productivity of the industry
- Expanding trading ambitions

[Read the Creative Industries Sector Deal.](#)