

ECONOMICS

BIS | Department for Business
Innovation & Skills

BIS OCCASIONAL PAPER NO. 2

The economic rationale for a
national design policy

AUGUST 2010

BIS | Department for Business
Innovation & Skills

BIS OCCASIONAL PAPER NO. 2

The economic rationale for a
national design policy

G.M. PETER SWANN
INNOVATIVE ECONOMICS LIMITED

AUGUST 2010

The views expressed with BIS Occasional papers are those of the authors and should not be treated as Government policy

Contents

Acknowledgments	iii
Executive Summary	iv
1. Introduction.....	1
1.1 Specification for the Project	1
1.2 The Elementary Rationale for Policy	1
1.3 Evolution of Government Policy towards Design	3
1.4 What Activities are Included in “Design”?	5
2. Rationales in Economic Theory.....	9
2.1 Market Failure	9
2.2 Systems Failure	14
2.3 ‘Footloose Multinationals’	20
3. Options for Policy Interventions.....	23
3.1 Strengthen the Design Profession.....	23
3.2 Create National Assets	24
3.3 Public Expenditure on Design, Stronger IP and Tax Credits	25
3.4 Design for Complex Systems and Standards for Design	25
3.5 Education about Design	27
4. Discussion Grouped by Theoretical Perspectives	28
4.1 Market Failure Rationale	28
4.2 Systems Failure Rationale	35
4.3 ‘Footloose Multinationals’ Rationale	38

5.	Discussion Grouped by Policy Initiatives	41
5.1	Strengthen the Design Profession.....	41
5.2	Create National Assets	41
5.3	Public Expenditure on Design, Stronger IP and Tax Credits	42
5.4	Design for Complex Systems and Standards for Design	43
5.5	Education about Design	43
6.	Conclusions	45
	Appendix	48
A1.	Investment in National Assets as a Game in R&D.....	48
	References.....	50

Acknowledgments

The author is grateful to Ray Lambert, David Godber, Jane Hartshorne and Mel Taylor for their comments at a preliminary meeting on 27 October 2009, and on two earlier drafts of the report. They are not responsible for remaining errors.

Executive Summary

This paper reviews three different rationales for a national design policy body, and assesses five broad activities of this body from each of these three perspectives. That is, we assess how well each option for policy can find a clear economic rationale.

After explaining the scope of the report and the approach taken, Part 1 presents a brief summary of how the Design Council has evolved from the foundation of its predecessor, the Council for Industrial Design, in 1944.

Then, as we cannot assess the economic case for public support of design without classifying what design comprises, we set out six essential characteristics of design as described by different commentators. These are the multi-faceted character of design; design as a link from creativity to innovation; design as a source of competitive distinction; design as an approach to planning and problem-solving; design as a means of creating order out of chaos; and design as an approach to systems thinking. We argue that the multifaceted character of design is a strength, not a weakness, and moreover that it strengthens, rather than undermines the case for policy intervention to support and co-ordinate design activity.

Part 2 describes the three perspectives. The first is the traditional 'market failure' rationale of neoclassical economics, and some other arguments based on neoclassical theory. This approach describes several generic economic phenomena (economies of scale and scope, asymmetric information, externalities and co-ordination problems) which cause market outcomes to fall short of their usual 'optimum' properties.

The second is the 'systems failure' rationale that originates from work on national systems of innovation and evolutionary economics. This approach recognises a much wider range of factors that may cause 'system failure' and hence inadequate innovation, including: infrastructural failures, institutional failures, interaction or network failures, transition or lock-in failures, and capability or learning failures.

The third may be called the 'footloose multinationals' approach to industrial policy, which builds on pioneering studies in the field of international business. In this perspective, business interests can be quite different from national interests because companies are no longer embedded in a single national economy in the same way. Indeed, businesses can start to behave like customers for the resources provided by different nations. From this perspective, government may decide to invest in location-specific (national) resources, knowing that businesses will not do so.

Part 3 then summarises some groups of options that exist for policy intervention in design. The first group includes various initiatives for public investment in strengthening the design profession. The second group contains various forms of public investment in national design assets. The third group includes initiatives for investment in design to shore up national economic competitiveness, as well as

stronger IP for design and tax credits. The fourth group includes various options for investment in design to support *systems thinking* and standards for design. The fifth and final group covers initiatives to educate end-users, companies and the public sector about the value of design.

Parts 4 and 5 then assess each of the options in Part 3 from the perspective of the economic rationales in Part 2. Do these policy options find an economic rationale and what is it? A simple table summarises the view of each option from each perspective. The version below summarises the main elements; a full version on page 41 of the report spells out further details.

		PERSPECTIVE		
		Market Failure	System Failure	'Footloose Multinationals'
POLICY OPTION	Strengthen Design Profession	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT
	Create National Assets	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT
	Public Expenditure on Design, Stronger IP and Tax Credits	MIXED SUPPORT	MIXED SUPPORT	MIXED SUPPORT
	Design for Complex Systems and Standards for Design	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT
	Education about Design	MIXED SUPPORT	MIXED SUPPORT	MIXED SUPPORT

It is clear from this table that there are many areas of design activity that are eminently worthy of support from public funding. Notably, the following three broad areas receive particularly strong support:

- Creating National Design Assets
- Design for Complex Systems and Standards for Design
- Strengthening the Design Profession

The other two broad areas receive some support, but not so strong:

- Public Expenditure on Design, Stronger IP and Tax Credits
- Education about Design

However, according to the perspectives taken in this paper, the areas most deserving of support are not necessarily the same as those that receive most attention in current government policy. This observation does not necessarily cast doubt on current priorities; for it may be that the limited range of (three) perspectives taken in this paper does not include those perspectives which provided the motivation for current policy priorities. But this observation does suggest that it would be useful to consider whether some other priorities might be added to the current list.

1. Introduction

1.1 Specification for the Project

The specification for this project asks for:

“A paper reviewing the market failure and other, cogent, rationales for a national design promotion policy and its scope of applicability, with some reference to the purpose and roles for a national design policy body.”

The specification stresses the need to provide a firm conceptual foundation for “the contribution that central government and a national level design promotion body can make to ensuring the optimal development and application of design capability.”

In short, why and how should Government promote design? The specification lists the following as examples of some of the possible rationales for policy:

- As a national asset, complementary to the research base and other knowledge and innovation investments?
- As a profession?
- As a source of competitive advantage?
- To offset market failures?
- In other ways?

but stresses that this list is not exhaustive.

1.2 The Elementary Rationale for Policy

Abraham Lincoln left us with a perfect distillation of the case for government action:

“The legitimate object of government is to do for a community of people, whatever they need to have done, but can not do at all, or can not so well do, for themselves in their separate and individual capacities. In all that the people can individually do as well for themselves, government ought not to interfere.”

And he went on:

“The desirable things which the individuals of a people can not do, or can not well do, for themselves, fall into two classes: those which have relation to wrongs, and those which have not. Each of these branch off into an infinite variety of subdivisions. The first, that in relation to wrongs, embraces all crimes, misdemeanors, and nonperformance of contracts. The other embraces all which, in its nature, and without wrong, requires combined action, as public roads and highways, public schools, charities,

pauperism, orphanage, estates of the deceased, and the machinery of government itself. From this it appears that if all men were just, there still would be some, though not so much, need for government.”

Opinions have long been divided on whether Lincoln's second category (combined action) should include much of a role for industrial policy. In 1989, for example, Nicholas Ridley, on his appointment as Secretary of State for Trade and Industry, famously said that he had nothing to do and thousands of officials to help him do it. His view was that market forces should be left to operate without interference. In 1992, by contrast, Michael Heseltine promised on his appointment as President of the Board of Trade that he would intervene “before breakfast, dinner and tea” to help British companies.

The aim of this report is to provide a brief survey of the rationale for industrial policy in general - and specifically in the context of design. We can approach this survey in two ways:

(a) One approach builds on economic theory. It says that there are, on grounds of economic theory, reasons to suspect that the observed market or system outcome is not as it could be were governments to make some policy interventions. An example of this is as follows. While, in ideal circumstances, markets would work sufficiently well to ensure that private agents (firms and consumers) allocate the optimum level of resources to each area of business, there could be market or system failures as a result of which this happy optimum does not occur. Instead, business devotes too little resources to each of these areas – too little for the collective interests of business and too little for the collective interests of the national economy.

(b) The second approach surveys some of the options for policy interventions in design. Some argue that regardless of whether or not the economist concedes that there is a market system ‘failure’, there are nonetheless prima facie grounds for believing that government intervention is required. An example of this, in the design context, is the argument that because governments in some SE Asian countries are investing so heavily in design, this will be a threat to the UK design sector and to UK companies that use design, and if business is not investing enough in design, then government should do so.

Set against these, there is one generic argument against industrial and innovation policy interventions. This argues that even if markets and/or systems ‘fail’, governments can ‘fail’ too. Governments do not and cannot have all the information required to make correct interventions, and the risk of making things worse is comparable to the risk of making things better.

In this report we focus on the two approaches described above and the connections between them. That is, we shall aim to assess how well each option for policy in (b) can find a clear economic rationale in (a).

The structure of the rest of this report is as follows. The rest of Part 1 provides a brief summary of the evolution of government policy towards design since 1944

(Section 1.3), and then defines some of the activities that are included within design (Section 1.4).

Part 2 analyses the sorts of rationale for policy found in several branches of economic theory. This starts with the traditional ‘market failure’ rationale of neoclassical economics and some other arguments based on neoclassical theory (Section 2.1). Next we summarise the ‘systems failure’ rationale that originates from work on national systems of innovation and other arguments derived from evolutionary economics (Section 2.2). Third, we summarise arguments based on what might be called the ‘footloose multinationals’ approach to industrial policy (Section 2.3).

Part 3 then summarises some of the options for policy intervention in design. This starts with options for public investment in the design profession (Section 3.1), public investment in national design assets (3.2) and other options for investment in design to shore up national economic competitiveness, including stronger IP for design and tax credits (3.3). We then turn to initiatives for investment in design to support *systems thinking* and standards for design (3.4), and finally initiatives to educate end-users, companies and the public sector about the value of design (3.5).

Parts 4 and 5 then assess each of the options in Part 3 from the perspective of the economic rationales in Part 2. Do these policy options find an economic rationale and what is it? Part 4 organises this discussion in terms of the different economic rationales: for each rationale, which options gain support, and which do not. Part 5 organises the discussion in terms of the different policy options: for each option, which rationales would support that option and which would not? Part 6 concludes.

1.3 Evolution of Government Policy towards Design

There are several public sector bodies with a role in promoting and developing design. The best known, and the one most dedicated to design promotion, is the Design Council. However, this is only one agency amongst several, with others including: the sector skills council, HEFCE, UKTI, the RDAs and DCMS. There are also other non-government agencies such as the Design Business Association (DBA), British Design Innovation, D&AD, and also the (international) Chartered Society of Designers.

In what follows, we summarise the evolution of the role of the Design Council since its foundation. It started life in 1944 as the Council of Industrial Design.¹ Its objective was to promote the improvement of design in the products of British industry. From 1947, the Council’s activities expanded to examine ways to reform design education, and to ensure that Britain had the industrial designers required to support the post-war economy. The Council also started to educate retailers and consumers in the merits of good design and arranged exhibitions and product

¹ The following summary is a slightly shortened and edited version of the history provided on the Design Council’s Website.

endorsements while also offering direct services to industry, commercial publishing and retail. It was a model widely imitated around the world.

From 1959, the Council's work involved an increasing emphasis on technology and engineering design, and in the early 1970s the name was changed to the Design Council. From 1977, the Council developed an initiative to increase visual literacy and design awareness in schools. By the 1980s Britain was certainly design conscious, with high street spending boosting design investment. Consumers and retailers seemed convinced about the merits of good design, and the design industry was steadily growing and increasingly visible.

From 1988, however, the Council's focus switched from public campaigning to business and education. The Design Council's retailing and product endorsement activities were closed and industrial services were regionalised. By the early 1990s, the Design Council was perceived to be "out of touch".² It was remote from the design community, viewed with indifference by much of industry and isolated politically. New Government plans, such as using Business Links to deliver industrial services including design, threatened its purpose.

In 1993, the Government announced a major review of the Design Council's work. This proposed a small, lean, agile, collaborative think tank organisation with around 40 staff, which would develop and disseminate new knowledge and inspire action, while devoting more resources to activities and initiatives, and far less to fixed costs like salaries and rent. The council's new purpose was enshrined in the mission statement: "to inspire the best use of design by the UK, in the world context, to improve prosperity and well being".

The Council focused its communications on business, education and government, introduced a forward-looking, team-working culture and set about forming partnerships with key opinion-leader organisations as a new means of inspiring audiences to use design. One of the initiatives was *Creative Britain*, which focused on how Britain's design strengths could help to improve the country's global standing. Another was the *Millennium Products*, launched by Prime Minister Blair, which identified over a thousand outstanding examples of British design and innovation and communicated the stories behind them in publications, learning materials and web-based case studies. The initiative led to a programme of highly successful exhibitions in many countries.

By the end of the Millennium, awareness of design's importance was well developed, but there still remained some uncertainty about *how* best to use design. From 2002, the Design Council embarked on a series of projects that saw designers and other experts working directly with selected businesses, schools and public services organisations to integrate design thinking and methods into their strategies and systems. The Design Council's work has concentrated on using the results of these projects to develop national initiatives that will strengthen and support the UK

² These are the Design Council's words, from their website – not mine.

economy. The Design Council is now pioneering new thinking about design-led solutions to social as well as economic problems.

1.4 What Activities are Included in “Design”?

Before proceeding to the next part of the report, we need to gather together *some* definitions of activities that are included in the term ‘design’. We emphasise that this is *not* an attempt to provide a definitive statement of what exactly is design. Indeed, it is probably impossible to reach any kind of agreement on such a definition,³ but without *some* description of design activities, we cannot assess the economic case for public support.

Perhaps the only safe way of defining design is to take the same approach that Sir John Hicks took to defining money:

“Money is what money does”

We could adapt that in the present context to:

“Design is what designers do”

Such a catch-all definition is not just pragmatic, but it is also important in that it recognises design as a *pervasive and multi-faceted* activity. Moreover, as we shall argue below, this pervasive and multi-faceted character is one of the strongest reasons why policy intervention is needed to ensure that the benefits of design are captured for the good of society and the economy.

Here are six essential characteristics of design as described by different commentators.

a) Multi-Faceted

Design is a multi-faceted activity. That will be clear from characteristics (b) to (f) below. The following definition captures this with commendable clarity and economy:⁴

“Design is a vision Design is a process Design is a result”

b) A Link from Creativity to Innovation

Consistent with the ‘process’ characteristics from (a), the DTI defined design as:

“A structured creative process”⁵

³ DTI (2005) and Swann and Birke (2005) describe some of the other definitions used by other writers.

⁴ Michael Wolff, quoted in Design Council (1995).

Underlying this definition is an assumption that creativity is generally a somewhat anarchic activity that can be a source of value to business, but also a source of chaos and disorder. Design is seen as a way in which creativity can be harnessed for good and not lead to chaos.

The Cox Review went further and described design as *the* link from creativity to innovation:

“Design is what links creativity and innovation. It shapes ideas to become practical and attractive propositions for users or customers. Design may be described as creativity deployed to a specific end.”⁶

And this idea has become part of government thinking on the subject:

“Design is the process that links creativity and innovation.”⁷

c) Offers Competitive Distinction

Consistent with the ‘result’ characteristics from (a), the following definitions describe how design can help to offer competitive distinction:

“Design adds the extra dimension to any product”⁸

“What will make a product stand out is the quality of the way it matches the purpose, skills and personality of the user, of the visual communication which goes with it, of the environment in which it is sold, and of the image of its maker. All of these are created by design.”⁹

“Corporate purpose is made visible through design”¹⁰

d) Planning and Problem Solving

Consistent with the ‘vision’ characteristics from (a), design is seen as a plan:

“Design, from the Latin *designare*, ‘to mark out’, is the process of developing plans or schemes of action ... (Design) indicates primarily an interrelation of parts intended to produce a coherent and effective whole.”¹¹

⁵ DTI (2005, p. iv)

⁶ Cox (2005, p. 2)

⁷ DIUS (2008, p. 33)

⁸ Sir John Harvey Jones, quoted in Design Council (1995). We find this an especially interesting definition in view of our own work on product innovation as a dimension-increasing activity (Swann, 1990).

⁹ Bensen (1987)

¹⁰ Olins (1989)

¹¹ Encyclopaedia Britannica (1968, p. 298)

“Everyone designs who devises courses of action aimed at changing existing situations into preferred ones.”¹²

And as a technique for creative problem solving:

“Design is not just about styling or the adding a final finishing gloss; its true value lies in the proven methods used (often behind the scenes) to develop solutions. Design is creative problem solving.”¹³

e) From Chaos to Order

Design is seen as a way to create order out of chaos:

“The point about good design is that it imposes order and simplicity on a chaotic world.”¹⁴

“And thus you see design, properly so called, is human intention, consulting human capacity. Out of the infinite heap of things around us in the world, it chooses a certain number which it can thoroughly grasp, and presents this group to the spectator in the form best calculated to enable him to grasp it also, and to grasp it with delight.”¹⁵

There is a clear affinity here with Sir Humphrey Appleby’s dictum about government:

“Government isn’t about good and evil; it’s only about order and chaos.”¹⁶

f) Systems Thinking

Finally, and perhaps most ambitiously, design is seen as a discipline to achieve that most difficult of all intellectual activities, ‘systems thinking’ or ‘integrative thinking’. Nelson and Stolterman put it as follows:

“Systems thinking is a necessary component of design. Indeed, design inquiry is, in effect, simply a particular type of system approach.”¹⁷

A final quotation, from the CEC, brings together several of the previous characteristics:

“Design for user-centred innovation is the activity of conceiving and developing a plan for a new or significantly improved product, service or system that ensures the best interface with user needs, aspirations and

¹² Simon (1966, p. 111)

¹³ Design Council, private communication, 2009

¹⁴ Prue Leith, quoted in Design Council (1995).

¹⁵ Ruskin (1996, Vol. 16, p. 285).

¹⁶ Lynn and Jay (1983, p. 116).

¹⁷ Nelson and Stolterman (2003, p. 115)

abilities, and allows for aspects of economic, social and environmental sustainability to be taken into account.”¹⁸

* * * * *

The definitions cited above are not meant to imply that design lacks focus. On the contrary, the multifaceted character of design and the fact that we cannot pin it down in one definition is a strength, not a weakness. Moreover, we shall see below that it strengthens, rather than undermines the case for policy intervention to support and co-ordinate design activity.

¹⁸ CEC (2009, p. 58)

2. Rationales in Economic Theory

This part of the report analyses the sorts of rationale for policy found in several branches of economic theory. We start with the traditional ‘market failure’ argument of neoclassical economics (Section 2.1), and briefly mention two other neoclassical rationales for industrial policy. Next we summarise the ‘systems failure’ arguments that originate from work on national systems of innovation over the last two decades (Section 2.2),¹⁹ and briefly mention some other emerging evolutionary ideas on policy. Then we offer a brief summary of what might be called the ‘footloose multinationals’ or ‘footloose capital’ rationale for policy intervention (Section 2.3).

2.1 Market Failure

This is the traditional rationale in neoclassical economics for industrial or innovation policy. It says that policy interventions may be justified when there is *market failure* (as defined below), but such interventions are not justified or necessary when there is no market failure. As such, it provides some quite strict economic criteria to test whether policy interventions are worthwhile.

The concept of *market failure* is the idea that while a perfectly competitive market could under some conditions deliver an *optimum* organisation of economic activities, some economic phenomena may cause the actual outcome in markets to deviate from this optimum. The extent of the market failure is defined by the distance between this optimum and the actual market outcome. Industrial or innovation policy takes this optimum as a benchmark or target, and tries to steer the market outcome back towards the optimum.

Market failure analysis tends to focus on the economic phenomena (such as incomplete information, externalities and increasing returns) that lead to the failure rather than the particular form or symptoms of that failure. As a result it may seem at first rather abstract as it sets no limits on where these phenomena may occur nor gives any particular clues as to where they are most likely to be found. In this way, market failure analysis is rather different from system failure analysis (see below) because the latter is far more explicit about the locations of likely failures. However economists have identified that some economic activities (such as basic research) are especially prone to incomplete information, externalities and increasing returns, and as a result we learn to be on the look out for possible market failures in those activities.

However, if none of these phenomena exist which would cause markets to fail, then there is no case for policy interventions. This sometimes confuses non-economists who use evidence about the profitability of an activity (X) as part of the case for

¹⁹ Navarro (2003) and Nelson (2009) compare and contrast those two approaches to thinking about industrial policy. In an interesting paper, Schröter (2009) argues that the ‘systems failure’ approach really adds rather little over and above the ‘market failure’ approach.

public-funding on X. But within the basic market failure perspective, such evidence is strictly irrelevant *unless* there is market failure. For if X is profitable, but there is no market failure, then we can take it that businesses will invest in X as much as it is profitable to do, and government has no business to invest any more.

The main economic phenomena that lead to market failure are as follows.²⁰

(a) Economies of Scale and Scope

It may seem strange to describe economies of scale and scope as a 'failure'. In many ways, they are a sign of economic success rather than failure because they allow consumers to buy products at lower prices. But it is not the scale and scope economies that are the 'failure', but rather the market which fails to manage these scale and scope economies.

The first reason for this market failure is as follows. When there are economies of scale and scope, that arise (say) from fixed costs of production, then a company cannot break even if it sells products at marginal cost. The company has to set prices above marginal cost in order to recover its fixed costs. As a result, some consumers, at least, are priced out of the market. By that we mean that the consumers would have been willing to pay the marginal cost of production, but cannot find the good priced at marginal cost, so do not buy.

The second reason for market failure is that where there are economies of this sort, the large scale producer can always undercut a smaller scale producer. This means that there is always a threat of monopolisation in the market. Ultimately, a monopolist producer will have lower average costs than any smaller scale competitor because the monopolist operates on a grander scale. But while monopolists may have lower costs, they will not generally pass on these lower costs in the shape of lower prices. On the contrary, monopolists will often try, if they can, to raise prices above minimum average cost. So the monopolisation of the market is in itself a form of market failure.

When we have scale or scope economies and these cause market failure, the sensible solution is not of course to get rid of these economies. That would make no sense, because the scale and scope economies are in themselves quite desirable. Rather, the sensible solution is to recognise that we have a case of *natural monopoly*. It is sensible to allow the monopoly to emerge, but either to regulate it so that it does not set excessively high prices, or to place it in public ownership. The public monopolist typically does not seek to maximize profit, but rather to maximize some broader social welfare objective.

²⁰ The classic statement of market failure in the provision of R&D is by Arrow (1962). Dasgupta (1987, 1988) and Stoneman (1987) offer comprehensive statements of the market failure rationale for industrial policy. The remainder of this section draws heavily on Swann (2009, Chapter 22).

(b) Asymmetric Information

Asymmetric information can be a source of market failure in many settings, but here we shall focus on one well-known example, the second-hand car market. In this market, sellers are usually well informed about the quality of their cars, while buyers are less well informed. The buyer may know, roughly speaking, what is the probability that any particular car is a good and reliable one, but cannot know for sure which cars are good and which are bad.

Because of this asymmetric information, the buyer faces a risk that the seller does not. And this fact also creates a problem for the seller of a good car. Whereas the seller of a good car knows that his car is good, the buyer does not know that. Unless the seller can convincingly demonstrate that his car is good, there is no obvious reason why a buyer will be prepared to pay a price premium for that car. Indeed, if the buyer simply cannot distinguish good cars from bad, then it is probable that good and bad cars will both sell at the same price. That is bad news for the seller of the good car, who would wish and expect to sell his good car at a premium, but is unable to do so. In that case, the seller of good cars may decide to withdraw his car from the market, because he simply cannot achieve an acceptable price.

We find, therefore, a phenomenon called *Gresham's Law*: the presence of bad cars in the market and the inability to distinguish good from bad means that 'bad drives out good'. If sellers of good cars withdraw their cars from the market, then the average quality will decline, and so will the market price. That makes it even more unattractive for the owners of good cars to try and sell their car in this market, and so even more withdraw from the market. Ultimately, we experience a severe market failure.

There are solutions to this problem, of course. Reputable car sellers can build up a reputation for reliability, and may also offer guarantees to the buyer. There are also independent agencies who can be paid to provide an informed assessment of the condition and value of a second-hand car. In many markets, sellers use standards and certification to demonstrate that their products meet certain standards, and are therefore worthy of a price premium.

All of these mechanisms remove some of the information asymmetries, and hence reduce the risk to the buyer. They also help to ensure that price and quality are more closely connected, and that makes it possible for the seller to get a fair price for a high quality product. That in turn may help to correct the original market failure - in part at least.

(c) Externalities

Consider two people, A and B. If A carries out some action which has an effect on B, but B is neither compensated for nor charged for this, then we say that A's activity causes an externality to B. If A's action imposes some cost or inconvenience on B, the externality is negative. Or if A's action generates a benefit or advantage for B, the externality is positive.

In either case, externalities can cause market failure. When there are negative externalities, markets fail to deliver the right outcome because they make certain activities look privately profitable when they are in fact socially costly. In this case, the market fails because it permits some 'wrong' activities to take place when ideally they *should not* take place. And when there are positive externalities, markets make certain activities look privately unprofitable when they are in fact socially desirable. In this case, the market fails because it prevents some 'right' activities from taking place, when ideally they *should* take place.

Once again, as with economies of scale and scope, we should emphasise that the 'failure' applies to the market rather than the externalities themselves. Positive externalities are not a failure as such; indeed, they can be quite benign. The 'failure' is the fact that there is no market for the harm or good caused by the economic activity because relevant property rights are not established.

There are three generic approaches to adjusting for externalities. One option is for the public sector to run privately unprofitable (but socially desirable) activities. A second option is for the government to subsidise activities that create positive externalities, and tax activities that create negative externalities. This system of taxes and subsidies corrects for the externalities and removes the market failure. The third option is to provide mechanisms for property (or intellectual property) protection. The provider of positive externalities may be able to charge the beneficiaries from these externalities a royalty for the benefit received. At the same time, those that suffer from negative externalities may be able to demand compensation from the producer of these externalities.

(d) Co-ordination

Themes (a), (b) and (c) are the three traditional sources of market failure considered in the mainstream literature. However, contrary to what is sometimes suggested, the neoclassical theory of policy does not live in complete isolation from ideas emanating from the 'systems of innovation' literature and the evolutionary literature. There is one further phenomenon that now forms part of an extended neoclassical account of the sources of market failure.

The economic analysis of standards races has recognised that there is a theoretical possibility, at least, that a market failure will occur where users get locked-in to an old standard when it would be in their joint best interests to switch to a new and better standard.²¹ This failure happens because the transition to a new standard calls for a coordination of decisions across many different users, but managing such coordination is beyond the powers of companies on their own and requires concerted government action. Some writers treat the costs of coordination as transaction costs, so that government's role is to reduce transaction costs. Others would not treat these coordination costs as transaction costs exactly, but would still

²¹ David (1985), Arthur (1989)

accept that government can in principle achieve such coordination when individual companies cannot.

(e) Other Neo-classical Rationales

Various other strands of neoclassical economics have suggested some rather different rationales for industrial policy. Two prominent examples are *Strategic Trade Policy* and *Endogenous Growth Theory* (or ‘New’ Growth Theory). The first offers a rationale for subsidising domestic firms, as that will deter foreign competitors and help domestic firms achieve an artificially dominant position in the market. The second argues that public policy can raise the rate of growth by increasing the proportion of GDP reinvested in R&D or by strengthening the protection of IPR.

Spencer and Brander (1983) described the concept of a *strategic trade policy*,²² which relates to a context in which there are (say) two exporting countries (X and Y) selling to a third country (Z) that does not produce the product. If the government of one of the exporters (X) makes an aggressive commitment to subsidize sales abroad, and the foreign government (Y) does not retaliate, then the foreign competitor (Y) has to reduce its output. In this case, the first exporter (X) obtains a larger share of sales and profits. The export subsidies are “rent-shifting” policies: they shift oligopoly profits from the firm Y to the firm X. The country with an interventionist policy (X) enjoys a national welfare gain even though it is subsidizing the importer (Z). This argument could be used to justify policies that divert national resources to local firms and institutions that compete in oligopolistic international markets.

Endogenous growth theory (or new growth theory) was developed by Romer (1986, 1990). It is a response to the (justifiable) criticism of the standard neo-classical growth model in which the rate of growth is exogenously determined. In contrast, endogenous growth theory argues that policy makers can have an impact on the long-run growth rate of an economy. They can do this by, for example, funding subsidies on research and development or education. Depending on the precise details of the endogenous growth model, such subsidies can raise the growth rate by increasing incentives to innovate. Models of endogenous growth can be constructed in which there is perfect competition. In many endogenous growth models, however, some degree of monopoly power is allowed – for example, when firms hold patents.

* * * * *

It is worth noting that some business people find the market failure perspective hard to understand. They accept that the best businesses will (by and large) make the right decisions in the absence of the factors that cause market failure – at least to the extent that government could not do any better and would probably do worse.

²² Leahy and Neary (1996, 2001) further examine the potential use of such a policy, while Reimer and Stiegert (2006) survey the empirical evidence on gains from such a policy.

But they are concerned that many of the less good businesses will (by and large) not make the right decisions even in the absence of the factors that cause market failure, and that government spending money to disseminate best practice could help to improve the performance of these less good businesses. The implication is that we have *business failure* not *market failure*. As a result, some business people are more interested in governments “doing things that will help business”, rather than the neoclassical economist’s preoccupation with having to prove market failure before government can do anything.

2.2 Systems Failure

The ‘systems failure’ approach to industrial policy or innovation policy, in particular, stems from work on national systems of innovation. The first work in this field was by Freeman (1987), and other pioneering contributions were by Lundvall (1992), Nelson (1993) and Edquist (1997). As Lundvall (2007) has recently argued, the concept of a national innovation system can be seen simply as a useful analytical concept. But some governments have also used it as a *development tool*. As a result, some of the innovation policy measures based on the ‘systems’ approach are very vigorous. We shall return to this later in this section.

The ‘systems failure’ approach to policy seeks to identify failures or weaknesses²³ in a particular innovation system, and correct these by policy interventions. As such the scope is wider than the ‘market failure’ approach. Some adherents to the ‘systems failure’ approach to policy would say that this will displace the ‘market failure’ approach because it is unambiguously better. While I would agree that the ‘systems failure’ approach has several important advantages, it cannot replace the ‘market failure’ approach because the two have some fundamental differences. We could say that market failure is about *why* policy may be needed and *how much* (but doesn’t immediately help us with *what* and *where*), while systems failure is about *what* policy is needed and *where* (but doesn’t give us so much help with *how much*).

First let us explore the differences,²⁴ and then let us see why neither can displace the other. The systems failure analysis of industrial and innovation policy stems from a rather different model of the innovation process than that used in neoclassical economics. An extreme account of this difference would be as follows:

- the neoclassical economics of innovation is based on the crudest ‘linear’ model of innovation – meaning that the flow of value from research to invention to innovation to wealth creation moves in one direction and operates along a single channel.

²³ Smith (2000) has argued that the word ‘weakness’ is really more suitable in this context, but the literature has ‘locked in’ to the term ‘systems failure’, so we shall use that term in what follows.

²⁴ Navarro (2003) and Nelson (2009) compare and contrast those two approaches to thinking about industrial policy. In an interesting paper, Schröter (2009) argues that the ‘systems failure’ approach really adds rather little over and above the ‘market failure’ approach.

- the ‘systems of innovation’ analysis of innovation is based on a much richer interactive model where there are many channels from invention to wealth creation and many feedback channels too, and moreover where a wide variety of institutions, actors and intermediaries play an essential role.

In reality, few neoclassical economists of today would use anything as crude as that basic ‘linear’ model, because some of the richer ideas from the ‘systems of innovation’ literature have diffused into the neoclassical tradition. Nevertheless, it is certainly true that models in the ‘systems of innovation’ are much richer and more interesting.

Moreover, one of the attractions of the ‘systems failure’ approach to policy, in comparison to the ‘market failure’ approach, is that the former can give explicit guidance on when and where the failures are likely to occur. In particular, this approach identifies several different types of failure and their explicit location in the innovation system. We shall define those below.

However, there is one important respect in which the systems approach cannot (in general) match the ‘market failure’ approach. While the market failure approach can define an optimum to which policy is directed, the systems failure approach cannot provide a clear account of the *optimum*. This stems in large part from the fact that in evolutionary economics approaches (such as the systems of innovation literature) welfare economics is much harder than in the relatively simple neoclassical models.²⁵ As a result it is generally very hard to define an optimum and may indeed be too hard to say with authority whether the results of policy actions actually generate an improvement. And if we cannot define an optimum then we cannot measure the extent of a system failure with precision. The best we can do is say that an outcome is unsatisfactory in some degree. This is the sense in which the term ‘system failure’ should be interpreted. As we noted before, Smith (2000) was right, and the term ‘weakness’ would really be preferable to the term ‘failure’ in this context.

The literature on ‘systems failures’ identifies the following categories, amongst others. The literature is not completely uniform on these points, but the categories below are found in many of the sources on ‘systems failure’.²⁶

²⁵ Schubert (2009) offers some interesting steps towards an evolutionary welfare economics.

²⁶ I have found the following syntheses of the ‘systems failure’ approach to policy of particular use here: Bergek *et al* (2007), Dobrinsky (2009), Foxon (2006), Hauknes and Nordgren (1999), Lundvall (2001), Lundvall and Borrás (1997, 2004), Navarro (2003), Schröter (2009), Woolthuis *et al* (2005), and the references therein. In what follows, I also give some specific references on particular mechanisms and arguments.

(a) Infrastructural Failures ²⁷

These concern failures in the physical infrastructure (such as road, rail, airports, telecommunications) and the science and technology infrastructure (universities, research labs, national assets). System failure may occur because of the characteristics of infrastructure: large-scale investment, long time horizons for payback on investments and indivisibilities, all of which make funding difficult. These reasons for system failure are very similar to the scale economy and externality arguments that underpin market failure - see Sections 2.1(a) and 2.1(c) respectively.

The items included in the categories 'physical infrastructure' and 'technology infrastructure' vary according to author, but in general the two categories are defined as follows:

- physical infrastructure: road, rail, airports, telecoms, high speed ICT infrastructure, broadband, energy supply, etc.
- science and technology infrastructure: universities, research labs, libraries, national assets, scientists (and designers), applied knowledge and skills, testing facilities, possibilities for knowledge transfer, patents, training, education.

Both the neoclassical market failure approach and the 'systems failure' approach to innovation policy recognise that infrastructure is a public good, and it is unlikely that such a public good would receive sufficient support if it is purely privately financed.²⁸

(b) Institutional Failures ²⁹

It is common to distinguish two types of institutional failure: hard and soft.

Hard institutional failures

These are failures in formal institutions (such as legal systems) that constrain innovation activity. The term, 'formal institutions' is taken to mean those that are specifically and purposively created and designed. An example of such a hard institutional failure would be ineffective IP protection, or problems in contract enforcement. Some also include in this category those regulations that constrain innovation.

²⁷ Several of the main contributors to the development of this 'systems failure' approach to policy refer to these infrastructure failures, including Edquist (2001) and Smith (1992, 2000).

²⁸ The work of Tassej (1982a, 1982b, 1992, 2005, 2008) in particular has helped us to understand why essential parts of the science and technology infrastructure would be subject to market failure. See also Smith (1997).

²⁹ Several of the main contributors to the development of this 'systems failure' approach to policy refer to these institutional failures, including Carlsson and Jacobsson (1997) and Smith (2000).

Soft institutional failures

These are the failures in informal institutions (such as political and social culture, and values). The term 'soft institutions', is taken to mean those that are *not* specifically and purposively created and designed, but are more spontaneous than the hard ones. These soft institutions are important to innovation as they help to foster a climate of co-operation, risk-bearing, open-ness to change and a supportive attitude towards entrepreneurship.

(c) Interaction Failures

The links, interactions and cooperative relations between different actors in the national Innovation System are a central element of that system. These interactions embrace relationships with other firms, customers, suppliers, government, universities, commercial research labs and so on. In the literature, interaction failures may mean *too little* interaction or *too much* interaction. Carlsson and Jacobson (1997) distinguish between *weak* and *strong* network failures.

Strong network failures

These are sometimes described as a 'blindness' to developments outside the firm's immediate network. A group builds up strong and long-lasting relationships (strong ties) which may become *too strong*. That leads to inward looking behaviour and a closure of the network to what is happening outside the network. Various dysfunctional phenomena (*GroupThink*,³⁰ over-embededness,³¹ myopia) are considered to be symptoms of strong network failures. In practice, excessively strong ties *within* the group are sometimes found together with excessively weak ties *outside* the group.³² This is unfortunate as the weak ties could help to overcome over-embededness.

Weak network failures

These occur because the lack of relations between complementary technologies or actors,³³ or non-complementarity of actors.³⁴ To the extent that innovation depends on interaction and collaboration, non-complementarities lead to an under-exploitation of resources and a lack of learning. These poor linkages between actors get in the way of articulating a common technological vision, and hence get in the way of co-ordination. Some aspects of cluster policy can be seen as an attempt to correct weak network failures.

³⁰ Janis (1972, 1982)

³¹ Granovetter (1985)

³² Granovetter (1983)

³³ Carlsson and Jacobsson (1997)

³⁴ Malerba *et al* (1999) and Malerba (2009)

(d) Transition Failures

These occur when firms are unable to adapt to environmental changes, and as a consequence may get locked-in to existing technological paradigms.³⁵ Smith (2000) writes of the inability of firms to adapt to new technological developments. He points out that new technologies not only have to compete with components of an existing technology, but with the *overall system* in which it is embedded. These systems comprise a complex of scientific knowledge, engineering practice, process technologies, infrastructure, product characteristics, skills and procedures. It is exceptionally difficult to compete against all this.

Chaminade and Edquist (2006) group these transition failures together with the next category, capability and learning failures.

(e) Capability and Learning Failures

These are failures in competencies and resources (technological, organisational, etc.) which restrict the firm's ability to learn and be innovative. Most firms have finite and limited technological competencies which consist of their knowledge, capabilities and skills in their comfort zone.³⁶ And most firms lack competencies in even quite closely related fields. For this reason, major technological shifts or changes in demand can lead to adaptation problems, and the lack of capabilities soon turns into an inability to learn, which in turn leads to lock-in.³⁷

(f) Other Evolutionary Rationales

The birth of the evolutionary approach to economics is usually associated with the pioneering and very influential work of Nelson and Winter (1982), though there are some antecedents. The 'systems failure' approach to policy is not the only policy perspective to have emerged from evolutionary economics, though it is the best known and best developed. Several pioneers have developed slightly different perspectives on an evolutionary industry policy.³⁸ However, at the present stage of development, it is hard to distil these into a manageable synthesis for policy purposes, so for the purposes of this report, we focus on the 'systems failure' approach.

³⁵ Malerba *et al* (1999), Smith (2000)

³⁶ Smith (2000)

³⁷ Malerba *et al* (1999), Malerba (2009) and Smith (2000). Lundvall (2001) has also written extensively about 'learning failures' and Tomer (1999) discusses a rationale for industrial policy based on developing the capabilities of the learning firm.

³⁸ Notably Metcalfe (1994, 1995a, 1995b, 2003) and Metcalfe and Georghiou (1997). Other contributions include the work of Pelikán and Wegner (2003), Teubal (1997), van den Bergh and Kallis (2009), Wegner (1997).

(g) The Use of the ‘Systems’ Approach as a Development Tool

As noted above, Lundvall (2007) recently argued that the concept of a national innovation system is not just a useful analytical concept; some governments have also used it as a powerful *development tool*. As a result, some of the innovation policy measures based on the ‘systems’ approach are very vigorous. Perhaps the most notable examples are the ambitious approaches to technology (and design) policy adopted by several SE Asian governments to build a very powerful national innovation system.

Tassey (2009, p. iii) points out:

“In these economies,³⁹ government, industry, and a broad infrastructure (technical, education, economic, and information) are evolving into increasingly effective technology-based ecosystems. Should the U.S fail to follow suit, its manufacturing firms will continue to compete largely as independent entities against these national economies. That is a race we⁴⁰ cannot win.”

If, rather than envisaging technological competition as a battle between firms, we take the step towards envisaging technological competition as a battle between different national innovation systems, then there is a clear economic rationale for making the national investment in R&D (and related expenditures) dependent on the typical level of national investment in R&D found in other countries. Appendix 1 develops a simple model in which there is a reaction curve of this sort.

Moreover, the use of the ‘systems’ approach as a development tool is consistent with Smith’s (1992) argument that policy making should take an adaptive approach, and one that promotes experiments. It is also consistent Dearborn’s dictum: “If you want to understand something, try to change it.”⁴¹ And indeed, Mytelka and Smith (2002) have shown how learning about policy and innovation theory have co-evolved as a result of such an adaptive approach.

Rodrik (2004) makes a similar point, though from a different tradition:

“the task of industrial policy is as much about eliciting information from the private sector on significant externalities and their remedies as it is about implementing appropriate policies. The right model for industrial policy is not that of an autonomous government applying Pigovian taxes or subsidies, but of strategic collaboration between the private sector and the government with the aim of uncovering where the most significant

³⁹ Here, Tassey is referring primarily to several SE Asian economies, but also to some European economies.

⁴⁰ Here, Tassey means the USA.

⁴¹ Quoted from Starbuck (n.d.). It is also consistent with the argument in Swann (2006, Chapter 12) that we learn far more from *real* experiments in the *real* economy than from the modern interpretation of ‘experimental economics’, where the experiments are lab-based and the participants act out *induced* (rather than actual) preferences.

obstacles to restructuring lie and what type of interventions are most likely to remove them.”⁴²

2.3 ‘Footloose Multinationals’

Finally, we summarise a third theoretical rationale for industrial policy. The intellectual roots of this rationale lie in three places. One is the research tradition which focuses on the activities of multinational enterprises, following the pioneering work of John Dunning.⁴³ The second is in the mainstream of neo-classical economics, where interest has grown recently in the concept and implications of ‘footloose multinationals’.⁴⁴ The third is the work of several important policy economists who have taken a careful and critical look at the activities of multinational companies.⁴⁵ This work has risen to great policy prominence because of the successive editions of the UNCTAD *World Investment Report*, which monitor the activities of multinationals.⁴⁶

We call this the ‘footloose multinationals’ rationale for industrial and innovation policy. We shall persist in putting this term in inverted commas, because it is not clear that multinationals are really, in practice, as ‘footloose’ as this perspective would suggest. We note, for example, Görg and Strobl’s (2003) article uses a ‘question mark’: *Footloose Multinationals?* On the other hand, it is a very useful perspective to take because it offers different insights into the role of policy.

To understand the difference between this rationale and the standard ‘market failure’ rationale, it is essential to understand the very different market contexts for which they were designed. The market failure analysis is mainly applied in a context in which:

- firms have a dominant national base
- their shareholders are primarily from that same nation
- they do much or most of their production in that nation
- if they trade, it is by exporting rather than establishing multinational enterprises in foreign markets

In that context, there is a substantial overlap between the interests of these national companies and the interests of a national government (directed by elected politicians who represent the citizens of the country). True, the shareholders’ views

⁴² This suggests that the form of any policy will evolve over time as different challenges are resolved. This is fully consistent with the account of the evolution of the Design Council in Section 1.3.

⁴³ Dunning (1997), Dunning and Lundan (2008). Other influential works in this tradition are those by Cantwell (2004), Caves (2007), Hood and Young (1997),

⁴⁴ For example, Barba Navaretti and Venables (2004) and Görg and Strobl (2003).

⁴⁵ Important examples include: Bailey *et al* (1994), Baumol and Gomory (2000, 2004), Cowling (1999), Cowling and Sugden (1999).

⁴⁶ Particularly important in the present context are UNCTAD (2003, 2005, 2008).

on the right way to maximize national income would perhaps be different from the view of some citizens and their elected representatives. Nonetheless, at least there is general agreement that maximizing national income would be a key plank of national economic strategy.

Contrast this with a context in which:

- firms may have a national base, but much of their activity is multinational enterprise dispersed across many other countries
- their shareholders are very international
- they only do a share of their production in the home nation
- their trade is a combination of exporting and establishing multinational enterprises in foreign markets, with the latter quite possibly the dominant form.

In this context, the interests of ‘national’ companies and the interests of national government are significantly different. The companies’ concern is to maximize their income or profit for their international shareholders and that can be rather different from maximizing the income of the ‘home nation’. In this new context, it is really no longer valid to claim that, “what’s good for GM is good for America”.

Some would go as far to say that, in this context, there are fundamental changes in the roles of companies and governments. These are captured in Table 1.

Table 1

	Traditional Market Failure Perspective	Alternative ‘Footloose’ Perspective
Companies	Embedded in national economy and stakeholders are national.	Multinational and footloose, they are ‘customers’ for the resources that different nation states can offer. Strong bargaining power with governments.
Government	Role is relatively modest: to correct market failure.	Strategists on behalf of national (citizen) interests. Invest in geographically embedded assets.

In the traditional perspective, business interests are seen to be primarily *national* in orientation because companies are heavily embedded in the national economy. Business interests and government interests are closely aligned, and decisions about production are made by companies alone - unless there is a clear sense of

market failure which calls for government intervention. But, apart from that, there is little role for industrial policy.

In the alternative (multinational) perspective, business interests are quite different from national interests because companies are no longer embedded in a single national economy in the same way. As a result, business and government interests are not necessarily so closely aligned. Indeed, business can no longer be seen as a servant of purely national interests as before. Indeed, business can start to behave like customers for the resources provided by different nations. If it is profitable to continue an operation in the UK, then that will be done, but if not it will be done elsewhere. And then the role of government is no longer as the master of the economy, but as a seller of national resources to business customers.

In the traditional perspective, there is scepticism about industrial policy interventions: why should we encourage these British firms to do other than they consider is their optimum strategy? Does government really know better than companies what is in their (the companies') interests? But in the alternative perspective, government may decide to invest in location-specific (national) resources, knowing that businesses will not do so - because (1) they are footloose and (2) they do not need to make such investment as other countries have already done the investment for them.

In the traditional perspective, a strategy of no intervention without market failure may make good sense. In the absence of those phenomena that cause market failure, the market outcome is an optimum. But in the alternative perspective, market failure is hardly relevant. It is not a market failure that means the market outcome is out of line with national interests: rather it is the disjuncture between national and corporate interests. In this circumstance it is easy to see why government can lose its way. At the very time citizens realise that companies' interests are no longer aligned with national interests and they look to government to support national interests as opposed to business interests alone, government finds its bargaining position with business has become much weaker. Government has become a seller of national resources (in a very competitive global market) to 'footloose multinationals' who act like *monopsony* or *oligopsony* buyers.

In these difficult conditions, government has to find a policy approach that represents the interests of their embedded citizens but also gives government something to sell to multinational business as a good reason to do business in the UK. In general, the interventions that gain support from this perspective will be those that create embedded national assets which are at the disposal of those who do business in the UK. Interventions that support the development of particular intangible assets in companies receive less support, because these too can be footloose. Investment in intangible assets may be paid for by UK taxation but these intangible assets may be deployed elsewhere.

In conclusion, let us repeat what we said at the start of this section. It is not clear that multinationals are really, in practice, as 'footloose' as this present perspective would suggest. Nonetheless, it is a very useful perspective to take here, because it offers different insights into the role of policy.

3. Options for Policy Interventions

This part of the report briefly summarises some of the options that have been considered for policy intervention in design. This starts with public investment in the design profession (Section 3.1), public investment in national design assets (3.2) and other initiatives for investment in design to shore up national economic competitiveness, including stronger IP for design and tax credits (3.3). We then turn to initiatives for investment in design to support *systems thinking* and standards for design (3.4), and to educate end-users, companies and the public sector about the value of design (3.5).⁴⁷

These five categories are useful for the purposes of illustration, but two important points should be born in mind. First, some of these categories include a variety of initiatives that are really quite different from each other. We have kept the number of categories to five, however, simply to keep our analysis to a manageable scale. In particular, the summary table used in Part 6 of the report can only be contained on a single page if the number of categories is kept to a manageable size. Second, many practical policies will in fact cut across more than one of these categories, and only some policies are neatly contained within one category alone.

In this part of the report, we simply state these options without further analysis. In Parts 4 and 5, we shall examine all the options from the different perspectives described in Part 2, to see whether there is a strong economic rationale to support these policies.

It is worth repeating at this point that although much of the discussion below refers to actual or potential activities by the Design Council, that is only one agency amongst several - albeit the one most dedicated to design promotion. There are several other public sector bodies with a related role including: the sector skills council, HEFCE, UKTI, the RDAs and DCMS.

3.1 Strengthen the Design Profession

Some have suggested that the long term success of the UK design profession cannot depend on investments in design by British companies alone but requires public investment in education (and other investments) to strengthen the national profession.

⁴⁷ In what follows, we don't discuss what we might call 'secondary' objectives. For example, the Design Council website mentions their objective to be, "recognised as an exemplar design institution for influence, impact and enterprise". These are important objectives, no doubt, once it is established that there is a coherent economic rationale for a national design body. But these do not, of themselves, constitute a part of that rationale.

The Design Council's website describes two current priorities:

- To help UK managers become the best users of design in the world, supported by the most skilled and capable design professionals
- To boost high-level skills in design to support a competitive creative economy and a thriving UK design sector

A natural extension of these activities would be to move towards a *professional body* or an *academy* for designers.

Moultrie and Livesey (2009) list some initiatives and proposals in other countries, including:

- To improve the design education of the workforce
- To set higher standards in design education.

3.2 Create National Assets

The Design Council has argued that “The UK design industry is renowned worldwide and makes a significant contribution to the UK economy ... Repeatedly, multinationals look to the UK as a source of skilled design professionals and leading edge design.”⁴⁸

A number of renowned national assets underpin this attraction, including the Design Council itself, the V&A Museum, the Design Museum, The Crafts Council, renowned design festivals and exhibitions (including the London Design Festival), our education system, and so on. All of these can be viewed as part of the design and innovation infrastructure.⁴⁹

Some have suggested that a national design institution such as the Design Council should fulfil a coordination role. Related to this is the idea that a national design institution can act as a ‘network hub’ in the national innovation system. The ambitious design plans of the Korean and Singapore governments include plans to make their design industries a ‘network hub’ for innovation in SE Asia.

⁴⁸ Design Council, private communication, 2009

⁴⁹ And, as noted at the start of Section 3, we could include related activities by the sector skills council, HEFCE, UKTI, the RDAs, and DCMS.

3.3 Public Expenditure on Design, Stronger IP and Tax Credits

Some argue that one of the most important reasons for public investment in national design capacity is in order to maintain national competitiveness. They point to the ambition of countries such as China and Korea and the huge public investments they are making in design and a broader group of countries (including Japan) which view design as being of strategic importance to the economy.

The Design Council has written:⁵⁰

“Design was identified in the Treasury’s Cox Review as a central part of the UK’s strategy to compete on the basis of added value rather than price in markets increasingly dominated by low-cost economies.”

The Design Council’s website lists some current priorities of this sort:

- To demonstrate that design can play a vital role in strengthening our economy and improving our society
- To build the UK’s capacity to innovate and deliver world-class brands, products and services by supporting the effective use of design in business and the public sector

Moultrie and Livesey (2009) list a variety of initiatives and proposals in other countries, including:

- To strengthen IP protection for design
- To modify patent system to capture design IP
- To extend tax credits to design expenditure.

3.4 Design for Complex Systems and Standards for Design

As noted above in Section 1.4(f), Nelson and Stolterman (2003, p. 115) argue that:

“Systems thinking is a necessary component of design. Indeed, design inquiry is, in effect, simply a particular type of system approach.”

Systems thinking is about seeing design and its effects as a part of a complex whole and not just as an embellishment of one part of the whole. What we here describe as design for systems thinking, could also be called design for social and environmental issues.

⁵⁰ Design Council, private communication, 2009

The Design Council's inspired initiative, *Design Bugs Out*,⁵¹ is an example of such systems thinking in action. The aim was to explore how design could be used to help combat the problem of MRSA in hospitals. Recognising that some of the problem may arise from the difficulties staff face in cleaning hospital furniture and equipment, this initiative sought to attack the problem by forming highly interdisciplinary teams spanning the medical profession, hospital management, technologists and designers. Such interdisciplinary teams are notoriously difficult to form.

In a similar way, some argue that designers using systems thinking can play an important role in combating a variety of adverse and unforeseen side-effects from innovation, including adverse effects on law and order, the environment, health, the workplace, creativity. The co-ordination role described in Section 3.2 is especially relevant in the context of design's role in supporting systems thinking, where it is so important to be able to "put all the stakeholders in one room".

Moultrie and Livesey (2009) list a variety of initiatives and proposals of these sorts in other countries:

- To create a national 'Design Council' along the lines of the British Design Council
- To use design to increase quality of life

Some have suggested that there is a case for public investment in extending the BS 7000 Series of standards for Design Management Systems. These developments would embody the sort of systems thinking described above.

A variant on this is the possibility that the Design Council could reinstate the "swing tag" from the 1960s, as a signal of good design that is sustainable, socially inclusive, and receptive to user feedback, which will ensure that any design defects are easily brought to the attention of producers. A related observation is that some countries (notably Korea) are busy investing in national design brands ('Brand Korea').

⁵¹ Design Council (2009). Another is the 'Dementia Care' initiative, which seeks to redesign crockery, tableware and tables to make them suitable for the disabled. See <http://news.bbc.co.uk/1/hi/health/8436259.stm>

3.5 Education about Design

The Design Council has remarked that they still have some way to go in order to make UK companies the most active users of design:⁵²

“Although the UK is a leading supplier of design to the rest of the world, UK industry is not the most effective user of design.”

The Design Council website lists the following priorities:

- To make design help people to do what they do, better
- To promote the use of design throughout the UK’s businesses and public services
- To help UK managers become the best users of design in the world, supported by the most skilled and capable design professionals
- To build the UK’s capacity to innovate and deliver world-class brands, products and services by supporting the effective use of design in business and the public sector

As these priorities demonstrate, the Design Council is going beyond the education of companies alone, and promoting the education of the public sector in the use of design. Some have also suggested that while UK consumers (on average) are undoubtedly more design conscious now than they were when the Design Council was formed, there is still a role for the Design Council in educating consumers about design.

Moultrie and Livesey (2009) list some initiatives and proposals in other countries, including:

- To improve the design education of the workforce
- To set higher standards in design education.

⁵² Design Council, private communication, 2009

4. Discussion Grouped by Theoretical Perspectives

Our objective in this part of the report and the next is to assess how each policy option in Part 3 weighs up when viewed from the perspectives in Part 2.

To put it very simply, the objective is to fill out a matrix such as the following. It shows how strong the case for each policy action (rows) looks from each of our perspectives (columns). The table below has not been filled in but illustrates the basic structure. Part 6 of the report will fill in this table, using the arguments in Parts 4 and 5.

Table 2

	Market Failure	Systems Failure	'Footloose Multinationals'
Strengthen Design Profession			
Create National Assets			
Public Expenditure on Design, Stronger IP and Tax Credits			
Design for Complex Systems and Standards for Design			
Education about Design			

There are two ways of organising the discussion - by the economic perspective taken (columns) and by the policy initiative proposed (rows). In Part 4 we organise the discussion by the different economic rationales and perspectives (columns). In Part 5 we organise the discussion by each policy initiative (rows).

4.1 Market Failure Rationale

In some ways, the market failure approach to appraising policy interventions takes a pretty sceptical stance.⁵³ An activity may be a good thing and an intervention may seem worthy, but that is not enough. There must be a compelling answer to both of the following questions. Why is there any need to intervene? Why is the market solution not the right one?

⁵³ In their very useful surveys, Aiginger (2007), Pack and Saggi (2006) and Rodrik (2004) illustrate some of the neoclassical or mainstream scepticism towards industrial policy.

To answer the sceptics, it is necessary to present a compelling argument why one (or more) of the factors:

- Externalities
- Asymmetric information
- Increasing returns
- Coordination problems

that cause market failure is present and why that leads to a significant market failure. In addition, the recognition of a likely market failure is not enough to justify a 'blank cheque'. The next question must be: what is the most cost effective way of removing this market failure?

First, we shall look at the six characteristics of design summarised in Section 1.4 and ask for which we expect market failure to be more common, and for which we expect it to be less common. Then we shall take the five broad policy interventions listed in Part 3 and group them into three categories: those initiatives for which a market failure rationale is *strong*; those initiatives for which a market failure rationale is *moderate*; and those initiatives for which a market failure rationale is *weak*.

The Relevance of Market Failure for Six Characteristics of Design

Is market failure relevant to design? The multi-faceted character of design described in Section 1.4 means that there is no simple answer to this question. There are some types of design activity where it seems that market failure is quite likely, while there are others where it would seem to be much less likely.

Those design activities that seek to make order out of chaos are often activities which seek to reduce negative externalities or to promote positive externalities. A good example of this is the humble 'wheelie bin'.⁵⁴ The use of wheelie bins by local authorities for waste collection has helped to reduce some of the chaos caused by household waste. Instead of streets strewn with unsightly black plastic bags, which could also be a health hazard, the waste is binned and is simply wheeled onto the street on the day of waste collection. The design of the bin aims for efficient use of space, and for the safety of the household and the waste collector. The latter, in particular, risked injury from lifting the traditional (wheel-less) bins or if there were sharp or other dangerous objects in plastic bags. Moreover, the use of multiple wheelie bins by some local authorities has helped recycling efforts.⁵⁵

In such cases where design reduces negative externalities, it is likely that there will be an element of market failure and the use of such designs will only take off if they

⁵⁴ George Dempster invented the bin in the 1930s to automatically load the contents of a steel container into a dustcart. The modern plastic bin was invented in the 1970s.

⁵⁵ In Beeston, Nottingham, we have four bins: *black* top for general waste, *green* top for recyclable material (paper, card, tins, cans, etc.), *brown* top for garden waste, and *yellow* top for glass.

are used as part of a concerted and planned effort by government or local authority to create order out of chaos.

Those design activities which focus on systems thinking seek to overcome negative externalities which, themselves, may arise from incomplete or asymmetric information. The 'Design Bugs Out' initiative (see Section 3.4) is a very good example of this. The negative externalities here (MRSA) arose from the fact that existing designs of hospital furniture were hard to clean effectively and this was recognised to be a source of MRSA. Market failure here stems not so much from the inevitability of the externalities but from incomplete information: the usual 'customer' for hospital furniture would be a manager in procurement, and would be quite remote from the cleaners who were unable to clean furniture adequately and quite remote from the nurses who might be the first to suspect that this was the source of the problem. Design to overcome such market and systems failures requires a concerted effort to develop communication across many different functions.

Here again where design overcomes problems of incomplete information to reduce negative externalities, it is likely that there will be market failure and the use of such designs will only take off if they are used as part of a concerted and planned effort by government or local authority to solve a problem by systems thinking.

The above are probably the two aspects of design where market failure is most likely. Those aspects of design concerned with 'the link from creativity to innovation' and the use of design to 'offer competitive distinction' are less likely to suffer from such market failures. For it is less clear why there should be externalities or information asymmetries in this area, which primarily concern the company's use of design as part of its competitive strategy. There might be an element of 'learning by doing' which would mean that a small company unaccustomed to the use of design might under-invest in design as a link from creativity to innovation or as a means of achieving competitive distinction. But it is hard to see why this market failure would apply to a company that is experienced in the use of design.

Turning to the last characteristic of design - planning and problem solving - would we expect market failure here? It depends. If we are talking of the use of design for planning and problem solving within a company's own operations, then the chance of market failure looks remote. But if we are talking of the planning and problem solving that is used to create order out of chaos and to develop solutions by systems thinking, then the chance of market failure is high – for the same reasons as we found in the case of the 'wheelie bin' and 'designing bugs out'.

Initiatives for which market failure rationale is strong

Now we turn to the options described in Part 3 and ask whether the market failure rationale for policy intervention would support these options. In this sub-section, we list those initiatives and options for which a market failure rationale is *strong*.

Create National Assets

National assets are typically clear examples of public goods. That is, they are non-rival and non-excludable. The modern terminology describes these as part of the infrastructure, or as infrastructure assets – including the Design Council itself, the V&A Museum, the Design Museum, The Crafts Council, renowned design festivals and exhibitions (e.g. the London Design Festival), our education system, and so on.

It is well recognised that the supply of these is subject to market failure.⁵⁶ First, any private investors in such infrastructure assets would find themselves generating social benefit well in excess of their own private benefit. This would mean that while the investment would be socially profitable it would not be privately profitable, and so would not happen. In some cases, a ‘club goods’ solution may exist, where several private investors ‘club’ together to internalise enough of these externalities to make their private investments worthwhile, but the public good solution may still be better than the club good solution.⁵⁷

Design for Complex Systems

It may be reasonable to argue that most companies have adequate information about the benefits of design to their business in order to ensure that there is no market failure in spending on design for competitive advantage. But even the most design conscious companies, who have made the most effective use of design in enhancing their competitiveness, may be less well aware of using the systems thinking aspect of design to ensure that there are no undesirable side effects from their products and processes.

For example, Apple has won very many design awards for its products. Their VP for Design, Jonathan Ive, has been honoured with many awards, and is rated as one of the most influential designers worldwide. But in late 2006 and early 2007, Apple was placed last in the Greenpeace league table of 14 electronics companies because they seemed to have given less attention to the environmental implications of their products than their rivals.⁵⁸ This was a shock to Apple and many of its followers, and since then Apple has taken various initiatives to move “towards a greener Apple”. By 2009, Apple had progressed to 9th in the Greenpeace league table (out of 18 companies) and is clearly showing strong commitment to improving this area of performance. But the lesson is clear. Despite being a leader in iconic design, Apple still had some way to go to achieve comparable standards in sustainable design.

⁵⁶ As mentioned in Footnote 28, the work of Tassej (1982a, 1982b, 1992, 2005, 2008) has demonstrated clearly why essential parts of the science and technology infrastructure would be subject to market failure.

⁵⁷ As argued by Swann (2003)

⁵⁸ As described on the Greenpeace website: <http://www.greenpeace.org/apple/>

Standards for Design

There is a clear role for government and/or government agencies to establish high quality and open standards in design, as elsewhere.⁵⁹ These standards can help to provide a guidepost for the efficient use of design, and to ensure that designs go as far as possible to create order rather than chaos, and that the best aspects of systems thinking are embodied in design processes. As far as possible the principle of open standards should be preserved. If standards are set in the market and are, as a result, not truly open, then they represent an uneven playing field, with one player (or a group of players) unfairly advantaged over the rest.

Some have raised the following quandary: if there is now little or no purpose in having purely national standards, is there any purpose in committing resources to a national standards effort? Is there an option to free ride on the standardization efforts of other countries? The short answer is no. Different national governments will try to ensure that the rules of the trading game are defined in such a way as to reflect national interests. In such a situation, free riding is not an option. Suppose that a country is not represented in the international standards forum, but leaves the definition of standards to representatives of a small number of other countries. Then it can expect that the resultant standards will be designed in such a way as to maximize the competitive advantage of those involved over those who are not involved. One must not underestimate the competitive disadvantage that can follow if obliged to play by rules defined purely in the interests of a few other countries.⁶⁰

Initiatives for which market failure rationale is moderately strong or mixed

From the market failure perspective, the case for the following options is moderately strong.

Strengthen the Design Profession

Why might the market outcome imply a weaker-than-optimal design profession? Or, to put it another way, why does it require policy intervention to achieve the right level of investment in the design profession?

The hardened free market economist might argue that companies will invest as much in the design profession as it is worth. If such investment enhances the profitability of their business, then they will invest, and so they should. If such investment does not enhance the profitability of their business, then they will *not* invest, and *nor* should they. So where, the free market economist asks, is the market failure?

⁵⁹ See Swann (2000) for a detailed discussion of the case for public support of standardization activities.

⁶⁰ Swann (2000) discusses this at further length.

There may be a market failure that stems from the mobility of labour. If it is left to employers to manage the general design education of their employees, then the employer faces a risk that he will recover little such investment in education if the employee leaves his/her employment and goes to work elsewhere. This risk may lead to underinvestment because the training company can only capture a share of the returns from their investment in education, and the rest is an externality to the next employer, perhaps a rival indeed. This market failure could argue for public involvement in general design education, but not in employer-specific education, as this must remain the responsibility of the employer alone.

From the employee's side, however, there may be sufficient incentive to invest in general education at his/her own cost. But in this case, the employee will not wish to invest in employer-specific training at his/her own cost as that only has value so long as (s)he is offered employment by a specific employer.

The case for public investment to strengthen the design profession is strongest for fledgling areas of design, and for design in fledgling industries, or fledgling public services.

Stronger IP and Tax Credits

Some would argue that there is a case for stronger IP protection of design and for tax credits to be extended to design, just as it applies to R&D. Does this option find support from the concept of market failure?

The answer depends on the extent to which design enjoys the same characteristics as R&D: economies of scale and significant positive externalities. The importance of scale economies is debateable. As for positive externalities, or spillovers from design, this will depend on the type of design activity in question. With iconic designs, there may indeed be a spillover from the designer to other companies, and this is why registered designs are used to protect such iconic design. Perhaps, in some cases, that is not strong enough, and a stronger form of IP protection is required.

But with design used for planning and problem solving, the value of the design is captured within the end product and does not necessarily spill over to rivals in the same way as would R&D. As a result, it is debateable whether there are really important positive externalities here which call for stronger IP protection or tax credits.

Indeed, some economists would argue that there may be a case for weakening IP protection in some settings and that there may be a case for tax charges (and not tax credits) to ensure that designers take proper account of 'end of life' issues – an especially relevant concern in the context of e-waste.

Education about Design

From a market failure perspective, initiatives to invest public money in educating companies about design are again met with some scepticism. The hardened free marketer might argue as follows.

Why is it necessary to invest public money in educating UK companies how to use design? Have they not learnt already what they need to know about the value of design to their business? If not, why not? And equally, why is it necessary to invest public money to promote the use of design throughout the UK's businesses? Don't these businesses already know the right amount of design activity for their business? And why should government presume to know better than the business what is the right use of design?

The case for investing public money in educating the end user about design may be stronger, however. On the other hand, this is something the Design Council has been doing for some time. Is that task now nearing completion? It seems that end users are definitely much more conscious of the benefits of design than they were in the early years of the Design Council.

And the case for investing public money to educate public sector service providers is *stronger still*. There is still a lot of scope to educate public service providers about the value of design in improving their quality of service. This is something the Design Council has only been doing for a short time, and the task is *far from complete*.

Initiatives for which market failure rationale is weak or uncertain

From the market failure perspective, the case for this remaining option looks weak or, at best, uncertain.

Public Expenditure on Design

From a market failure perspective, initiatives to invest public money in promoting national competitiveness are sometimes viewed with scepticism. Since it is in companies' interests to be competitive, why should there be a market failure for investment in competitiveness? If companies believe they are investing enough to ensure their own competitiveness, why would government presume to know better and seek to get companies to invest more in competitiveness than the companies think is necessary?

Initiatives to encourage such investment to promote national competitiveness enjoy more support from the 'systems failure' perspective, discussed in the next section.

* * * * *

To conclude this section, let us make a couple of observations about which of these options enjoy support from one of the other neoclassical rationales discussed in Section 2.1 - endogenous growth theory. Endogenous growth theory argues that

policy makers can have an impact on the long-run growth rate by, for example, funding subsidies on research and development or education. Such subsidies can raise the growth rate by increasing incentives to innovate. This perspective would give *particular* support to tax credits for design (which should directly increase the incentive to innovate through design), and some support to stronger IP for design, creating national assets and standards for design (which may all in their own way increase the incentive for innovation through design).

4.2 Systems Failure Rationale

In contrast to the market failure approach, the systems failure approach to appraising policy interventions takes a pretty supportive stance. As we saw in Section 2.2, there are many possible sources of systems failure. If we take account of all these sources of systems failure, then **all** of the policy initiatives in Part 3 can find a systems failure rationale.

Indeed, some sceptics argue that whereas the market failure rationale may be too demanding, the systems failure rationale for policy is too lax. Almost any policy intervention can be justified to some extent, and it is hard to rank them in terms of importance.

The Relevance of Systems Failure for Six Characteristics of Design

First, we ask the same question (in this different context) as at the start of Section 4.1. Is systems failure relevant to design? The multi-faceted character of design described in Section 1.4 means again that there is no simple answer to this question. It is hard to give so detailed an answer as in Section 4.1, but as we saw with market failure, the systems failure argument does seem relevant to some aspects of design even if not to all.

The systems failure argument seems, *prima facie*, most relevant to those aspects of design that involve systems thinking, and communication outside the usual comfort zone. So, for the following three characteristics of design:

- Planning and Problem Solving
- From Chaos to Order
- Systems Thinking

it seems likely that interaction failures as well as capability and learning failures, in particular, and perhaps also institutional failures and transition failures could constrain the design process.

On the other hand, the systems failure arguments seems, *prima facie*, less relevant to those aspects of design that involve familiar activities within the designer's usual comfort zone. So, for the following two characteristics of design:

- a link from creativity to innovation
- offers competitive distinction

it seems likely that a more limited range of systems failures would be relevant – perhaps just capability and learning failures and transition failures.

Systems Failure Rationale for Initiatives

Now we turn to the options described in Part 3 and show that in almost all cases, the systems failure rationale can be used to provide at least some support for these options.

Strengthen the Design Profession

The ‘systems’ literature recognises various types of infrastructural failures that apply especially to the science and technology infrastructure. These could occur in: universities, research labs, libraries, national assets, scientists (and designers), applied knowledge and skills, testing facilities, possibilities for knowledge transfer, patents, training, and education. Several of these could be relevant to the design profession and could be relevant to any initiative to strengthen the design profession. The precise linkage would depend on the specifics of the initiative.

Equally, the ‘systems’ literature recognises various types of capability and learning failures. These restrict the innovator’s ability to learn because most have finite and limited technological competencies which consist of their knowledge, capabilities and skills in their comfort zone. These ‘failures’ could be relevant to the design profession and for this reason an initiative to strengthen the design profession could increase designers’ abilities to adapt their skills to other fields, to cope with major technological shifts or changes in demand, and to learn outside the comfort zone. Again, the precise linkage would depend on the specifics of the initiative.

Create National Assets

The ‘systems’ literature describes failures in the science and technology infrastructure that explicitly refer to a shortfall in national assets – including universities, research labs, libraries, possibilities for knowledge transfer and so on. We could add to these the various national design assets listed in Section 3.2 including: the Design Council, the V&A Museum, the Design Museum, The Crafts Council, renowned design festivals and exhibitions (including the London Design Festival), our design education system, and so on.

Public Expenditure on Design

Almost any of the failures recognised in the 'systems' literature could be mobilised to provide at least some support to options for public expenditure on design to enhance competitiveness. For example:

- infrastructural failures (physical or science/technology)
- institutional failures (hard or soft)
- interaction failures (strong or weak network failures)
- capability and learning failures
- transition failures.

Without further detail on the initiative, it is hard to be more specific than that.

Stronger IP and Tax Credits

The 'systems' literature recognises weak IP protection as a form of 'systems failure' and classifies it as a 'hard' institutional failure. By contrast, the 'Systems' literature has relatively little to say about tax credits except that they may help to redress some of the institutional failures in providing public goods (hard and soft institutional failures). Arguably, indeed, the 'Systems' rationale for tax credits is less clear than the market failure rationale.

Design for Complex Systems

Design for complex systems could be subject to several different sorts of 'systems failure'. These could include:

- Interaction failures: strong and weak network failures
- Hard and soft institutional failures
- Science and Technology infrastructure failures
- Capability and learning failures

Design for complex systems involves many skills beyond the ordinary; it involves collaboration across several fields and disciplines, which in turn calls for a great deal of constructive dialogue and good will.

Standards for Design

To develop useful standards for design, which help the designer with some of the more substantial design challenges (planning and problem solving, creating order from chaos, and systems thinking) requires careful and open collaboration between different interested parties. This will be difficult to achieve in the face of certain types of hard and soft institutional failures, including a failure of trust between different players and the lack of a climate for cooperation and mutual support. It will also be difficult to achieve when players are involved in networks that are too strong (with the risk of Groupthink) or too weak (with a resistance to the ideas of outsiders). The move to a new standard for design could also be constrained by transition failures.

Education about Design

Education about design may fall short of what is required when there are interaction failures (lack of knowledge exchange and mutual learning between different players) and capability/learning failures (where, for whatever reason, companies know less and learn slower than they should).

* * * * *

In Section 2.2, we stated that the ‘systems’ literature was not the only policy literature emerging from evolutionary economics, and that other evolutionary perspectives are starting to emerge. However, at this stage of development of evolutionary policy, it is hard to make a clear separation between those policy initiatives that would gain support from this alternative evolutionary perspective and those that wouldn’t. So we shall not take this any further in the present report.

4.3 ‘Footloose Multinationals’ Rationale

While the first rationale sought simply to correct cases of market failure and the second sought to improve those outcomes subject to systems ‘failure’ or systems ‘weakness’, this third rationale asks quite a simple question of any policy initiative. Will the policy invest in the UK in such a way as to encourage companies (whether of UK origin or foreign origin) to remain in the UK?

It is hard to talk about the relevance of this rationale to the different characteristics of design *per se*. For that reason, we shall simply assess the different policy initiatives from this perspective.

Initiatives for which ‘Footloose multinationals’ rationale is clear

The policy initiatives that earn clear support in this perspective are those that create strong attractors, which attract businesses and which are geographically embedded in the UK.

Strengthen the Design Profession

Policies to strengthen the design profession receive clear support from this perspective so long as they lead companies to access the UK-based design profession. These design professionals do not necessarily have to stay in the UK for each specific piece of work they undertake, but they do need to be UK-based.

So for example, a UK-based 'college of design' would fit these criteria in that designers would need to be UK-based to attract design business from foreign multinationals. On the other hand, investment in design education in the UK would not necessarily be so effective at keeping design talent in the UK, and instead some would come to the UK to train, and then leave to work elsewhere.

Create National Assets

Policies to create national design assets receive support from this perspective inasmuch as the assets are geographically embedded in the UK. This would be true of many of those described in Section 3.2. The key here is that the investment should be restricted to assets that can only be (or, at least, are best) accessed by businesses operating in the UK.

Design for Complex Systems

Policies to help develop in the UK design profession an exceptional talent for systems thinking and other design skills required for the design of complex systems will receive support from this perspective to the extent that this talent is embedded in the UK and, even more so, if UK-based business finds it easier to tap this exceptional talent. This brings us back to the issues about embeddedness discussed above under the heading "Strengthen the Design Profession". It also touches on issues, well understood in the literature on 'clusters', about whether those companies located in the cluster are better able to access the talent in that cluster – and that seems important whenever a lot of tacit knowledge sharing is required, and when transaction costs are lower for companies co-located in a cluster.

Initiatives for which 'Footloose multinationals' rationale is Mixed

Tax Credits for Design

Policies to offer tax credits for design *could* receive support from this perspective, so long as UK-based businesses are better placed to access these privileges than non-UK-based businesses, and so long as the tax credit is limited to expenditure on design within the UK. The first condition is clear enough: only companies subject to the UK tax system can benefit from these advantageous tax policies. But the second condition is less clear: is it possible to ensure that tax credits are only given if all the design expenditures take place within the UK? And is that desirable indeed? Outsourcing key parts of design effort to other countries may be essential for the overall effectiveness of the design effort.

Stronger IP and Standards for Design

Policies to strengthen IP might appear, *prima facie*, to receive less support than policies for tax credits. The location of a business within a country is not necessarily a pre-requisite for using that country's institutions for IP protection. On the other hand, it is clear that some multinationals have based location decisions on the strength of the IP regime in the chosen country.

The same sort of reasoning appears to apply to standards. It is not necessary for a company to be located in the UK to benefit from the use of UK standards, because these standards take the form of codified knowledge and can be accessed from many locations around the globe. On the other hand, standards are not simply codified knowledge, but also signal a strong technology diffusion culture. So for that reason, location in a country with a strong standards infrastructure may be attractive.

Public Expenditure on Design

Unless public expenditure on design creates a geographically embedded design asset that attracts design-conscious businesses to the UK, then it receives less support from this perspective. Policies that direct expenditure at strengthening the UK design profession, creating national design assets and developing a national expertise in design for complex systems (as described above) will receive support from this rationale. But support for other such expenditures is much less clear.

Education about Design

From this perspective, there is less support for educating footloose UK multinationals in design, unless it can be ensured that the design activities promoted as a result of this education takes place in the UK. The sceptics might argue that once such education has taken place, it is hard to follow (and impossible to enforce) where the design activities are located. The design activities may be just as footloose as the multinationals. On the other hand, transaction costs may be lower between the design-educated multinational and those designers located in the country where the education took place.

There may be some support for policies to educate ordinary employees about design (to the extent this makes them more attractive employees) and to educate those UK subcontractors that are geographically embedded in the UK. But in general, the 'footloose multinationals' rationale does not give very strong support to such policies.

5. Discussion Grouped by Policy Initiatives

Once again, our objective in this part of the report is to assess how each policy option in Part 3 weighs up when viewed from the perspectives in Part 2. In this part, we organise our summary by each policy initiative in turn.

The match between each option and each perspective has already been covered in Part 4, in some detail, and we shall not repeat all of that here, but simply summarise the main points. For that reason, this part of the report can be very brief.

5.1 Strengthen the Design Profession

This option finds support in all three rationales.

From the market failure perspective, the case is not a very strong one, but it can be argued that there may be market failure stemming from the mobility of labour. The training company can only capture a share of the returns from their investment in education, and the rest is an externality to the next employer. As a result there is an element of market failure.

The systems failure perspective offers some support for this option, based on the case that there are science and technology infrastructure failures, and also capability and learning failures.

The ‘footloose multinationals’ perspective also supports this option, so long as the investment to strengthen the profession creates a strength that is geographically embedded in the UK.

5.2 Create National Assets

This option (as described in Section 3.2) also finds support in all three rationales, and in this instance, all three cases are strong ones.

From the market failure perspective, investment to create national assets is an investment in public goods, and it is well recognised that the supply of public goods is often subject to market failure. These national assets become part of the design infrastructure in the UK and once again, there tends to be market failure in infrastructure investments.

From the systems failure perspective, it is well recognised that there is a tendency for ‘failures’ in the science and technology infrastructure, and these include a shortfall in national assets, including universities, research labs, libraries, possibilities for knowledge transfer, and indeed all the national design assets listed in Section 3.2.

From the ‘footloose multinationals’ perspective, investments in national assets look an especially good idea when the assets are geographically embedded in the UK, and where they are best accessed by companies based in the UK.

5.3 Public Expenditure on Design, Stronger IP and Tax Credits

These options only find support in one rationale each, and it is a different one in each case.

Public Expenditure on Design

A wide variety of initiatives for public expenditure to enhance competitiveness may find support from the systems failure rationale. This is because almost any of the failures recognised in the ‘Systems’ literature can be mobilised to provide at least some support to such initiatives.

By contrast, initiatives for public expenditure to enhance competitiveness are viewed with some suspicion from the market failure perspective. Why should government presume to know better than business itself what is the right level of investment in design to ensure competitiveness? It is recognised however that public expenditures on the creation of national assets, investment in design for complex systems and in standards for design does find support in the market failure rationale.

Finally, initiatives for public expenditure to enhance competitiveness will only find strong support in the ‘footloose multinationals’ rationale if the investments help to create assets that are geographically embedded in the UK, and are of greatest use to businesses operating in the UK.

Stronger IP and Tax Credits

In general, the market failure rationale is the most sceptical framework in which to study policy interventions. But in the case of these options (stronger IP protection and tax credits for design) it is arguable that the market failure rationale is stronger than that provided by the systems failure or ‘footloose multinationals’ perspectives.

The market failure rationale recognises that there may be a case for stronger IP protection and tax credits to compensate for the positive externalities from certain types of design activity to other design active companies. The systems failure rationale recognises that IP protection may fall short because of institutional failures but doesn’t really present much of a case for tax credits.

Equally, initiatives to offer tax credits for design *could* receive support from the ‘footloose multinationals’ perspective, so long as the tax credit is limited to expenditure on design within the UK. And initiatives to strengthen IP *could* receive support if the location of a business within a country is a pre-requisite for deriving maximum benefit from that country’s institutions for IP protection.

5.4 Design for Complex Systems and Standards for Design

For the most part, these options find strong support.

The case for public support of design for *complex systems* is clear from all three of our chosen perspectives: market failure, systems failure, ‘footloose multinationals’. The market failure rationale recognises this as a legitimate area for public expenditure because this is an area in which externalities are very significant and in which incomplete or asymmetric information is a pervasive phenomenon.

The systems failure rationale offers strong support for investment in design for complex systems because there are so many potential systems failures here that may lead to under-investment: interaction failures, hard and soft institutional failures, science and technology infrastructure failures, and capability and learning failures. And the ‘footloose multinationals’ rationale also offers strong support for such investment, if UK expertise in systems thinking is sufficiently embedded in the UK that it encourages multinationals to locate their design business in the UK.

Turning now to public investment in standards for design, the arguments are similar. Section 4.1 argued that there is a clear market failure rationale for public activity to set standards in design. Section 4.2 argued that there are several systems failures that can motivate the expenditure of public resources to develop high quality design standards.

However, the case for providing public support for design standards does not look so strong from the ‘footloose multinationals’ perspective. This is because it is not necessary for a company to be located in the UK to benefit from the use of UK standards, because these standards take the form of codified knowledge, and can be accessed from many locations around the globe.

5.5 Education about Design

This option only finds strong support in one rationale, and mixed support elsewhere.

The systems failure rationale provides a reasonably strong case for investment in education about design, because such education may fall short of what is required when there are interaction failures and capability/learning failures. In that context, there is a reasonably strong rationale to support initiatives for education about design.

From the market failure perspectives, however, the case is mixed. Why is it necessary to invest public money in educating UK companies how to use design? Have they not learnt already what they need to know about the value of design to their business? If not, why not? But the case for investing in the education of consumers is a bit stronger, and the case for investing in the public sector’s understanding and appreciation of design is even stronger still.

From the 'footloose multinationals' perspective, the case is also mixed. There is little support for educating footloose UK multinationals in design, *unless* it can be ensured that such design takes place in the UK. There is also little support for educating ordinary employees about design, *unless* this indigenous expertise attracts the 'footloose multinationals' to locate its design activities in the UK.

6. Conclusions

The specification for this report asked for:

“A paper reviewing the market failure and other, cogent, rationales for a national design promotion policy and its scope of applicability, with some reference to the purpose and roles for a national design policy body.”

We have looked at a group of five generic design policy options for such a national design body, from three different perspectives – where each perspective corresponds to a different economic rationale.

In this concluding section, we endeavour to fill out the table sketched at the start of Part 4. The objective of that table is to show how strong is the case for each policy intervention, from each of our three perspectives.

It should be clear from this final table (*Table 3*) that there are many areas of design activity that are eminently worthy of support from public funding. Notably, the following three broad areas receive particularly strong support:

- Creating National Design Assets
- Design for Complex Systems and Standards for Design
- Strengthening the Design Profession

The other two broad areas receive some support, but not so strong:

- Public Expenditure on Design, Stronger IP and Tax Credits
- Education about Design

Indeed, according to the perspectives taken in this paper, the areas most deserving of support are not necessarily the same as those that receive most attention in current government policies. This observation does not necessarily cast doubt on current priorities; for it may be that the limited range of (three) perspectives taken in this paper does not include those perspectives which provided the motivation for current policy priorities. But this observation does suggest that it would be useful to consider whether some other priorities might be added to the current list.

Table 3: How Much Support does each POLICY OPTION receive from each PERSPECTIVE?

		PERSPECTIVE		
		Market Failure	System Failure	'Footloose Multinationals'
POLICY OPTION	Strengthen Design Profession	<p>MODERATE SUPPORT</p> <p>Case based on inability of the training company to capture a proper return on its investment because of labour mobility.</p>	<p>MODERATE SUPPORT</p> <p>Case based on science and technology infrastructure failures, and also capability and learning failures.</p>	<p>MODERATE SUPPORT</p> <p>So long as the investment creates a strength that is geographically embedded in the UK.</p>
	Create National Assets	<p>STRONG SUPPORT</p> <p>Case for investment in public goods, based on clear market failure in supply of public goods.</p>	<p>STRONG SUPPORT</p> <p>Tendency for 'failures' in the science and technology infrastructure, including national design assets.</p>	<p>STRONG SUPPORT</p> <p>Good idea if assets are geographically embedded in the UK, and are best accessed by companies based in the UK.</p>
	Public Expenditure on Design, Stronger IP and Tax Credits	<p>MIXED SUPPORT</p> <p>IP and Tax Credits supported if clear spillovers, and by new growth theory. Otherwise, limited support for public expenditure of this sort.</p>	<p>MIXED SUPPORT</p> <p>Almost any of the recognised systems failures provide some support to such options. IP protection may fall short because of institutional failures.</p>	<p>MIXED SUPPORT</p> <p>Expenditure supported if benefits generated are embedded in the UK. Support for stronger IP and tax credits depends on geographical embeddedness.</p>

		PERSPECTIVE		
		Market Failure	System Failure	'Footloose Multinationals'
	Design for Complex Systems and Standards for Design	<p>STRONG SUPPORT</p> <p>This is an area in which externalities are very significant and in which incomplete or asymmetric information is pervasive.</p>	<p>STRONG SUPPORT</p> <p>Many systems failures here lead to under-investment in design of complex systems and require intervention to develop high quality design standards.</p>	<p>MODERATE SUPPORT</p> <p>Strong support for investment in complex system design, if embedded in the UK. More limited support for investment in standards.</p>
	Education about Design	<p>MIXED SUPPORT</p> <p>Is it necessary to educate companies how to use design? But case for educating consumers and, especially, public sector in value of design remains stronger.</p>	<p>MIXED SUPPORT</p> <p>Education may fall short of what is required when there are interaction failures and capability/learning failures.</p>	<p>MIXED SUPPORT</p> <p>Limited support unless it leads to design investments in the UK or it attracts multinationals to the UK.</p>

Appendix

A1. Investment in National Assets as a Game in R&D

This Appendix relates to Section 2.2 of the main report, and describes a game between two symmetric nation-players 1 and 2, where comparative investment in R&D defines the relative competitiveness and sales of two nations. This structure will not be relevant in all cases. But in a significant range of settings, the relative competitiveness of two different countries' products will depend on their relative investment in innovation, of which R&D is an important part. The model is defined as a game in R&D, but could equally well apply to any form of investment in assets that enhances the competitiveness of the nation.

The revenues of 1 depend on the relative investment in R&D in 1 and 2, as follows:

$$X_1 = H_1 + (R_1 - aR_2)^b$$

In general $0 < a < 1$ and $0 < b < 1$. The costs of 1 depend on the investment in R&D in 1:

$$C_1 = cR_1$$

The profit in 1 is defined as:

$$\Pi_1 = H_1 + (R_1 - aR_2)^b - cR_1$$

The profit maximizing strategy of 1 is found by differentiating the last equation with respect to R_1 :

$$b(R_1 - aR_2)^{b-1} - c = 0$$

This is rearranged to give:

$$R_1 = aR_2 + \left(\frac{c}{b}\right)^{\frac{1}{b-1}}$$

As $b < 1$, then we can rewrite this conveniently as the reaction curve for player 1:

$$R_1 = aR_2 + \left(\frac{b}{c}\right)^{\frac{1}{1-b}}$$

And a similar result for the reaction curve for player 2:

$$R_2 = aR_1 + \left(\frac{b}{c}\right)^{\frac{1}{1-b}}$$

This indicates a generic reaction curve:

$$R_i = R_0 + aR_j$$

Where:

$$R_0 = \left(\frac{b}{c}\right)^{\frac{1}{1-b}}$$

And, because the two players 1 and 2 are symmetric, the Nash equilibrium levels of R&D, R_1 and R_2 are equal to each other, and defined as follows:

$$(1-a)R_1 = (1-a)R_2 = R_0$$

Hence:

$$R_1 = R_2 = \frac{R_0}{(1-a)}$$

From this we see that the effect of competition in R&D is to raise the equilibrium level of R&D in each nation from R_0 to $R_0/(1-a)$. When competition is intense ($a \rightarrow 1$), then the increase in R&D due to competition is very large indeed.

References

- Aiginger K. (2007) "Industrial Policy: A Dying Breed or a Re-Emerging Phoenix", *Journal of Industrial Competition and Trade*, 7, 297-323
- Arrow K.J. (1962) "Economic Welfare and the Allocation of Resources for Inventions", in R.R. Nelson (ed.), *The Rate and Direction of Inventive Activity*, Princeton, NJ: Princeton University Press
- Arthur W.B. (1989) "Competing Technologies, Increasing Returns, and Lock-in by Historical Events", *Economic Journal*, 99, 116-131
- Bailey D., G. Harte and R. Sugden (1994) *Transnationals and Governments: Recent Policies in Japan, France, Germany, the United States, and Britain*, London: Routledge
- Barba Navaretti G. and A.J. Venables (2004) *Multinational Firms in the World Economy*, Princeton: Princeton University Press
- Baumol W.J. and R.E. Gomory (2000) *Global trade and conflicting national interests*, Cambridge MA: MIT Press
- Baumol W. J. and R.E. Gomory (2004) "Globalization: prospects, promise, and problems", *Journal of Policy Modelling*, 26, 425-438
- Bergek A., S. Jacobsson, M. Hekkert and K. Smith (2007) "Functionality of Innovation Systems as a Rationale for and Guide to Innovation Policy", *RIDE/IMIT Working Paper*, #84426-006
- Bernsen J. (1987) "Design in Action", in *Design Management in Practice*, Copenhagen: Danish Design Council
- Cantwell J. (ed. 2004) *Globalization and the location of firms*, Cheltenham: Edward Elgar
- Carlsson B. and S. Jacobsson (1997) "In Search of Useful Public Policies: Key Lessons and Issues for Policy Makers" in B. Carlsson (ed.) *Technological Systems and Industrial Dynamics*, Dordrecht: Kluwer Academic Publishers
- Caves R.E. (2007) *Multinational Enterprise and Economic Analysis*, 3rd Edition, Cambridge: Cambridge University Press
- CEC (2009) *Design as a Driver of User-Centred Innovation*, Commission Staff Working Document, SEC(2009)501 final, Brussels: Commission of the European Communities, 7th April

Chaminade C. and C. Edquist (2006) "From Theory to Practice: The Use of the Systems of Innovation Approach for Innovation Policy", in J. Hage and M. Meeus (eds.), *Innovation, Science and Institutional Change*, Oxford: Oxford University Press

Cowling K. (1999) *Industrial policy in Europe: theoretical perspectives and practical proposals*, London: Routledge

Cowling K. and R. Sugden (1999) "The Wealth of Localities, Regions and Nations: Developing Multinational Economies", *New Political Economy*, 4, 361-378

Cox G. (2005) *Cox Review of Creativity in Business*, London: Her Majesty's Treasury, November

Dasgupta P. (1987), "The Economic Theory of Technology Policy", in P. Dasgupta and P. Stoneman (eds.), *Economic Policy and Technological Performance*, Cambridge: Cambridge University Press

Dasgupta P. (1988), "The Welfare Economics of Knowledge Production", *Oxford Review of Economic Policy*, 4, 1-12

David, P.A. (1985), 'Clio and the Economics of QWERTY', *American Economic Review*, 75, 332-336

Design Council website, <http://www.designcouncil.org.uk/>

Design Council (1995) *Definitions of Design*, London: Design Council

Design Council (2009) *Design Bugs Out*, London: Design Council

DIUS (2008) *Annual Innovation Report 2008*, London: Department for Innovation, Universities and Skills, 4th December

Dobrinsky R. (2009) "The Paradigm of Knowledge-Oriented Industrial Policy", *Journal of Industrial Competition and Trade*, forthcoming (published online, 8th May 2009)

DTI (2005) *Creativity, Design and Business Performance*, DTI Economics Paper No. 15, London: Department of Trade and Industry, November

Dunning J.H. (ed. 1997) *Governments, Globalization and International Business*, Oxford: Oxford University Press.

Dunning J.H. and S.M. Lundan (2008) *Multinational enterprises and the global economy*, 2nd Edition, Edward Elgar Publishing, 2008

Edquist C. (1997, ed.) *Systems of Innovation, Technologies, Institutions and Organisations*, London: Pinter

- Edquist C. (2001) "Innovation Policy: a Systemic Approach", in D. Archibugi and B.-Å. Lundvall, (eds.) *The Globalizing Learning Economy*, Oxford: Oxford University Press
- Encyclopaedia Britannica (1968) "Design", *Encyclopaedia Britannica*, Volume 7, Chicago: William Benton Publisher
- Foxon T. (2006) "The Rationale for Policy Interventions from an Innovation Systems Perspective", in J. Murphy (ed.) *Governing Technology for Sustainability*, London: Earthscan
- Freeman C. (1987) *Technology and Economic Performance: Lessons from Japan*, London: Pinter Publishers
- Görg H. and E. Strobl (2003) "Footloose Multinationals?", *The Manchester School*, 71, 1–19
- Granovetter M. (1983) "The Strength of Weak Ties: A Network Theory Revisited", *Sociological Theory*, 1, 201-233
- Granovetter M. (1985) "Economic Action and Social Structure: The Problem of Embeddedness", *American Journal of Sociology*, 91, 481-510
- Greenpeace (n.d.) *A Greener Apple*, <http://www.greenpeace.org/apple/>
- Hauknes J. and L. Nordgren (1999) *Economic Rationales of Government Involvement in Innovation and the Supply of Innovation-Related Services*, STEP Report R-08, Step Group, Oslo
- Hood N. and S. Young (1997) "The United Kingdom", In Dunning, J.H. (ed.), *Governments, Globalization and International Business*, Oxford: Oxford University Press.
- Janis I. (1972) *Victims of Groupthink*, Boston: Houghton Mifflin
- Janis I. (1982) *Groupthink: Psychological studies of policy decisions and fiascos*, 2nd edition, Boston: Houghton Mifflin.
- Leahy D. and J.P. Neary (1996) "International R&D Rivalry and Industrial Strategy without Government Commitment", *Review of International Economics*, 4, 322 – 338
- Leahy D. and J.P. Neary (2001) "Robust Rules for Industrial Policy in Open Economies", *CEPR Discussion Paper*, No. 2731. Available at SSRN: <http://ssrn.com/abstract=266621>
- Lundvall B.-Å. (1992) *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter Publishers

- Lundvall B.-Å. (2001) "Innovation Policy in the Globalizing Learning Economy", in D. Archibugi and B.-Å. Lundvall (eds.) *The Globalizing Learning Economy*, Oxford: Oxford University Press, pp. 273-292
- Lundvall B.-Å. (2007) "National Innovation Systems: Analytical Concept and Development Tool", *Industry and Innovation*, 14, 95-119
- Lundvall B.-Å. and S. Borrás (1997) *The Globalising Learning Economy: Implications for Innovation Policy*, Report Based on Contributions from Seven Projects under the TSER Programme DG XII, Commission of the European Union, Available at: <ftp://ftp.cordis.lu/pub/tser/docs/globeco.doc>
- Lundvall B.-Å. and S. Borrás (2004) "Science, Technology and Innovation Policy", in J. Fagerberg, D.C. Mowery and R.R. Nelson (eds.), *The Oxford Handbook of Innovation*, Oxford: Oxford University Press
- Lynn J. and A. Jay (1983) *Yes Minister*, Volume 3, London: British Broadcasting Corporation
- Malerba F., R. Nelson, L. Orsenigo and S. Winter (1999) "History-friendly models of industry evolution: the computer industry" *Industrial and Corporate Change*, 8, 3-40
- Malerba F. (2009) "Increase Learning, Break Knowledge Lock-ins and Foster Dynamic Complementarities: Evolutionary and System Perspectives on Technology Policy in Industrial Dynamics" in D. Foray (ed.) *The New Economics of Technology Policy*, Cheltenham: Edward Elgar Publishing
- Metcalfe J.S. (1994) "Evolutionary Economics and Technology Policy", *The Economic Journal*, 104, 931-944
- Metcalfe J.S. (1995a) "Technology Systems and Technology Policy in an Evolutionary Framework", *Cambridge Journal of Economics*, 19, 25-46
- Metcalfe J.S. (1995b) "The Economic Foundations of Technology Policy: Equilibrium and Evolutionary Perspectives", in P. Stoneman (ed.), *Handbook of the Economics of Innovation and Technological Change*, Oxford: Blackwell Publishers
- Metcalfe J.S. (2003) "Equilibrium and Evolutionary Foundations of Competition and Technology Policy" in Pelikán P. and G. Wegner (eds.) *The Evolutionary Analysis of Economic Policy: New Horizons in Institutional and Evolutionary Economics*, Cheltenham: Edward Elgar Publishing
- Metcalfe J.S. and L. Georghiou (1997) "Equilibrium and Evolutionary Foundations of Technology Policy", *CRIC Discussion Paper No. 3*, Centre for Research on Innovation and Competition, University of Manchester
- Moultrie J. and F. Livesey (2009) *International Design Scoreboard: Initial Indicators of International Design Capabilities*, London: Design Council

- Mytelka L. and K. Smith (2002) "Policy Learning and Innovation Theory: An Interacting and Co-Evolving Process", *Research Policy*, 31, 1467-1479
- Navarro L. (2003) "Industrial Policy in the Economic Literature: Recent Theoretical Developments and Implications for EU Policy", *Enterprise Papers*, No. 12, Enterprise Directorate-General, European Commission
- Nelson H.G. and E. Stolterman (2003), *The Design Way: Intentional Change in an Unpredictable World : Foundations and Fundamentals of Design Competence*, Englewood Cliffs, NJ: Educational Technology Publications
- Nelson R.R. and S.G. Winter (1982) *An Evolutionary Theory of Economic Change*, Cambridge Mass: Harvard University Press
- Nelson R.R. (ed., 1993) *National Innovation Systems. A Comparative Analysis*, Oxford: Oxford University Press
- Nelson R.R. (2009) "Building Effective Innovation Systems Versus Dealing With Market Failures as Ways of Thinking about Technology Policy" in D. Foray (ed.) *The New Economics of Technology Policy*, Cheltenham: Edward Elgar Publishing
- Olins W. (1989) *Corporate Identity: Making Business Strategy Visible Through Design*, London: Thames and Hudson
- Pack H. and K. Saggi (2006) "The case for industrial policy: a critical survey", *The World Bank Research Observer*, 21, 267-297
- Pelikán P. and G. Wegner (eds. 2003) *The Evolutionary Analysis of Economic Policy: New Horizons in Institutional and Evolutionary Economics*, Cheltenham: Edward Elgar Publishing
- Reimer J.J. and K.W. Stiegert (2006) "Evidence on Imperfect Competition and Strategic Trade Theory", *Staff Paper #498*, Department of Agricultural and Applied Economics, University of Wisconsin-Madison
- Rodrik D. (2004) "Industrial Policy for the Twenty-First Century", *CEPR Discussion Paper #4767*. Available at SSRN: <http://ssrn.com/abstract=666808>
- Romer P. (1986) "Increasing Returns And Long-Run Growth," *Journal of Political Economy*, 94, 1002-1037
- Romer P. (1990) "Endogenous Technological Change", *Journal of Political Economy*, 98, S71-S102
- Ruskin J. (1996) *The Works of John Ruskin: The Library Edition*, Edited by E.T. Cook and A. Wedderburn, Cambridge: Cambridge University Press

- Schröter A. (2009) "New Rationales for Innovation Policy? A Comparison of the Systems of Innovation Policy Approach and the Neoclassical Perspective", *Jena Economic Research Paper*, # 2009-033, Jena: Max Planck Institute of Economics
- Schubert C. (2009) "Is Novelty always a good thing? Towards an Evolutionary Welfare Economics", *Papers on Economics and Evolution* # 0903, Max Planck Institute of Economics, Jena.
- Simon H.A. (1996) *The Sciences of the Artificial*, 3rd Edition, Cambridge, MA: MIT Press
- Smith K. (1992) "Innovation policy in an evolutionary context", in Saviotti, P. and Metcalfe, J. S. (eds.) *Evolutionary Theories of Economic and Technological Change: Present Status and Future Prospects*, Harwood Academic Publishers, Reading
- Smith K. (1997) "Economic Infrastructures and Innovation Systems", in C. Edquist (ed.) *Systems of Innovation, Technologies, Institutions and Organisations*, London: Pinter
- Smith K. (2000) "Innovation as a Systemic Phenomenon: Rethinking the role of Policy", *Enterprise and Innovation Management Studies*, 1, 73-102
- Spencer B.J. and J.A. Brander (1983) "International R&D rivalry and industrial strategy", *Review of Economic Studies*, 50, 707-722
- Starbuck W.H. (n.d.) "Organizational Research Should Involve Design, and Design Should be Discovery", <http://www.forskarskolan-mit.nu/mit/files/documents/seminarier/Design.pdf>
- Stoneman, P. (1987), *The Economic Analysis of Technology Policy*, Oxford: Oxford University Press
- Swann G.M.P. (1990) "Product Competition and the Dimensions of Product Space", *International Journal of Industrial Organisation*, 8, 281-295
- Swann G.M.P. (2000) *The Economics of Standardization*, London: Department of Trade and Industry
- Swann G.M.P. (2003) "Funding Basic Research: When is Public Finance Preferable to Attainable Club Good Solutions?" in A. Geuna, A. Salter and W.E. Steinmueller (eds.) *Science and Innovation: Rethinking the Rationales for Funding and Governance*, Cheltenham: Edward Elgar Publishing
- Swann G.M.P. (2006) *Putting Econometrics in its Place*, Cheltenham: Edward Elgar Publishing
- Swann G.M.P. (2009) *The Economics of Innovation: An Introduction*, Cheltenham: Edward Elgar Publishing

Swann G.M.P. and D. Birke (2005) *How do Creativity and Design Enhance Business Performance? A Framework for Interpreting the Evidence*, 'Think Piece' for DTI Strategy Unit, 18th July

Tassey G. (1982a) "Infratechnologies and the Role of Government", *Technological Forecasting and Social Change*, 21 (2), 163-180

Tassey G. (1982b) "The Role of Government in Supporting Measurement Standards for High-Technology Industries", *Research Policy*, 11, 311-320

Tassey G. (1992) *Technology Infrastructure and Competition Position*, Norwell, MA: Kluwer

Tassey, G. (2005) "Underinvestment in Public Good Technologies", *Journal of Technology Transfer*, 30 (1), 89–113

Tassey G. (2008) "Modelling and Measuring the Economic Roles of Technology Infrastructure", *Economics of Innovation and New Technology*, 17, 615–629

Tassey G. (2009) *Rationales and Mechanisms for Revitalizing U.S. Manufacturing R&D Strategies*, Unpublished Paper, National Institute of Standards and Technology

Teubal M. (1997), "A catalytic and evolutionary approach to horizontal technology policies", *Research Policy*, 25, 1161-1188

Tomer J.F. (1999) *Human Firm: A Socioeconomic Analysis of its Behaviour and Potential in a New Economic Age*, London: Routledge

UNCTAD (2003) *World Investment Report: FDI Policies for development: National and International Perspectives*, New York: United Nations

UNCTAD (2005) *World Investment Report: Transnational Corporations, and the Internationalization of R&D*, New York: United Nations

UNCTAD (2008) *World Investment Report: Transnational Corporations, and the Infrastructure Challenge*, New York: United Nations

van den Bergh J.C.J.M. and G. Kallis (2009) "Evolutionary Policy", *Papers on Economics and Evolution* #0902, Max Planck Institute of Economics, Jena.

Wegner G. (1997) "Economic Policy from an Evolutionary Perspective: A New Approach" *Journal of Institutional and Theoretical Economics*, 153, 485–509

Woolthuis R.K., M. Lankhuizen and V. Gilsing (2005) "A System failure Framework for Policy Design", *Technovation*, 25, 609-619

BIS Economics Papers

BIS places analysis at the heart of policy-making. As part of this process the Department has decided to make its analysis and evidence base more publicly available through the publication of a series of BIS Economics Papers that set out the thinking underpinning policy development. The BIS Economics series is a continuation of the series of Economics papers, produced by the former Department for Business, Enterprise and Regulatory Reform (BERR) which analysed issues central to business and industry.

The main series is complemented by a series of shorter Occasional papers including literature reviews, appraisal and evaluation guidance, technical papers, economic essays and think pieces. These are listed below:

Main BIS Series

6. **Learning from some of Britains sucessful sectors: An historical analysis of the role of government**, March 2010
5. **Learning from Britain's successful sectors**, March 2010
4. **Supporting analysis for "Skills for Growth: The national skills strategy"**, March 2010
3. **The space economy in the UK: An economic analysis of the sector and the role of policy**, February 2010
2. **Life Sciences in the UK - Economic analysis and evidence for 'life sciences 2010: Delivering the Blueprint'**, January 2010
1. **Towards a low carbon economy – economic analysis and evidence for a low carbon industrial strategy**, July 2009

Main BERR Series

6. **The globalization of value chains and industrial transformation in the UK**, February 2009
5. **China and India: Opportunities and Challenges for UK Business**, February 2009
4. **Regulation and Innovation: Evidence and Policy Implications**, December 2008
3. **High Growth Firms in the UK: Lessons from an analysis of comparative UK Performance**, November 2008

2. **Five Dynamics of change in Global Manufacturing**, September 2008
1. **BERR's Role in Raising Productivity: New Evidence**, February 2008

BIS Occasional Papers

1. **Research to improve the assessment of additionality**, October 2009

BERR Occasional Papers

3. **Impact of Regulation on Productivity**, September 2008
2. **Evaluation of Regional Selective Assistance (RSA) and its successor, Selective Finance for Investment in England**, March 2008
1. **Cross-Country Productivity Performance at Sector level: the UK compared with the US, France and Germany**, February 2008

These papers are also available electronically on the BIS Economics website at <http://www.berr.gov.uk/Policies/economics-statistics/economics>.

Further information on economic research in BIS can be found at <http://www.bis.gov.uk/policies/economics-statistics/economics/bis-research> . This site includes links to the various specialist research areas within the Department.

Evaluation reports are available on the BIS evaluation website at <http://www.berr.gov.uk/Policies/economics-statistics/economics/evaluation>.

The views expressed within BIS Economics Papers are those of the authors and should not be treated as Government policy. We welcome feedback on the issues raised by the BIS Economics Papers, and comments should be sent to bis.economics@bis.gsi.gov.uk.

© Crown copyright 2010
Department of Business, Innovation and Skills
1 Victoria Street
London SW1H 0ET
www.bis.gov.uk

URN 10/1112