IfM Centre for Industry and Government

Rationales for industrial policy based on industry maturity

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Centre for Industry and Government
Working Paper 2010/1

Centre for Industry and Government

Working Paper Series

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Abstract

This paper proposes a framework for thinking about industrial policy based on the maturity of a given industry in the country contrasted to the maturity of the industry in a global sense. Current models for industrial policy tend to be based on the issues faced by emerging economies. By providing a coherent framework for rationales for industrial policy that spans both developed and developing economies, we can assess various industries and discuss the merits of providing support on a comparable basis. The paper finishes by using the framework to discuss the case of emerging macromolecular based industries in the UK and the kinds of industrial support which may be appropriate.

Contents

1. Introduction

The use of industrial policy in developed economies such as the United Kingdom (UK) has gone in and out of favour over the past thirty years. There is a current resurgence in both the use of the term industrial policy and the potential for interventions which will impact the structure of industry. The credit crisis of 2008 – 2009, a major driver of this re-emergence, has led many to believe that a rebalancing of the economy towards manufacturing is required for stability. As Lord Mandelson has commented "Some rebalancing is required, and the next decade will be about strengthening manufacturing's place at the heart of Britain's economy alongside and rooted in a strong services sector."[1]

However the foundations for industrial policy, especially in a developed economy, have become unclear. The existing policy rationales, based on market failure and system failure, struggle to explain or guide the policy maker (Zerbe and McCurdy 1999). Over the past twenty years the study of industrial policy has largely taken place in development economics (Pack and Saggi 2006; Rodrik 2007) while at the same time the policy discussion in countries such as the UK moved on to innovation and entrepreneurship.

With the re-emergence of industrial policy as an option in countries such as the UK there is a need to revisit and update the frameworks used to analyse and justify industrial policy interventions. This paper proposes a framework for thinking about industrial policy for leading economies based on the maturity of a given industry in the country contrasted to the maturity of the industry in a global sense. This provides a framework for analysis which recognises different activities within an industry and the relative maturities of a number of industries in a given country, allowing for a more nuanced discussion on the rationales for intervention beyond standard market failure arguments, and which may encourage a portfolio approach to industrial policy interventions. The paper takes the example of the UK at the macro level, and also discusses how to link this framework to support for so-called molecular and macromolecular (MMM) based industries.

[1] See Lord Mandelson's speech to the CBI Manufacturing Dinner, 5th February 2009 available online at http://www.berr.gov.uk/aboutus/ministerialteam/Speeches/page50022.html.

2. Existing foundations for industrial policy

Before discussing what a framework for 'modern' industrial policy might be, we have to be clear on what industrial policy has been in the past and currently represents. Unfortunately the definition of industrial policy is unclear (Beath 2002; Aiginger and Sieber 2006; Aiginger 2007) and continues to be used in a variety of ways both in academic writing and in policy practice. As Geroski (1989: p.20) notes "Any random collection of six economists is sure to produce at least a dozen different opinions on the subject …" and this makes this job difficult, as depending on the agreed scope industrial policy can be all inclusive or highly targeted at very small parts of the economy. The following sections discuss how the various definitions of industrial policy can be separated and what position we may need to take for a developed economy such as the UK.

2.1 Separating existing definitions of industrial policy

There are a large number of existing definitions of industrial policy. Aiginger (2007: p. 319 - 320) provides a collection of such definitions from the early 1980s to around 2005. These definitions range from the fairly simple, "… to promote or prevent structural change …" through to those that include attempting to improve competitiveness and productivity.

Following Aiginger, a number of key questions or dimensions appear to separate the various definitions. These include -

- Does the definition limit industrial policy to production, manufacturing or does it include all industries?
- Are the interventions included horizontal in nature (covering many or all sectors) or vertical (targeted at particular sectors)?
- Is the target of industrial policy large companies or SMEs?
- Does the policy intend to influence the structure of the economy directly or is it attempting to improve productivity or competitiveness, i.e. influence the enabling conditions rather than change the industrial structure directly?

We need to clarify these four questions prior to providing a framework for analysing when industrial policy may be appropriate, in order to have a clear definition of what we mean by industrial policy. The following sections take the four points above in turn and discuss whether there is a clear approach that should be taken in the developed country case.

2.1.1 Production, manufacturing, economy

The first question is whether industrial policy applies to the whole economy or just to the manufacturing sector, or in an even more restricted sense to production. The answer to this question completely changes the rationales for intervention and the potential policies that could be put in place. For some writers industrial policy is about production, for example Pack and Saggi (2006: p.267 - 268) define "… industrial policy as any type of selective government intervention or policy that attempts to alter the structure of production in favour of sectors that are expected to offer better prospects for economic growth …" In contrast Rodrik (2004) investigates "… policies for economic restructuring …" which he notes have been referred to as 'industrial policies' in the past. These are the two ends of the spectrum, with the former wishing to focus on production as one activity in many sectors, compared to the latter who is more worried about changes in the structure of the overall economy. The loose use of the terms industry and manufacturing leads to significant confusion, as the scope of intended effect will be quite different.

Some of the confusion in commentary on the manufacturing and service industries arises from the use of 'production' and 'manufacturing' to refer to the same activity or category. However, these are distinct things. Production is a specific activity whereas manufacturing is a collection of activities, ranging from R&D, through design and production, to logistics and service provision (Livesey 2006).

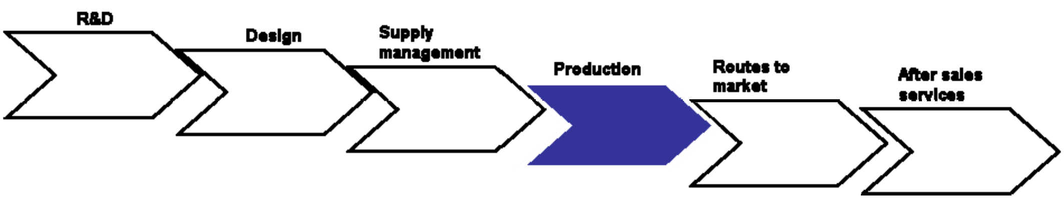

FIGURE 1 – chain of potential activities for a manufacturing firm

Viewing manufacturing in this extended sense makes explicit the potential linkages between the various activities involved in developing products, making them, delivering them to consumers and providing their associated services.

This move is also reflected in recent discussions on design and new product development which emphasise the need to consider the 'augmented product' which includes product related services such as financing, servicing and installation, and the 'meta-product' which forms the underpinning business model. "…for example, the Apple iPod is successful in part because of its unique business model, linking the hardware with software and the availability of media to purchase online." (Moultrie, Clarkson et al. 2006)

This broader definition of manufacturing coupled to the concepts of extended or augmented products complicates the accepted narrative for the evolution of a 'modern' economy. The stylised notion of a transition from agriculture to industry and on to a service economy does not admit the blending together of the production and service elements of the economy. The split embedded in industrial classifications from their inception may have been tenable in an era of vertically integrated firms and few service-based business models. However, its continuation only serves to reinforce a view of the economy which is out of date and potentially misleading for policy analysis.

Adding a value chain perspective to industrial policy

Figure 2 imagines an economy with a number of sectors showing each of their value chains running from R&D through production and on to services and end of life management (EOLM). How might a government approach deploying its interventions across these industries?

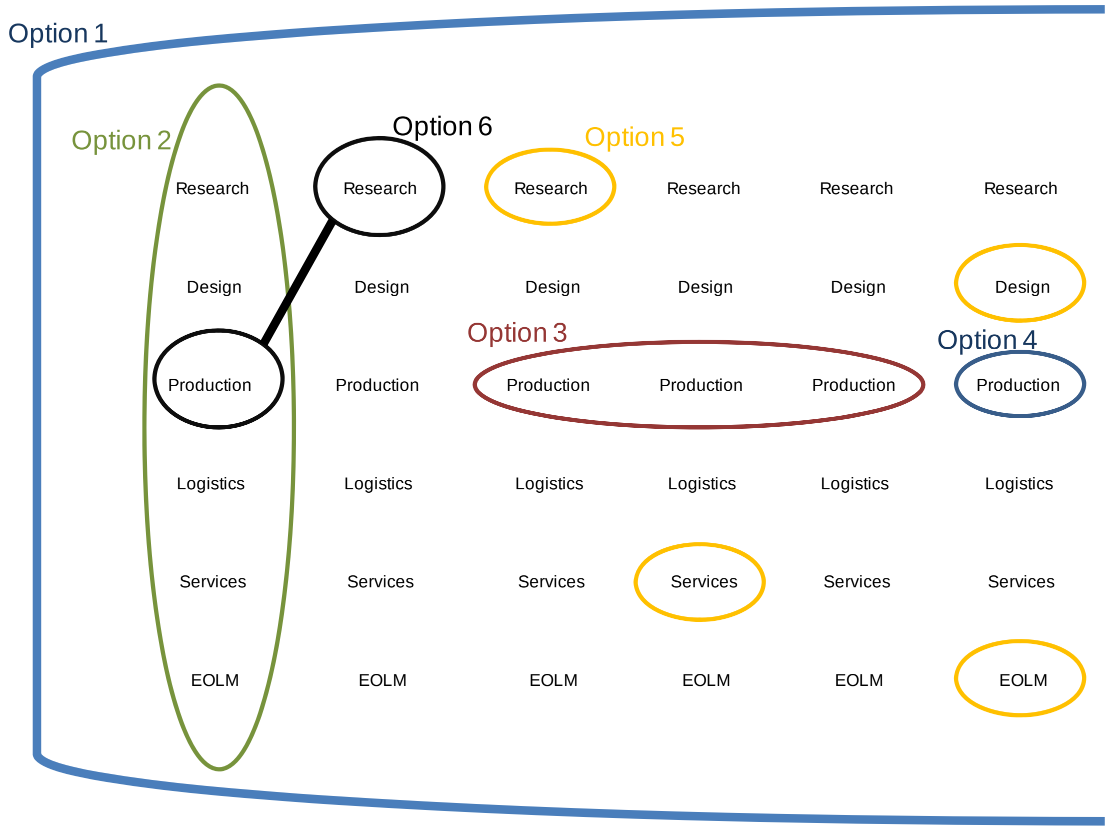

Figure 2 – interventions across and between value chains

Option one is to have an inclusive, all embracing approach to industrial policy where all sectors are involved and all activities are open for incentivisation. This covers the non-targeted approach of setting enabling conditions and improving general business conditions. The second option is specific sector targeting, looking across the whole of the value chain for that given sector. This is akin to the approach of the UK innovation and growth teams, where all of a given sector's activities are reviewed to understand where across the value chain the government can provide support. Option three is where production across a number of sectors is being targeted, for example through investment tax breaks for developing production facilities. The fourth option is a narrowing of option three, where instead of having instruments that apply to production in a number of sectors the instruments are developed specifically to address the needs of production in one particular sector. Option five is where there are interventions on an as needs basis across a number of sectors in the economy, where for example in one there is a need for support for production capacity, whereas in another there is a need for raising the levels of R&D. Finally, option six is where there is an explicit linking between an intervention at an early stage in one value chain linked to a later stage of another value chain.

Using the value chain to discuss intervention highlights how action may reach across industries and together with the maturity perspective below should provide policymakers with a clearer picture of when and where they may wish to intervene.

2.1.2 Targeting versus enabling, horizontal or vertical

One of the key arguments against industrial policy is that government has no particular knowledge or skill that allows it to 'pick winners'. This comes from interpreting all industrial policy as being sectorally targeted, and in many cases targeted at a single industry such as aerospace or automotive. This tension between the targeting of individual sectors and intervention to support general conditions has led to a focus on productivity and competitiveness, which is discussed in section 2.1.4.

The most recent attempt to resolve the tension between general and specific policies is within the new European industrial policy[2] which has been characterised as having a matrix approach (Aiginger and Sieber 2006). Zourek (2007) lists the horizontal policies outlined by the EU which include the management of structural change through the European Globalisation Adjustment Fund, improvement of skills, a dialogue on intellectual property rights and a simplification programme for regulation. These are contrasted to a set of sectoral initiatives for areas such as pharmaceuticals, aerospace and mechanical engineering, with the actions in each sector being tailored to the needs of that sector and developed in consultation with stakeholders across the sectors. In this way there are interventions to improve the general conditions for all industries, aligned to specific policies for specific industry sectors.

The matrix approach in some way avoids the question of either horizontal or vertical by including both. However, it does not provide any guidance on when it may be appropriate to have more or less of

[2] EU COM (2005) 474: Implementing the Community Lisbon Programme: a policy framework to strengthen EU manufacturing – towards a more integrated approach for industrial policy, available online at http://ec.europa.eu/enterprise/enterprise_policy/industry/com_2005/com_2005_474.pdf.

either. If sectorally specific approaches are to be taken, as Rodrik (2007) discusses, the goal is to have a strong dialogue between both sides so that there is at least a shared understanding of the issues facing various industries, if not agreement on which industries should be supported by government. This partnership model is the one espoused in the latest statements from the UK government (HM Government 2009) with "… markets wherever possible, complemented by state action wherever necessary." This implies a specific implementation model of partnering between industry and government and is discussed further in section 5.

As the decision on whether industrial policy should be horizontal or vertical is highly context dependent, both options should be included in the definitional scope of industrial policy. This also leans towards the portfolio approach to intervention, whereby the industrial policy towards a given sector is not developed in isolation from that for all other sectors.

2.1.3 Large versus small companies

The role that large versus small companies play in economic growth has gone through a number of shifts, from Schumpeter's claims for the dominant role of the entrepreneur (Schumpeter 1934), through Chandler's description of the rise of large companies (Chandler 1962), to modern work on the rising share of small and medium sized enterprises (SMEs) in employment and output across developed economies (Carree and Thurik 1998; Aquilina, Klump et al. 2006). The desire to create national champions, in a similar manner to policy in the 1970s, is no longer present and much of current opinion is that it is not possible for the government to create the conditions for significantly large UK firms to emerge (Owen 2004) even if such companies are desirable elements of the economy.

However, the dynamics of new industries tend to revolve around the emergence of new firms with a peak and shake out as the industry matures (Utterback 1994). If industrial policy is to be relevant across the lifecycle of an industry, it must admit the possibility of addressing the needs of companies of all sizes, depending on the stage of maturity of the industry.

2.1.4 The move to productivity and competitiveness

As noted above, much of the discussion on whether governments can 'pick winners and losers' and the disenchantment with sectorally targeted interventions led to a discussion on how to broadly improve productivity and competitiveness for industry. As Beath (2002) notes for the UK "… the 1980s saw the discussion of a positive industrial policy slip off the agenda for discussion … this also involved a move away from the vertical targeting approach … to more horizontal, sector-neutral policies …".

The 1995 Command paper from the Department of Trade and Industry, *Competitiveness: Forging Ahead*, provides a list of how government can improve conditions for companies when market imperfections stop firms from improving themselves (DTI 1995):

- "providing the stable macroeconomic environment, based on low inflation, sound public finances and competitive tax rates, which is essential to give business confidence to invest;
- maintaining and developing open and competitive world markets and fighting to bring down barriers to trade;
- removing unnecessary burdens on business through deregulation, aimed particularly at small and medium-sized enterprises (SMEs);
- making markets work better through liberalisation, sharpening incentives by the reform of personal and business taxation, and extending markets through privatisation;
- helping business help itself through better informed decision-making and the spread of best practice;
- ensuring a favourable environment for inward investment; and
- improving value for money and standards in services, such as education, which are best provided by the public sector."

This stance on the limits to government intervention in support of industry has changed, as discussed earlier, but remains as a backstop argument for those who believe that government can never positively intervene in selected industries.

In a similar fashion to the discussion on horizontal versus vertical policies, a modern interpretation of industrial policy should include but not be limited to improving the enabling conditions for industry. One of its goals should be productivity improvements, but this should not be the sole determinant of the need for or the success from intervention.

2.2 Current issues for industrial policy

As noted above, the majority of work on industrial policy over the past twenty years has occurred in development economics, far removed from the context of a leading developed economy. However, there are a number of current pieces that should be highlighted.

The most recent expression of the need for a new theory of industrial policy is Aiginger's attempt to define strategic industrial policy (Aiginger 2007). This is a reinvention of industrial policy that focuses on 'dynamic competitiveness', encouraging "... activities with positive spillovers, creating 'good' institutions, providing pro competitive regulation." In this view, for so-called 'frontier economies' industrial policy merges with innovation policy (Soete 2007). The new industrial policy for Aiginger will depend on how close to the frontier an economy is placed. This is an issue we return to in section 3 as the rationales and modes of action may be quite different depending on the maturity level of the industry.

The links between different policy areas has also been commented on, most notably in Soete (2007) which describes the transition from low-tech to high-tech industrial policy, and from there on to innovation policy. “From something with a distinct negative connotation in the 1980s often resulting from some spectacular particular cases of policy failures, industrial policy under its new form of innovation policy seems to open up new policy priorities: e.g. in the design of appropriate eco-innovation as well as social welfare policies in both the developed and emerging economy world.” Whether industrial policy is clearly distinct from innovation policy (or even science and technology policy) is in some ways a matter of labels, but labels that matter as the term has such negative connotations. Another version of this re-labelling is the appearance of manufacturing strategies, as discussed by Beath (2002). While the points of leverage may have moved, it appears the core themes of competitiveness, innovation, and competition remain constant.

With the re-emergence of industrial policy in developed economies some framework pieces have appeared. The most relevant for this paper is Benhassine and Raballand (2009) which develops a framework to describe how much an intervention departs from neutral policies. The dimensions are the degree of selectivity and the extent of price subsidies. Taking the position that “laissez-faire/getting the basics right” is the foundation or neutral position is in itself an ideological statement, but the framework does begin to tease apart the rationales for different types of intervention.

3. Developing a maturity based framework for industrial policy

Developments in how companies organise their value chains aligned to changes in the international economic scene have brought industrial policy back into favour, at least at the level of soundbite, in developed economies. However, the existing frameworks, based on the matrix approach or in terms of strategic industrial policy, do not provide a strong enough foundation for countries such as the UK to develop a clear policy towards industry. This section provides a high level framework to clarify the rationales for industrial policy, which may lead to an overall framework to guide industrial policy development, based on industry lifecycles.

3.1 Linking country and global maturity of industries

Existing work on the rationales for industrial policy appears to be based on differentiating based on the development level of a country alone. This does not admit to a mixed world where there are varying levels of industrial development across a given economy and that countries with overall levels of development lower than leading countries could be leading in specific industries. The concepts of market failure and systemic failure are applied in the main without reference to the global context, specifically the maturity or state of a given industry outside of a country.

The concept of industry lifecycles (also dubbed product life cycles) has a long history (see for example (Gort and Klepper 1982; Miller and Friesen 1984; Klepper 1996; Dinlersoz and MacDonald 2009)). Most of these approaches are based on measuring or modelling the number of firms (usually referred to as producers) within the industry over time. A general pattern is seen with a low and relatively stable number of firms initially, followed by a significant increase in firms, with a peak followed by a decline to a stable number of producers.

Most of these models for industry lifecycle end up with a four or five stage structure. Figure 2 is a four stage version adapted from (Gort and Klepper 1982; Dinlersoz and MacDonald 2009) with an emergent period, followed by significant growth in the producers, a mature phase and finally decline as the market for the industry decays and the industry essentially ceases to exist in its current form.

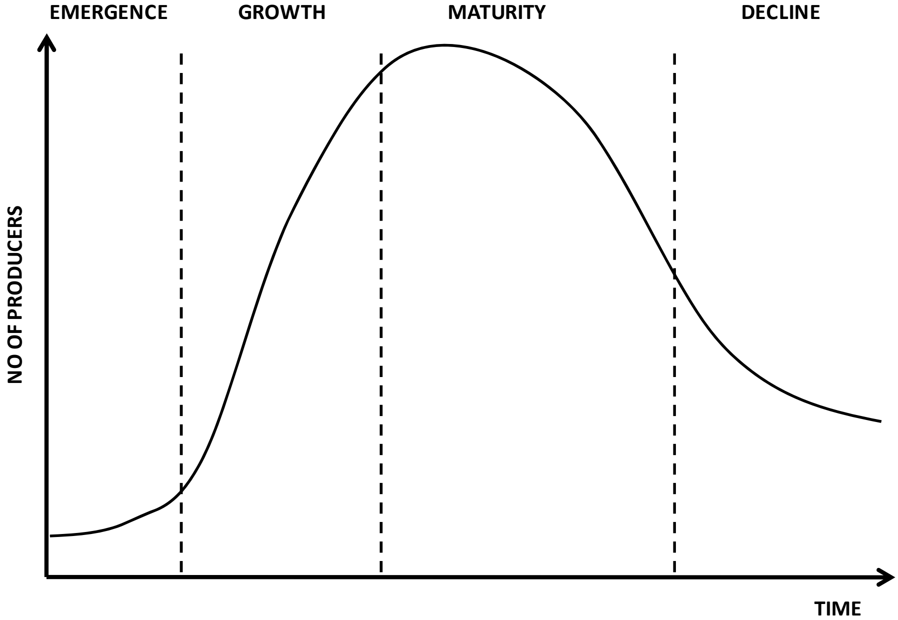

Figure 2 – stages of industry lifecycle

It should be noted that these phases are not correlated to output, in fact as the number of producers is declining output can, and many times is, be increasing. These models also presuppose an initial producer or set of producers, i.e. that the development of product zero has occurred and there are buyers and sellers in existence. This is discussed in section 4 as there is a need in clarifying the language on industrial policy to establish clear links to science, technology and innovation policy.

Building on the concept of a general industry lifecycle, we can contrast the lifecycle points for a given industry within a country and at the global level. Figure 3 shows a simple grid linking country and world industry lifecycles. This gives us a framework to discuss when different rationales might exist for a government to develop industrial policy in a more nuanced form.

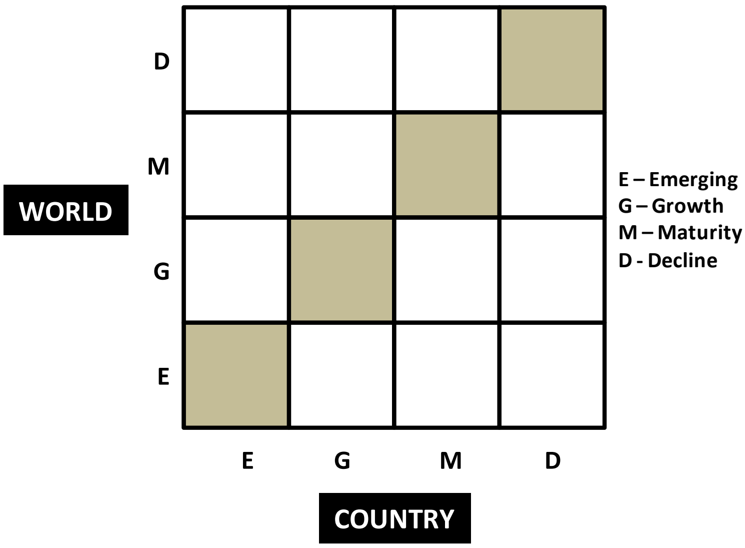

Figure 3 – Country versus world maturity grid

Above the shaded squares, the industry in the country is lagging the lifecycle of the industry in a global sense, whereas below the shaded squares the opposite is true and the country based industry is leading the global lifecycle. Obviously, in the shaded portion the two are in sync. The existence of the lower right portion is essentially the missing piece in industrial policy discussions to this point.

3.2 Rationales for industrial policy based on comparative maturity

With the framework in place what can we say about the types of interventions that might be used by government and their rationales? The majority of industrial policy in a developing country context presupposes the existence of the industry on a global scale prior to that industry emerging in the country. This leads to arguments for infant industry protection or tariff setting. However, if the industry is new both to the country and to the world, these arguments make no sense. The support required for a truly new industry, emerging for the first time, will radically differ from that which may be deployed to sustain a declining industry or to provide shelter for an as yet uncompetitive industrial base in a country.

Taking the framework in figure 3 we can break it into a number of segments each with different contexts for the policymaker to consider as they decide on levels and types of intervention. These are shown in figure 4.

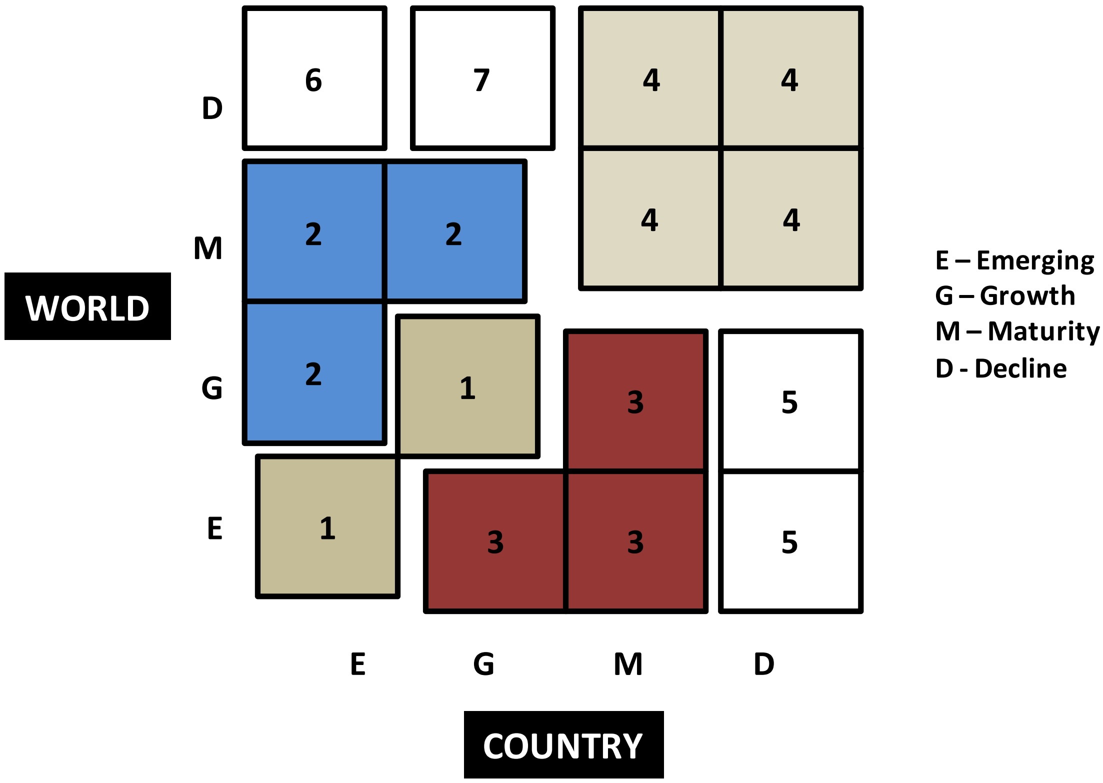

FIGURE 4 – discussing industrial policy rationales based on comparative maturity

Area 1 is where industrial policy meets science and technology policy in a very direct way, as new industries are supported as they emerge for the very first time. This is a highly contentious area, where the critique of government choosing industries to support is at its highest. However, depending on the size of the market and the type of capabilities the country has (i.e. strength in research or production scale up and cost), there may be strong arguments to preference the industry to attempt to move it into area 3.

In contrast, for area 2 there will be arguments for infant industry protection, where countries attempt to enter an existing world industry and protect themselves while moving down the learning and cost curves associated with that industry. This is where most industrial policy has to date focused and may be the least relevant for a leading economy. Area 3 is the category where a country has a significant lead as an industry develops (for example, early nuclear industry developments in the United States). There may be no explicit support required, although a government may focus on a leading sector to maintain its comparative advantage.

As an industry matures it will move into area 4. As the industry is mature and well established the focus is likely to be on either improving productivity and competitiveness, providing transition support to industries that are declining or imposing tariffs and engaging in protectionism to maintain the industry for example to protect employment. Similarly to area 3 this is where there has been much discussion in the past, in particular the arguments against government picking winners and losers or supporting industries beyond their useful life for political reasons.

Area 5 is where the industry in decline for the country but may be emerging or growing in the global context. Here any discussion of intervention depends on whether the country is essentially losing an industry to competitor countries or whether it is moving away from an industry that is no longer relevant in its context. For example, if the industry had emerged from the science base and grown to a stable set of producers over an extended period of time, followed by imitators from other countries taking advantage of patents expiring or spillovers of knowledge allowing them to enter the market, there could be an argument for some protections for the industry. However, the default in this position may be to allow the transition to occur.

The mirror of this is areas 6 and 7. In area 6, as there are by definition a small and relative stable number of producers in your country as the world position deteriorates, it is mostly likely that this is an industry in true decline and will be unwise to support. However, in area 7 if the industry was in decline prior to developments in your country, it may be that it is an industry that truly is in decline in a global sense.

A key outcome of developing this maturity grid is to highlight that pure market or systemic failure arguments may not provide a clear picture on both the context and linkages for industries as they move through their lifecycles.

3.3 Example of mapping across UK industry sectors

What might a map of a given economy's industrial sectors look like? Taking the example of the UK and a small number of sectors, Figure 5 shows how they may map into the framework.

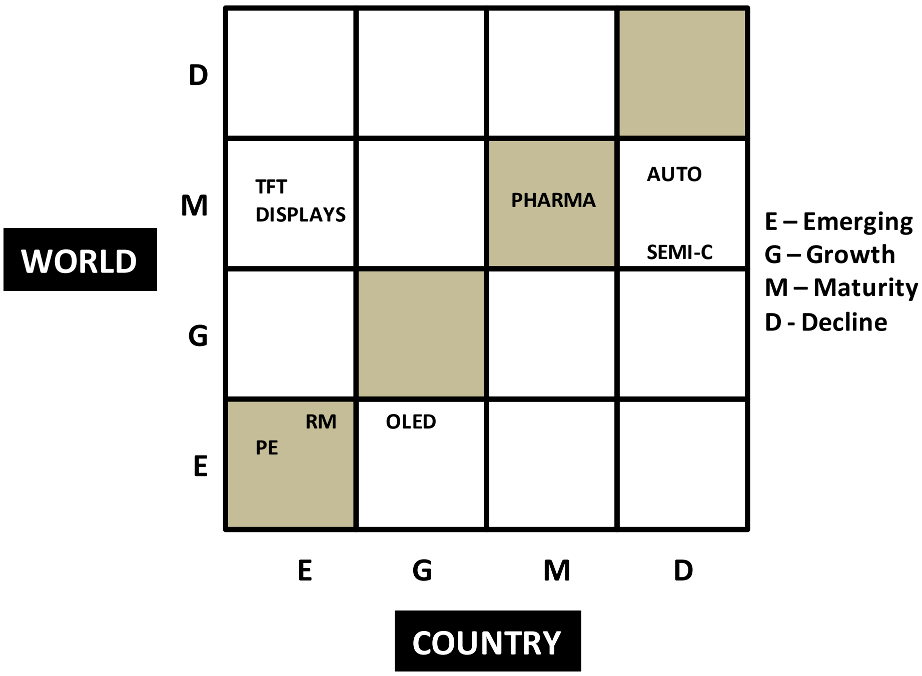

Figure 5 – example mapping of sample of industries in UK

It should be stressed that decline in this framework is a decline in the number of producers, and for much of that phase may not be a decline in output.

Beginning with the emerging area, plastic electronics (PE) and regenerative medicine (RM) are both at the very early stages of development with few producers and few products on the market at present. There is possibly a difference between the two for the UK, with the translational link to scale up production working slightly better for regenerative medicine than plastic electronics. In contrast, while the OLED space is still emerging on a global scale, there is a possible lead for the UK here. The mapping for TFT displays is difficult, since much of the original technology emerged from UK research, but the industry has not developed over a significant period. One interpretation is that the emergence phase for TFT displays in the UK has been extremely long. Another would be to say that the industry has no foundation in the UK and essentially is mapped onto the vertical axis. This example in particular points to the difficulty with lifecycle models, as they tend not to be able to represent the complex time paths of emergence, retrenchment and growth which occur in many industries.

At the other end of the scale, automotive in the UK has gone through a mature phase and we are seeing a reduction in the number of producers (even if the volume of cars produced has risen). Pharmaceuticals is mature in both contexts, but there is a concern that the UK research base is now under threat. This highlights the difficulty with characterising an industry, especially larger and longer established industries, within one point in the framework. Focusing on number of producers will place pharmaceuticals at the mature/mature point, but there are elements of the broader industry which are more emerging. This may require going one level deeper and mapping each large industry in its sub elements to get a clearer picture of the dynamics underneath the large established brand names.

3.4 MMM based industries in the maturity framework

The Cambridge IKC is investigating molecular and macromolecular materials (MMM). As noted by the CIKC at an early stage, these have the potential to disrupt a number of different industries, notably communications, displays and sensing technologies. This creates a difficulty, as to speak of MMM based industries is misleading. There are a number of industries where MMMs will have an impact, but there are few industries that are wholly created and defined by the use of MMMs. They, and the techniques developed to produce them, are in effect a platform technology. The question for the CIKC therefore, is how to link discussions on industrial policy, especially at this moment of heightened interest from government, to emerging platform technologies.

In section 3.2 when discussing rationales for the first area of the maturity grid (emerging/emerging and growth/growth) it was noted that there is a direct link at this point to science, technology and innovation policy. Specifically the first phase of emerging/emerging can be considered to be the direct overlap between science and innovation policy and industrial policy.

One way to link the maturity framework to a platform technology is to map the industries it may impact and if these are seen as potential targets for intervention, then the platform technology has an additional rationale to be addressed in science and innovation policy. Specifically, if the platform technology is going to radically disrupt the industries of interest or allow for UK based companies to access the value chain of an existing industry of significant size, this could be the basis to provide support for the platform technology.

This implies that beyond maturity there are further criteria to assess if there is a reason or potential benefit to be gained from government intervention in support of a given platform technology. The ‘third axis’ to the maturity grid in figure 5 could be based on a number of indicators. For example, if the concern is employment, the labour intensity of the sector should be considered. However, if it is pure return to the exchequer, it may be better to look at projected world market and the share of that market a UK based industry could capture. Again, this points to the multidimensional nature of goals that may exist between industry and government.

The example of MMMs as a platform technology also highlights the need to understand the linkages between different industries and their value chain elements. For example, the interplay between new battery technologies and the automotive sector clearly highlights how a well established industry can be in the mature phase, but there will be significant innovation and change in the elements of its value chain. This can appear contradictory due to the labels of mature and decline for the later phases in most industry life cycle models.

4. Discussion and conclusions

The maturity framework developed above is intended to act as a strategic tool for policymakers to analyse and understand where they may wish to intervene in support of a given industry. As highlighted, a key element is to understand the relative positioning of the industry in the national context. This moves the discussion on whether to use industrial policy away from an almost one size fits all approach and allows for distinctions to be made between industrial policy in leading economies and those who are late industrialisers (Amsden 2003) or emerging economies.

As well as highlighting the comparative maturity of a given industry, the discussion in section 2 highlighted the emergence of value chains across industry sectors. Bringing together the value chain perspective and the comparative maturity of industrial sectors in a country provides a complex picture for the policymaker, but it is one that is more realistic and allows for an understanding of the linkages between potential interventions. This is important both when deciding whether to intervene and how to intervene.

However, this work does highlight a number of issues which remain problematic. The first is that the language around industrial policy (and by implication innovation and technology policy) is confused. What is portrayed as a single area is used to discuss targeting support for technologies, individual companies and whole industries. Whether it is possible to do the last without doing the first two is debatable, but when the language itself is confused it is difficult to have a reasonable discussion on the appropriateness of intervention.

Next, there is a continuing problem with the definition of industry or sector. Speaking of industries as complex as automotive or aerospace as being at a particular point of emergence or maturity is a gross simplification. It is also complicated by the interplay between the development of new technologies which can form part of a new industry or revitalise an existing industry. For example, the improvement of fuel efficiency standards in the automotive sector is a change in an existing industry, but does the development of a radical fuel cell technology which can be used in an automotive environment constitute a new industry or the transition of an old industry back to the frontier of technology development?

This is a similar point to whether government intervention is targeting technologies, companies or industries as all three are very different. In supporting a platform technology without considering how it enters into the production process, or impacts on the given market structure, science and technology policy may fall short of its promise. This is a key reason for revisiting industrial policy in developed economies – the production of new scientific knowledge does not automatically lead to new industries and growth.

Throughout this discussion the issue of company ownership or nationality has not been raised. It is an open question as to whether company nationality has a long term impact on whether interventions in a national geography succeed or not. Industrial policy needs to include this in its development, as to assume that helping any company of any structure or nationality is equivalent is to avoid the fact that company and country goals do not always align.

This paper has outlined a framework based on maturity and highlighted the need to understand the value chain and its linkages across industries. Taking the framework forward will require developing further criteria that can be used almost as a third axis for the maturity grid so that potential market size, accessible market share, potential for job creation and other factors can be included in the decision making process surrounding support for particular industries or across a set of industries. The paper also raises questions for the industry life cycle model, for example does a disruptive platform technology change the industry lifecycle structure radically? The process of revival is included in some life cycle models, but how one industry spawns another or is interdependent on platform technologies is not adequately included as yet.

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