

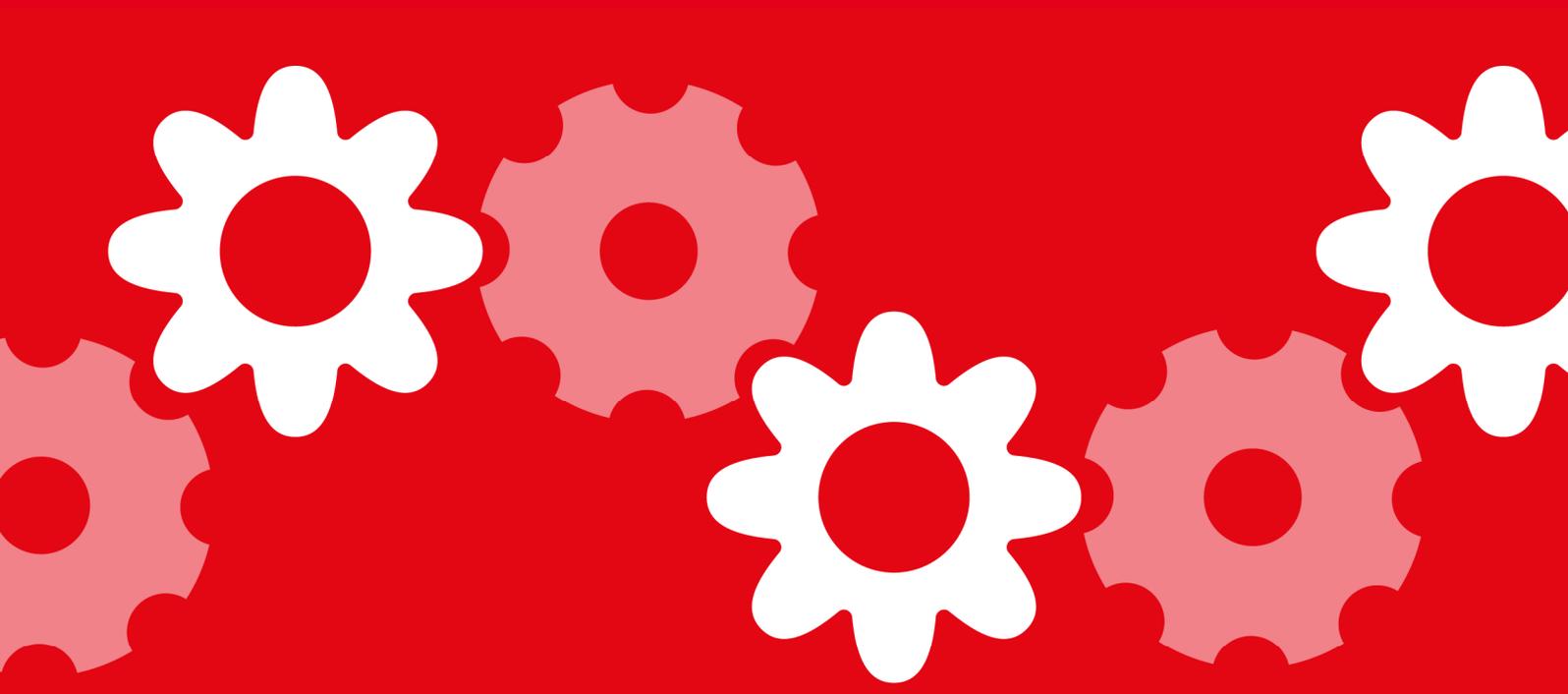
December 2012



Market Making

A modern approach to industrial policy

Andrew Sissons and Spencer Thompson



The authors would like to acknowledge the contributions to this paper of the following:

Dr. Katy Mason, Senior Lecturer in Marketing, University of Lancaster

Dr. Martin Spring, Senior Lecturer in Operations Management, University of Lancaster

Professor Luis Araujo, Personal Chair in Marketing, University of Lancaster



The Big Innovation Centre is an initiative of The Work Foundation and Lancaster University. Launched in September 2011, it brings together a range of companies, trusts, universities and public bodies to research and propose practical reforms with the ambition of making the UK a global open innovation hub as part of the urgent task of rebalancing and growing the UK economy, and with the vision of building a world-class innovation and investment ecosystem by 2025.

For further details, please visit www.biginnovationcentre.com

Executive Summary

The debate about how involved government should be in the economy – in terms of industrial policy, picking winners and so on – is a long-standing and contentious one. Since the 1970s, industrial policy has often been associated with the policies of state ownership, dirigisme and support for incumbents that led to a collapse in UK competitiveness during that decade. But today, industrial policy is creeping back into fashion, as the UK considers how to renew its economy within a rapidly changing global environment.

The return of industrial policy has been driven both by the weakness of the UK recovery and the resilience of statist economies in Asia and elsewhere. The government's first attempt to 'rebalance' the UK economy by devaluing sterling, lowering interest rates and promoting export-led growth appears to have failed, partly thanks to the underlying weakness of the UK's manufacturing sector. In response, many politicians and business groups are eyeing a more active approach, one in which the state helps to shape the UK economy and build up its strongest industries. Lord Heseltine's recent growth review¹ recommended that government should have a "clear policy for each sector of the economy", a call for industrial policy in all but name.

But the type of industrial policy being advocated today is vastly different to the policies of post-war Britain. Modern proponents generally advocate a more subtle approach to industrial policy, in which the government concentrates on removing barriers to growth and funding activities that the private sector cannot do, rather than picking specific companies or industries to back. There are many things that the state must do to support businesses – providing skills, removing regulatory barriers – which are sector-specific, and must be tailored to different industries. This type of approach, so long as it avoids favouring specific companies, is to be broadly welcomed, and has been advocated by the Big Innovation Centre in the past.

However, while today's breed of industrial policy has moved on from mistakes of the past, it still has some significant weaknesses. Most important of these is the tendency to focus on established sectors – such as car manufacturing and aerospace – rather than on the growth areas of the future. Industrial policy is far better geared towards supporting known quantities, which have mature technologies and markets, than emerging, disruptive technologies. As a result, industrial policy is more heavily geared towards incremental rather than radical innovation. This is a significant problem, because the majority of economic growth tends to come from radical ideas and brand new markets, rather than from well-established ones.

¹ Heseltine, M. (October 2012) *No Stone Unturned in Pursuit of Growth*

This paper argues that the state should focus more of its efforts on supporting new disruptive markets, and advocates a new approach to doing this, which we call 'market making'. Rather than focus on specific industries, this approach concentrates on enabling the growth of new markets, thus allowing entrepreneurs and innovators to scale up their ideas more quickly. Breakthrough inventions usually face a series of barriers to becoming fully fledged markets – from new infrastructure requirements to changes in intellectual property needs – and businesses often rely on the state to help tackle these. By working with innovative businesses and entrepreneurs, and responding to the needs and challenges that they face in creating new markets, the government can promote innovation and economic growth without playing a leading role, or having to commit vast sums of cash.

This paper argues that markets are complex institutions, which do not just emerge and fall into place instantaneously. They require coordination and agreed rules between a range of different players, and without this they can easily fail to emerge. This paper identifies seven aspects of market making that typically need to be addressed before a new technology can spawn a functioning market:

- **Technologies** – technologies often underpin the workings of a market. They need to be available, viable, and compatible with the wider infrastructure and institutions of the market.
- **Infrastructure and locations** – markets almost always require some sort of physical infrastructure to bring buyers and sellers together, whether it is roads or broadband cables. They also need a location, whether it is a place or a digital domain.
- **Standards** – markets often depend on having established standards which all players can follow, to allow them to be coordinated and achieve critical mass.
- **Customer behaviour and conventions** – customer habits play a major role in shaping markets and determining value. Unless customers are willing to adopt new products and services, they will not take off.
- **Supply chains and networks** – there is a wide range of structures and logistics which provide the 'plumbing' within a market. These structures often rely on relationships between many different firms.
- **Regulation** – regulation on competition, on health and safety and a range of other areas can help to create markets and build consumer confidence, but it can also hold them back.
- **Legal rights** – property rights – be they for intellectual or tangible property – play a central role in defining what is traded in a market, and enabling buyers and sellers to capture the benefits from what they exchange.

Most of the functions of market making are carried out by businesses and entrepreneurs, but there are certain key issues, such as legal rights and regulation, that require government action. Market making may also present coordination challenges, where the solutions to certain problems are beyond the reach of individual businesses. In such cases, the

government is well placed to act as a coordinator, helping businesses overcome such problems.

Part of the problem for government is the wide range of public bodies with responsibility for different policy areas. Coordinating these different bodies, such that their policies are timed and designed in a complementary way, is an important role for central government to play.

This market making approach is not without risks for government. Disruptive technologies are by their nature unpredictable, as are consumer tastes, and can easily develop in unexpected ways. As a result, it is all too easy for government to introduce the wrong policies, and to lock new markets onto the wrong paths. Equally, the state risks stifling competition if its approach is biased towards one particular business or outcome. These risks cannot be entirely mitigated, but government can seek to avoid them by remaining flexible in its approach, and playing a supporting rather than leading role. Governments that support market making must remain alert to changes in the market, and must be prepared to drop policies quickly where circumstances change.

If it is to play its supporting role in market making effectively, the government should:

- Identify future markets with the potential for significant growth, through a combination of **technology foresight and communication with businesses** and entrepreneurs;
- Establish **Market Making Councils**, convened by the Department for Business, Innovation and Skills (BIS), where markets with significant potential have been identified;
- Work with businesses, entrepreneurs and academics to **identify barriers and coordination problems**, before finding mutually beneficial solutions;
- Coordinate the **different levers of public policy**, such that any policy changes needed can be implemented promptly and effectively;
- Adopt an approach that is **technology- and business-neutral**, and focuses on outcomes rather than processes, to avoid imposing the wrong solutions to the challenges of market making.

Examples of markets that government may wish to pilot this approach on include 3D printing, peer-to-peer finance and e-learning. The Big Innovation Centre has recently published a study looking at how the government could support the development of a mass market for 3D printing², applying the principles set out in this paper.

² Sissons, A. and S. Thompson (Big Innovation Centre, 2012) *Three Dimensional Policy; Why Britain needs a policy framework for 3D printing*

Chapter 1 Introduction

Whether it's 3D printing or nano-technology, big data or autonomous machines, Britain's economic growth over the coming decades will be based on new technologies, and on the new uses we put them to. These technologies have the potential to transform the way businesses operate, and to change our everyday lives as consumers. But developing and perfecting new technologies is not, in itself, enough to unlock economic growth. They must be turned into products and services that people want, and used to create new, valuable markets.

For many new ideas and technologies – especially those with the potential to disrupt the status quo – the process of turning them into household products is slow, complex and uncertain. There is a range of barriers and obstacles that often need to be overcome, from putting in place infrastructure and standards, to persuading consumers to change their behaviour. These issues are just as much a part of the process of innovation as questions of technology or skills, but they don't always get the attention they deserve from policy makers. If the UK cannot create markets for new ideas, then businesses will see no benefits from innovation, and the economy will not grow.

In this paper, we argue that the process of making markets is a key part of innovation, and that the UK must take this idea far more seriously. Our economy is built on markets, and it grows in part because innovative businesses constantly create new markets. Most market making is done by businesses, which develop new products and services, find new ways of engaging with customers or come up with new ways of running their business. But for the most radical, disruptive technologies – the ones that can produce a step change in the economy – making new markets gets much harder. In these situations, businesses often face challenges that are beyond their own individual reach, and require support from the state and its institutions.

There are plenty of technologies around at present that have the potential to transform the world economy. Some of these will require further development before they are ready to use. But many of the technologies are approaching a degree of maturity, and could bring enormous benefits to consumers and to society. The barriers to their uptake are less about technical capabilities, and more to do with bringing them to market. Technologies such as 3D printing and self-driving vehicles are developing quickly, but they are still some way off being mass market items. Unlocking the full benefits from technologies like these will require major changes in the way certain parts of our society and economy are organised.

Of course, these disruptive markets are likely to develop at some point over time, however slowly. But the speed at which these markets are created matters; the need for economic growth is immediate. If the UK is to become a global innovation hub in these areas, it needs to move quickly to make these markets work and become a world leader in them. Recent

research from the Big Innovation Centre³ has shown that the UK has been left behind in many of the fastest growing markets of the past 15 years; we cannot afford to be left behind again. We believe that taking a more deliberate approach to making new markets is critical if the UK is to become a global innovation hub, and return to serious economic growth.

This paper considers some of the issues around market making, and sets out what a coherent policy approach in this area would need to consider. We have identified seven themes which we think need to be addressed by market makers, and provided a brief outline of why each of these matters. Finally, we have set out the approach that government should take to market making, in its role as a convenor and a controller of institutions.

What are markets?

In developing policy on market making, it is useful to understand what markets are and why they matter. Markets are the places – whether physical or virtual – where buyers and sellers exchange things. Markets occupy a sacrosanct position within economics, because of the range of benefits they often provide. They normally allocate resources efficiently, and tend to respond dynamically to gaps or new developments. Moreover, exchanges between buyers and sellers tend to be mutually beneficial, such that more trade, and more markets, normally make everyone better off.

But in reality markets are often much more complex than economic theory allows for. Markets, especially for new or complicated things, do not always form instantaneously, even where there are a range of potential buyers and sellers. There is often a series of pre-requisites that need to be put in place before a market emerges, matures and grows. Equally, markets often fail in unexpected ways, sometimes due to failures in the institutions that support them.

Rather than thinking about markets as a simple series of exchanges, which just emerge wherever there are demand and supply, it makes more sense to view them as institutions. Markets involve a set of rules, conventions and infrastructures that develop and evolve over time. Markets sometimes form slowly, as buyers and sellers are slow to get used to the conventions of the market, or as different rules are put in place. Once markets have emerged, they play a role in shaping behaviour by businesses and customers, often enabling new trades to take place. There are many examples of businesses shaping market conditions to persuade customers to buy things; anything from the attractiveness of a street market to the user-friendliness of a website can help to sway a buyer's decision. One paper within the marketing literature even argues that shopping trolleys play an important role in changing the calculations customers make when buying things in a supermarket (Cochoy, 2008).

³ Thompson and Sissons (2012) Consumer Habits and Innovation: How do our spending decisions shape the economy?

In effect, markets operate like small ecosystems. They involve different businesses, customers, government and a range of other institutions working together for mutual benefit. The government can put in place some of the conditions to help markets flourish, but they cannot force them to emerge by themselves. Likewise, individual businesses rarely have the reach to form new markets on their own.

There is a significant body of literature dedicated to this institutional view of markets (some of which is flagged in the Bibliography to this paper). This literature focuses on how markets evolve, how they shape people's behaviour, and how businesses and marketing professionals can create new markets and grow existing ones. Where there is a gap, though, is in extending the concept of market making to a policy-making level. The aim of this paper is to describe the role that government can – and cannot – play in making new markets, especially for the most disruptive technologies.

The key point is that markets are not like manna from heaven; they do not just emerge as soon as a new product emerges or customers find new things they want. Markets take time to evolve, and they often need to be imagined and created by businesses, by customers and by governments. In some cases, customers may be slow to adapt their behaviour to the possibilities offered by a new market. In other cases, a lack of formal rules – or constraints created by too many rules – may hold back the development of a market.

In short, there is a place for the state, businesses and customers to work together to create markets. The creation of effective new markets takes time, and requires coordination between different bodies to create platforms and remove barriers. Governments are often the only players who have sufficient reach or power to shape such factors, such as regulations and standards, or fund the set up of key pieces of infrastructure.

But government intervention can just as often stifle the development of markets; after all, markets are used by private individuals and companies, and should be designed according to their needs. Government's role in making markets must be carefully interpreted; it should rarely act as a leader, but often as a coordinator or facilitator, helping private agents achieve mutually beneficial outcomes.

Why do new markets emerge?

At a basic level, a new market can emerge when there is something new (a technology, product or service) that meets the needs or desires of a customer. These markets may not work until a working institutional structure falls into place, but the underlying potential is there.

However, there is considerable debate in the academic literature over whether innovation is driven by companies responding to the needs of customers (demand-pull), or by inventors and entrepreneurs dreaming up new ideas (technology-push). Dosi (1982) attempts to reconcile these two approaches by suggesting that they may account for different types of innovation, and work at different stages in the maturity of a new technology. According to Dosi, demand-pull factors tend to be the key driver behind incremental innovation, whereas technology-push factors tend to give rise to radical, transformative innovations that could not have been produced by considering existing customer needs.

To explain how this works, Dosi argues that the most radical technological changes create new technological “paradigms”. These paradigms, once they emerge, become a new focus for “technologists and engineers”, and set future technological progress and consumer demand onto a new trajectory. Within new paradigms, there will over time be a series of incremental innovations (driven in part by demand-pull factors) that create new markets and cause the technology to mature.

This distinction between radical and incremental technologies is often blurry in practice, but it has implications for market making. Trying to create markets for the most radical and disruptive technologies is likely to involve revolutionising many institutions, or creating new ones altogether. Once in place, these new institutional frameworks are likely to shape future, more incremental developments within that area.

Chapter 2 How big are the UK's markets?

The UK economy is made up of a series of interlocking markets, with a total value of over £3 trillion. That is far more than the UK's GDP, because it includes all of the intermediate business-to-business transactions that go into making finished outputs, as well as taxes. Within this, there is a vast range of different markets serving different purposes. Markets differ according to the nature of the buyer (consumers, businesses, government), or what's being sold (manufactures, services, raw materials). This section provides a brief overview of the different markets that make up the UK economy, and how big they are.

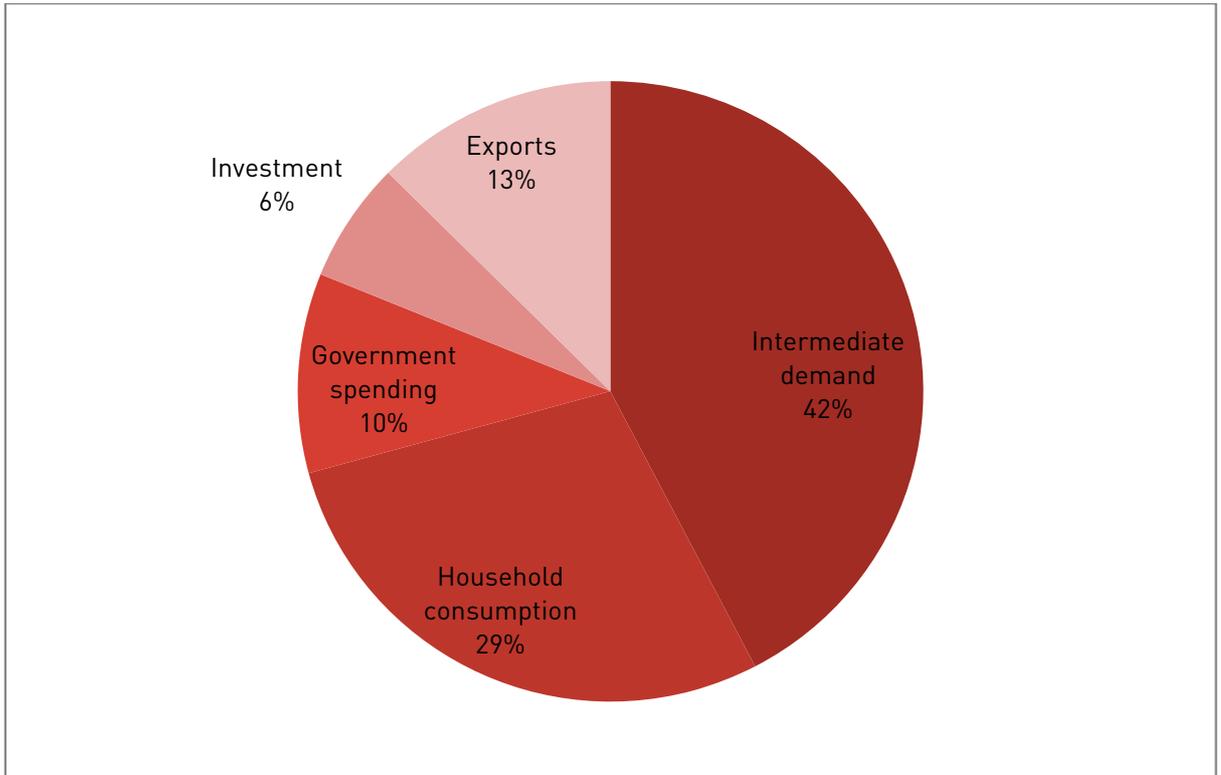
Table 1 shows the breakdown of demand in the UK economy – a list of which agents spend money on products and services – and Figure 1 repeats this analysis graphically. These markets can initially be split between intermediate (i.e., business-to-business trade) and final demand (i.e., sales to end users). Final demand is then split out into a number of different components, including household consumption and investment.

Table 1: UK markets presented according to source of demand

Type of demand	Description	Value (£)	% of total demand
Total demand	The total number of transactions in the UK economy	£3.15 trillion	-
Intermediate demand	Business-to-business trade that goes into making other finished products and services	£1.33 trillion	42%
Final demand	Demand for finished outputs from their enduser	£1.82 trillion	58%
Of which:			
Households	Spending by consumers	£890 billion	29%
Investment	Spending on physical capital	£200 billion	6%
Government	Government spending (including central government and local authorities)	£330 billion	10%
Exports	Sales to overseas markets	£400 billion	13%

Notes: All data from ONS Supply and Use Tables for 2009. All prices at 2009 levels. Some figures do not add up due to rounding.

Figure 1: Breakdown of UK markets according to source of demand



Notes: All data from ONS Supply and Use Tables for 2009. All prices at 2009 levels. Some figures do not add up due to rounding.

These figures make it clear that the biggest market in the UK economy is business-to-business trade, worth around £1.3 trillion. This market includes manufacturing supply chains (for example, a steel maker selling materials to a car manufacturer), business services (such as IT support and legal advice) and a range of other service contracts. Business-to-business trade – especially in knowledge-based business services – is a key area of strength for the UK economy.⁴

Within final demand, household consumption is the biggest element (around £890 billion), with exports (£400 billion), government spending (£330 billion) and investment (£200 billion) also making significant contributions. This reflects the fact that spending by domestic consumers is the most important factor in final demand, but is far from the only market available to businesses.

⁴ For evidence on this, see Sissons, A (The Work Foundation, 2011) *Britain's Quiet Success Story: Business services in the knowledge economy*.

Consumer markets⁵

The UK consumer market is worth just under £900 billion, spread across a wide range of goods and services. This spending is roughly evenly split between goods and services, with items such as housing, transport and recreation making up large shares of household spending.

Over the past three decades, consumer spending has been the main source of growth in demand, accounting for over 70% of demand growth between 1979 and 2010⁶. Growth in consumer spending has been concentrated in areas of innovation and technological progress, such as consumer electronics. Table 2 ranks different consumer markets according to their growth (in volume terms and 2008 prices) since 1997. It shows that clothing and consumer electronics have been the fastest growing markets over that period, driven partly by falls in the cost of these goods.

Unfortunately, the UK appears to be relatively weak (as measured by trade performance) in many of the fastest growing consumer markets. The UK has relied heavily on imports in many of these markets, which has acted as a significant drag on the economy. This highlights the importance of getting ahead in the most innovative and fast-growing markets, to capture the full economic benefits from growing markets.

⁵ All of the analysis in this subsection is drawn from Thompson and Sissons (Big Innovation Centre, 2012) *Consumer Habits and Innovation: How do our spending decisions shape the economy?*

⁶ Sissons (2011) *The Next Wave of Innovation: Five areas that could pull the UK clear of recession*

Table 2: The markets with the fastest growth in consumer demand 1997-2009⁷

Market	Change in volume of consumption 1997-2009 (2008 £bn)⁸	% Change in consumption 1997 - 2009	Consumer spending 2009 (2008 £bn)
Clothing	31.6	238%	44.8
Audio-visual, photo and info processing equipment	20.7	779%	23.4
Other recreational equipment etc	15.4	132%	27.1
Purchase of vehicles	10.3	37%	37.9
Telephone and telefax services	8.1	124%	14.7
Personal care	7.1	52%	20.6
Transport services	6.1	26%	29.7
Recreational and cultural services	5.2	21%	29.4
Food	5.1	8%	67.8
Operation of personal transport equipment	4.4	8%	56.2
Footwear	4.3	146%	7.2
Alcoholic beverages	4.2	45%	13.5
Other major durables for recreation and culture	3.3	88%	7.2
Furniture, furnishings, carpets etc	3.0	26%	14.7
Medical products, appliances and equipment	3.0	59%	8.0
Total	230.9	37%	858.2

Source: ONS Consumer trends 2011.

Business-to-business markets

The UK's £1.3 trillion business-to-business market features a wide range of different transactions between businesses. There are around £310 billion worth of supply chain transactions within the UK's manufacturing and production industries,⁹ which involve one UK production company selling inputs to another. These sales account for around a quarter of total demand in manufacturing, and are far more than production's total GDP. The

⁷ We exclude from the analysis imputed rents for owner-occupiers and financial services indirectly measured (FSIM), as these are not paid explicitly by consumers.

⁸ Volume measures are indexed to 2008 prices

⁹ Manufacturing and production here are defined as SIC (2007) codes 1 to 39 inclusive. This includes manufacturing, agriculture, mining, utilities, but excludes construction.

production sector also sells around £210 billion of output to the service sector, inputting into a range of service businesses.

Business-to-business trades are even larger within the services sector. The knowledge-based business services (activities such as IT consultancy, legal services and design services) and financial services sectors sell around £380 billion of output to other businesses; they exist mainly to engage in business-to-business trade. The vast majority of sales from business services are made to other service sector businesses; there is very little knowledge sold from business services into the manufacturing sector.

There are also £425 billion of business-to-business sales from other, less knowledge-based services and construction. This reflects the volume of transactions between businesses in terms of distribution and other support services.

The UK appears to be relatively strong in business-to-business markets, particularly business and financial services. Table 3 shows the UK's trade balance for several key industries, and compares it with the share of demand in each industry that is made up of business-to-business trade. Several of the most business-to-business intensive industries have strong trade surpluses (although mining and quarrying is a significant exception to this), while less business-to-business intensive industries, especially manufacturing, have large trade deficits.

Table 3: The international competitiveness of business-to-business industries

Broad Industrial Group Code	Industry	Share of demand from business-to-business trade	Trade balance (£ million)
M	Professional, scientific and technical activities	78%	15 774
N	Administrative and support service activities	76%	4 405
B	Mining and quarrying	72%	-10 746
H	Transportation and storage	63%	3 738
J	Information and communication	48%	7 564
K	Financial and insurance activities	47%	46 155
C	Manufacturing	39%	-93 965
R	Arts, entertainment and recreation	23%	-1 669
I	Accommodation and food service activities	16%	-3 405

Source: ONS Supply and Use Tables, 2012 edition. All data for 2010, in 2010 prices.

The figures presented in this section give only a brief flavour of the complexity of the UK's markets. Market making policy must be responsive to the different types of market that make up the UK economy, and not focus disproportionately on consumer markets.

Chapter 3 What's involved in market making?

Markets are complex entities, and the business of market making is rarely straightforward. Added to that, markets take many different forms – no two markets are the same. That makes it very difficult to establish firm rules for market making; it needs to be done on a case-by-case basis. Creating a mass market for 3D printing will involve very different activities to making self-driving cars a mainstream product.

However, there are certain key building blocks that apply to most markets. The list below features seven dimensions of market making:

- **Technologies** – technologies often underpin the workings of a market. They need to be available, viable, and compatible with the wider infrastructure and institutions of the market.
- **Infrastructure and locations** – markets almost always require some sort of physical infrastructure to bring buyers and sellers together, whether it is roads or broadband cables. They also need a location, whether it is a place or a digital domain.
- **Standards** – markets often depend on having established standards which all players can follow, to allow them to be coordinated and achieve critical mass.
- **Customer behaviour and conventions** – customer habits play a major role in shaping markets and determining value. Unless customers are willing to adopt new products and services, they will not take off.
- **Supply chains and networks** – there is a wide range of structures and logistics which provide the 'plumbing' within a market. These structures often rely on relationships between many different firms.
- **Regulation** – regulation on competition, on health and safety and a range of other areas can help to create markets, but it can also hold them back.
- **Legal rights** – property rights – be they for intellectual or tangible property – play a central role in defining what is traded in a market, and enabling buyers and sellers to capture the benefits from what they exchange.

This list is far from comprehensive, but it gives an idea of the range of issues associated with market making. The next section of this report describes each of these, highlighting particular issues that need to be considered, and offering examples of how businesses and the state engage in market making along each of these dimensions.

Technology

Technology is often the key enabler behind new markets, and it is quite often the source of new potential markets. Mason and Spring (2011) break down technologies into four types:

- Product technology – what can the product actually do?
- Process technology – how does the business go about making its product and providing services to customers?
- Core technology – what are the key general purpose technologies that underpin the market, that are used in a wide range of products and processes?
- Infrastructural technology – what are the platforms that connect the business to buyers, and other businesses?

Product and process technologies tend to sit within the domain of the firm; different businesses within a market will have their own variations on these technologies. But core and infrastructural technologies have a wider reach, often spanning whole markets. These types of technology often require a degree of coordination between firms and institutions; if every firm in a market relies on certain technologies, these technologies need to be accessible and easily compatible with the various processes involved in the market.

In some markets, such as that for mobile phones, key technologies are forcibly made accessible through terms such as Fair, Reasonable and Non-Discriminatory (FRAND) licensing. In other cases, as with broadband or utilities, key infrastructural technologies are regulated or even provided by government, to ensure that they can be widely accessed by different competitors. Striking a balance between investing in technology and making it accessible is vital to creating effective markets.

Technologies often undergo a long development phase before they are efficient enough to be viable for widespread use in markets. After initial stages of prototyping and testing, continual improvements occur which gradually reduce cost. Many technologies follow this pattern, known as a technology cost curve.

The state often acts to speed up this process for key technologies. By providing subsidies at early stages of development, otherwise economically inefficient technology can be made viable, increasing up-take by users. This provides greater incentives to the producers of the technology to make incremental improvements, further reducing costs. The subsidy should be gradually withdrawn in a planned and transparent way as the technology becomes more economically viable without state support. This provides an added incentive to businesses to increase efficiency.

Some technologies, because of input scarcity or simply because improvements are difficult to come by, do not experience these falls in costs and may remain economically unviable. Therefore the state needs to monitor policy in this area, and potentially remove or alter the path of subsidies if expected efficiency gains don't arrive.

The Technology Strategy Board is the main UK body with strategic oversight of emerging technologies. It works with the academic community to identify technologies with the most significant potential, monitors technology readiness levels and promotes the development and commercialisation of these technologies.

Mobile phones¹⁰

The history of the development of mobile phones presents an interesting case study of the technological side of market making. Whilst we tend to think of the mobile phones we use as a single piece of consumer electronics, in fact their development relied on the compatibility of many interlocking technologies and raw materials.

Most of the components that comprise a mobile phone, including batteries and LCD display technologies, existed in some form decades before the mobile phone became the ubiquitous consumer good it is today, but for cost and practicality reasons, combining them into a mass market product was not viable. Usage of mobile communications in the early 20th century was confined to the Royal Navy, as it took a vehicle as large as a ship to be able to transport the necessary equipment.

But parallel improvements in many of the different components that make up mobile phones have made them increasingly viable. For instance, whilst earlier batteries were too large and inefficient to be used in a portable device, the energy saving nature of using an LCD as opposed to LED display reduced the necessary threshold of efficiency at which battery power became possible.

The supply of raw materials is also vital to the mobile phone market. The rare earth metal tantalum is an essential input, and can only be found in several places in the world, including the Democratic Republic of Congo. The long-running civil war there disrupted the supply and increased the price of tantalum. These and similar considerations can threaten the viability of technologies based on rare and geographically-specific natural resources.

Despite these complex and delicate interactions between the different technologies and raw materials needed for mobile phone technology to be viable, it has proved a large and dynamic growth market, with massive user demand incentivising rapid innovation to add features, improve efficiency and reduce costs.

State involvement in mobile phone technology has largely been indirect, with early development and funding of radio technology for use by the armed forces. The state has been more closely involved with the development of telephone services, through auctioning

¹⁰ This section draws on Agar (2004) *Constant touch: a global history of the mobile phone*, Icon Books.

off licences to use the radio spectrum, a public resource necessary for mobile communications technology, and regulation of the telecommunications industry.

While there are few UK leaders in the design and manufacture of mobile phones themselves, the UK has proved successful in making a market for mobile services. This market developed from state monopolies and has, since the early eighties, become fully privatised. The market for mobile services includes infrastructure providers, including Virgin and BT, who purchase parts of the radio spectrum from the government and install communications infrastructure. These networks are then used to provide mobile services to customers, either by the infrastructure providers themselves or by selling access to other businesses such as Tesco mobile.

The industry in the UK is regulated by Ofcom, who auction licences for spectrum access and require service providers to follow specific guidelines for operation. The state also regulates providers on competition grounds, ensuring enough businesses have access to spectrum to prevent uncompetitive behaviour.

Mobile phones illustrate the complexity of technological market making. A whole host of different technologies needed to be developed, radio spectrum had to be auctioned by the state, and national infrastructure networks installed, before it could become a mass-market product.

Solar Panels

Solar Panels represent a useful example of government involvement in developing economically-viable technology. As it stands, using solar panels as a means to generate electricity is not as efficient as other, more carbon-intensive forms of generation, despite the fact that sunlight is an infinite resource. This is because the technology that allows the conversion between sunlight and energy, solar cells, is at an earlier stage in development than traditional methods of energy generation.

In order to reduce the cost differential between the two, governments in the UK and elsewhere have offered subsidies for the uptake of solar panel technology for use in the home. Without some form of government action to reduce this differential, homeowners would continue to rely on carbon-intensive generation, as they do not currently face the long-term and dispersed costs associated with carbon emissions.

These forms of subsidies also have the potential to spur innovation in the solar panel market. The technology exists for much more efficient solar cells, but currently their costs are prohibitively high, even with the subsidy. By providing long-term support for all solar cell use, governments can potentially guide the more advanced solar cell technology through its initial high-cost phase of the cost curve to a place where it can compete on its own without subsidies against other forms of generation. There is a risk attached to this approach, however, as the cost curve for solar panels may not develop as predicted. Costs may remain

high, leading to continued low uptake, or sudden technological breakthroughs may decrease the price quickly and generate high uptake and large subsidy costs. Therefore monitoring and potential exit is vital for policymakers.

State involvement in this area needs a long-term and transparent policy approach, in order to incentivise those trying to scale up and make viable more efficient solar cells. In the UK, the recent experience of feed-in-tariff subsidies for solar panel adoption provides an illustration of the difficulty of this kind of policy. The government moved forward the date at which the subsidy decreased without consultation, and have been accused of promoting other policies that run counter to a green technology agenda. This is likely to increase risk perceptions amongst those developing technology that relies on government subsidies. Seeing the outlook for green technology policy worsen, businesses in the sector may delay or cancel solar cell R&D projects that are reliant on those policies.

What this illustrates is the difficulty of providing the long-term and transparent policy support that key technology often needs. The political cycle functions on a much shorter time-scale than technology research and development, so encouraging investment in technology where up-take and economic return is reliant on some form of government support can prove difficult for the state.

Infrastructure and locations

Markets always require some sort of infrastructure. Infrastructure brings buyers and sellers together, helps them exchange and pay for products and services, and enables businesses to cooperate with one another. Infrastructure covers both physical infrastructure, which enables goods and people to move around, and other types, such as digital networks. There are many potential challenges associated with the infrastructure that underpins markets. Large scale infrastructure often requires huge upfront investments, which can be difficult to fund. Infrastructure can be difficult to build, update and maintain, especially in densely populated areas where there is little space to work. There is also a range of planning issues around infrastructure projects, as roads, electricity cables and mobile phone masts can have negative effects on local environments.

A lack of provision of the necessary infrastructure can damage market development. Businesses will not attempt to develop new markets where the infrastructure that underpins and supports that market is missing. Digital technologies requiring fast connection speeds would not have been developed and commercialised without the installation of broadband networks. And as shown in the case study below, a lack of recharging points can act as a strong disincentive to the development and uptake of electric vehicles.

Infrastructure can have a strong 'network effect' in those markets that rely on it, exponentially increasing demand and uptake for products with the pervasiveness of the infrastructure those products rely on. Having a large market for cars depends upon the

provision of a connected road network. Similarly, much of the power of the internet derives from the global scale and connectivity of digital networks. Patchy provision of infrastructure can therefore inhibit this effect and curtail the growth of markets.

On top of this, there are significant challenges around coordinating infrastructure and making sure that it is compatible with all of the products within a market. If wrongly designed, infrastructure can fail to support key technologies within a market. There are also questions about ownership and access to infrastructure. Many large infrastructure networks tend towards being natural monopolies, which may restrict the ability of companies to use it innovatively.

Infrastructure UK, the body within government responsible for coordinating infrastructure funding, sits within HM Treasury. However, individual departments, including Transport, Energy and Climate Change and Culture, Media and Sport have significant roles in overseeing different types of infrastructure development.

Electric and self-driving cars

One of the main factors holding back the mass adoption of electric cars is the difficulty of coordinating the necessary infrastructure, particularly electric car recharging points. The greater the number of people that drive electric cars, the greater the benefits of supplying recharging points. But it is unlikely there will be widespread adoption of electric cars until there is a sufficiently large network of points. This almost catch-22 situation, along with the environmental benefits of greater use of electric cars, provides the justification for the state's involvement.

By acting as an anchor institution amongst a wide range of public and private partners, as well as providing funding, the state can help the actors in markets to work together, providing the necessary infrastructure and generating the network effects needed to incentivise widespread adoption.

The UK government set out its 'plug-in vehicle' strategy in 2011¹¹. They acknowledged the vital role for the state in supporting and facilitating infrastructure for electric cars, both through incentivising uptake of the technology amongst users, via tax breaks and a grant for purchasers, and by providing funding for pilot projects installing up to 8,500 charge points in eight cities. This package of support aims to accelerate the growth of the electric car market to a point where it has enough critical mass that it can carry on expanding without state support.

¹¹ Office for Low Emission Vehicles (2011) *Making the Connection: The Plug-In Vehicle Infrastructure Strategy*

There is likely more that could be done, particularly around incentivising property developers to provide more recharging facilities in homes, and more support for low-carbon vehicle research and development. But the government's strategic approach to market making in this instance is a good model of the way in which the state can co-ordinate the relevant infrastructure providers to accelerate market development around an emerging technology.

4G in the UK

The ongoing issues with 4G implementation in the UK illustrate how the actions of the state can prevent an efficient market being made for a particular technology. 4G technology provides greatly improved wireless mobile communication, and is currently in use in South Korea and in Scandinavian nations. It has only just been implemented by the first commercial provider in the UK, and delays in issuing spectrum licences to service providers may delay the uptake of this new technology further until 2013 and beyond.

By early 2012 the technology existed for 4G communications, and several devices that made use of this technology were being prepared for launch in the UK, including the latest Apple iPad. Telecommunications services such as Vodafone and O2 wanted to purchase the necessary spectrum licences from the government, and many consumers were eagerly anticipating being able to access 4G through devices like the iPad.

Problems arose with the government's process of auctioning off licences, which was delayed substantially. Only a few 4G 'hotspot' trials have been run, and new service provider Everything Everywhere has been awarded an early licence on existing free spectrum, which was regarded by other major providers as potentially stifling the market for this service. These concerns have led to repeated threats to sue the government, which has further slowed the licensing process. While these issues have now largely been resolved by the government, the UK is still some way behind many countries on the development of 4G markets. Beyond this, there have been concerns that the 4G issue is not sufficiently prioritised by government. The Government's 'Strategic Vision for UK e-infrastructure' made no mention of 4G, despite the network's importance for business and technology adoption¹².

The UK has a strong track record in some areas of e-infrastructure, particularly growth in broadband speed and competition, but the government's slow response to co-ordinate 4G licensing alongside user demand for the technology highlights the need for the state to be aware of business and consumer infrastructure needs.

¹² BIS (2011) *A Strategic Vision for UK e-Infrastructure*

Standards¹³

In complex markets, where many different firms work together to combine technologies and processes, market standards are often needed to facilitate cooperation. These standards might relate to technologies (eg DVDs and Blu-Ray, AA batteries), to coding protocols (eg Internet Protocol or Morse code), or simply to the quality of certain products (eg grading systems for agricultural produce). These standards help firms work together across markets, and can create a 'modular system' to enable different technologies to be fitted together.

Market standards can be created in different ways. They are sometimes dictated by dominant forces within a market, such as large infrastructure providers. The state often performs this function, acting to select and enforce standards. Its role as a large buyer can have an impact, with the state's chosen standard becoming the dominant design. Or through regulation and the provision of standards guidance the state and other institutions can enforce standards.

In other cases, they may be decided by agreement across key players within a market. There are also examples – such as the VHS-versus-Betamax race to control the video recording market – of different companies competing to create a market standard.

The development of standards is often an important prerequisite for the establishment of a functioning market, whatever the process by which the standard comes into being. However, it is entirely possible for a market to get locked into an inferior standard; Arthur (1989) shows how accidents in the process of adopting standards can create problems in the long term. Therefore the state, where it has a role as an enforcer of standards, needs to be adaptable to the shifting benefits of different standards, and ready to abandon inferior ones when they arise.

In addition, there is often a tension between a single dominant standard, and anti-competitive behaviour by the provider of that standard. In this case competition authorities need to strike a fine balance between capturing the benefits to market co-operation from having a dominant standard, and incentivising innovation through enforcing competition in the market for that standard.

The British Standards Institution, an independent organisation that operates around the world, is a key body in helping to define and uphold market standards. It works with businesses to establish standards, and provide assessment and training in the use of those standards.

¹³ This section draws upon chapter four of Schilling (2006) *Strategic Management of Technological Innovation* McGraw-Hill/Irwin

The Victorian railway gauge war¹⁴

The first major British train routes were developed in the Victorian era. Several companies laid down track and provided rail services for travellers and freight across the UK. But different companies used different track widths, meaning that trains had to be developed to work on specific routes and could not transfer lines. This meant a passenger travelling on many routes in the 1830s had to change trains where the track widths altered, adding time to their journey and requiring two trains to service a single route.

It became clear that the economically efficient solution was to ensure all train lines and rolling stock used a single standard gauge width, as the fact this differed between routes was imposing unnecessary costs. Having a single gauge would allow easier interconnections and potentially generate significant network benefits. Problems arose because it was not clear which of the two most prominent gauges should become the market standard; the broad gauge used by the Great Western Railway or what became known as the standard gauge, used on most other lines. These providers were fairly entrenched in the use of their respective gauges, and each had a strong private interest for theirs to become the standard, as the cost of switching was prohibitively high. A similar battle between Northern and Southern rail networks in the USA led to riots by workers whose jobs relied on switching cargo between trains using different gauges.

Eventually the UK government, a large buyer of rail services and with an interest in ensuring compatibility, arbitrated between the two potential standards by setting up the Royal Commission on Railway Gauges, which ruled in 1945 that the broad gauge should become the standard for all track and rolling stock. This provides a good example of the way in which the state is able to arbitrate between standards, where market actors face strong incentives to perpetuate the economically inefficient incompatibility of several standards. The issue of Victorian railway gauges was also instrumental in creating the British Standards Institution, the key UK body for the definition and promotion of standards.

Software standards – when does a standard become a monopoly?

The growth of Microsoft's Windows operating system and its associated software packages illustrates the tensions around standards and competition. While having compatible software amongst users greatly facilitates market interactions, it can also lead to uncompetitive and monopolistic behaviour that, in the long run, has negative effects on innovation and market development.

As the market for personal computing grew in the 1980s and through the 90s, a dominant design for operating systems emerged, with Microsoft's Windows becoming a clear leader.

¹⁴ This section draws on Shapiro & Varian (1998) *Information Rules: A Strategic Guide to the Network Economy* Harvard Business School Press

This occurs naturally in many markets and in this case was driven by various factors. As more users adopted Windows, the knowledge base around the software grew, with more users and the producers learning from failures and fixing issues. This led to a faster rate of improvement in quality than in other operating systems. Popular software packages were developed primarily for Windows in order to access its large user base. These acted as assets complementary and specific to Windows, and reinforced lock-in to the standard amongst users.

By the late 90s the Windows operating system and many of its core applications such as Office and Outlook had become, in effect, natural monopolies. The majority of computer use in business and at home occurred through Microsoft products or on software that relied upon the Windows operating system as a standard.

Where this became a problem in terms of market functioning was in its effect on the future of the software market. It has been argued that once Windows emerged as the dominant design for operating systems, it had a stifling effect on continued product innovation in that market. With competing operating systems highly unlikely to be able to overthrow the standard, the incentives for Windows to continue to invest in improving their product may have been diminished. Fears over the dominance of Microsoft in the software market led to several high profile legal cases being brought against them over anti-competitive practices, including the case brought by the EU over licensing practices that required royalties to be paid to Microsoft on computers sold even if they were not packaged with Windows.

These fears have somewhat subsided over the last decade, with the rise of alternative providers such as Apple and a more diverse array of access to similar services, including Google documents and other office packages such as Openoffice. These have been able to challenge the dominant standard of Windows through ensuring compatibility with the existing installed technology base. You can easily open a Microsoft office document on an Apple operating system, for instance, and new software increasingly aims for compatibility between Windows, Apple and other platforms.

What this case study illustrates is the blurred boundary between an efficient standard, something that is good for economic coordination, and a monopoly market, which can often stifle product innovation and market development. This reinforces the need for active state competition authorities to be on guard against uncompetitive practices and willing to legally challenge monopoly behaviour by the developers of standards.

Customer behaviour and conventions

Customer habits play a vital role in enabling new markets to emerge. No new technology, however good it is, can be turned into a functioning market unless users are willing to pay for it. The process of re-shaping consumer habits and forming new social conventions is complex, and often involves businesses, social organisations and, sometimes, the state. To get customers to shift from an old technology to a new one, companies need to raise awareness of the new product, persuade customers that it is better than the old one, and then form consistent habits around new behaviours. This can be difficult, especially where disruptive technologies or services radically alter the way consumers behave. For example, encouraging consumers to switch from owning a car to using an on-demand car service requires a big shift in habits.

Businesses and consumer habits

Firms engage with consumers in order to better understand consumer behaviour. They market test new ideas through surveys and focus groups, collecting customer feedback in order to gauge opinion. This allows them to assess the size of a given market and the viability of new products. They also attempt to actively shape consumer behaviour. Advertising and branding can increase the willingness of consumers to buy products, and even the way goods are arranged in shops can have an effect on consumer decisions.

The ability of businesses to harness consumer behaviour is improving rapidly. The technology exists for businesses to monitor many consumer decisions, particularly on the internet, but also in physical markets through data-collecting club cards and use of electronic devices. Businesses can then apply this data to better tailor markets to fit individual consumers' behaviours and preferences. This is already a feature of much online retail and advertising, and in the future will become an increasingly important source of feedback between consumers and business in all sectors.

Where new and disruptive technologies are involved, there is often a particularly significant role for 'lead users' to play in perfecting technologies and accelerating their diffusion. Some consumers engage proactively in the development of new technology and markets as early users, and their feedback can help improve the technologies they use. Companies can seek to take advantage of this, for instance by releasing software in 'beta' mode to allow them to be tested. This can help to speed up market development in certain products, with lead users often setting up their own companies specialising in an emerging technology. According to Rao (2009)¹⁵, lead users sometimes act as "market rebels", working to promote disruptive technologies and form social conventions around them. Many early personal

¹⁵ Rao (2009) *Market rebels: How activists make or break radical innovations*

computing businesses developed in this way, with hobbyists developing technologies and forming conventions which they later developed into mass markets.

Social campaigns and consumer habits

Besides the efforts of businesses, social campaigns can also help to shape and alter consumer habits. Movements that organise around a particular cause or set of values, such as environmentalism or fair trade, can help to alter customer behaviour in ways that businesses cannot. Such campaigns are normally independently organised, although governments may back such campaigns (such as Made in Britain-type campaigns) from time to time.

The state's role in shaping consumer habits

In general, it is unwise for the state to intervene in shaping people's tastes and habits. However, there are certain ways in which the state may sometimes help the diffusion of new ideas and technologies. For the most part, this centres around providing information on new markets and raising their profile. Action to make this happen can range from ministerial appearances to television programmes.

The government can also engage in the provision of so-called 'judgement devices'. By regulating information provision on products, the state can help consumers to make informed choices about what they purchase. This could include enforcing energy labelling on household appliances, or nutritional information on food products.

In certain cases, the state may also have a supporting role to play in enabling new social conventions to form. For example, teaching the skills needed to use computers and other new technologies can help speed their uptake.

Governments can act as lead users themselves, with their procurement policies and role as a large buyer potentially playing a significant role in generating uptake of new technologies and services.

The power of branding

Businesses have long used marketing and branding as a way to create and grow markets. The diamond mining and distribution company De Beers used marketing as a way to associate diamonds with wedding and engagement rings, a practice which has endured and entered common culture. The public relations expert Edward Bernays used branding and marketing techniques to promote smoking amongst women, greatly increasing the market size for tobacco.

Other market actors have also developed strong brands in order to influence behaviour. The Fair Trade movement uses a kite mark for products that meet a minimum standard of income for producers in developing countries. Many consumers are willing to pay a higher

price for these products, reflecting their concerns about sustainability and economic development. The Campaign For Real Ale in the UK uses a similar kite mark to differentiate between beer brewed using traditional ingredients and left to mature in a cask and beer that is mass-produced. Strong kite marks such as these, with buy-in from consumers, allow markets to segment and better fit the varying tastes of consumers.

The state both understands the influence branding and marketing exerts and uses similar techniques itself. Governments in the UK and elsewhere have banned or restricted advertising for certain products that cause public health problems, such as tobacco, in an effort to reduce consumption and improve health outcomes. Implicit in these policies is an awareness of the influence marketing has on consumer decisions. The state also uses official and informal kite marks with the aim of influencing behaviour. Recently the Prime Minister David Cameron emphasised to consumers the importance of 'buying British' in order to generate a healthy agricultural industry in the UK, for instance. The Department for Business, Innovation and Skills recently launched a campaign to raise awareness of UK manufacturing, 'Make it in Great Britain', including a website and an exhibition at the Science Museum. Beyond this they fund advertising that raises awareness over important issues related to public health such as healthy diets, drinking and driving and tobacco use.

Often policy can be more effective when supported by consumer behaviour. Some of the most successful examples of cities implementing carbon reduction plans are in areas such as Bristol that have a strong grassroots environmental movement. Top-down policies, such as subsidies for solar panels and funding for improved bicycle facilities, are likely to experience greater uptake amongst users where residents are already concerned about issues of sustainability. What this suggests in general is that policy, where success rests on its uptake by individuals, can benefit from actions to raise awareness and support for relevant community groups.

Engaged users

Consumers often proactively engage with new and emerging markets by acting as lead users. Having an active and engaged base of early users can speed up innovation in a market, as users generate feedback and engage in co-creation.

This has long been a feature of the computing industry. The Homebrew Computing Club in 1970s Silicon Valley brought together enthusiastic users of hardware, some of whom went on to found successful businesses such as Apple and Microsoft. The open source software community, mainly composed of software enthusiasts, have successfully developed operating systems such as Linux, with users offering incremental improvements to the system on a continual basis. This has also spawned several businesses, such as Canonical, who offer technical support to users of their Linux-variant Ubuntu. It has also had widespread business applications. The majority of internet servers use Linux, and Google's Android operating system is itself a variant of Linux. What this points to is the real value that

engaged and lead users can generate, where their innovation inputs have the potential to lead to genuine business applications.

Another group of users that echoes this activity is the strong community that has built up around 3D printing technology. Some of the earliest home-use 3D printers, allowing users to manufacture simple objects through printing digital designs, were developed as open source projects at Bath University. Since then communities of users have appeared up on the internet and in cities including New York, generating improvements to the printers themselves and sharing open source designs for printing and modification. Some businesses have developed around this community, such as Thingiverse, which provides a platform for user sharing and modification of designs, and Makerbot Industries, which sells assembled and fully functioning open source 3D printers. This community may prove analogous to early computing, with wide-ranging economic implications as its products and services improve and develop more business applications.

The question of whether policy has any role to play in supporting lead users and user co-creation is an interesting one. There may be a case for changes to the intellectual property system in order to facilitate greater knowledge sharing and co-creation amongst users and between users and businesses.

Supply chains and networks

Supply chains, the networks of businesses that supply different inputs into a product, are extremely important in many markets, particularly those where the products have high levels of complexity and require high levels of skill at several points in the supply chain. These include goods such as passenger cars and consumer electronics.

The presence of supply chains can be a major factor in business decisions about where to locate. For complex products requiring the coordination of many inputs, firms often set up shop near suppliers, as it allows easier monitoring of quality and reduces transport costs¹⁶ (Dicken). Therefore, gaining an advantage in a particular market also can depend on the quality and presence of a supply chain in that market.

But supply chains are fragile and often face significant coordination problems. Short-term barriers in access to finance, skills or other inputs can lead to some firms in the chain having to close down. This has an impact on supplier and buyer businesses, and can lead to other firms being adversely affected, reducing supply chain viability over the longer term.

¹⁶ Dicken, P. (2011, 6th Edition) *Global Shift*

This is a problem both for incumbent industries and for growth industries specialising in new technology. Incumbent supply chains can break up, and some growth markets may lack the complex chains needed for a fully functioning market to exist, with the incentive for supplier firms to enter being reduced because of a lack of buyers and vice versa. This negative feedback loop can prevent market growth, even for products where there is a large and growing demand.

The state is often involved in supply chains, by acting as a co-ordinator and facilitator in certain sectors, as well as through implementing specific policies that aim to target supply chains, such as access to finance and skills funding. The lengthy process of building up supply chains means a long-term strategic commitment from government is often needed.

Supply chains in UK automotive manufacturing

Passenger cars are complex products, comprising many different components and complementary technologies. Because of this, the network of component suppliers, assemblers of finished products, logistics and retail/wholesalers all have to be present and co-ordinated for a domestic automotive market to function effectively.

Car manufacturing in the UK has a long and chequered history. It was once the largest exporter of cars in the world, but after decades of decline it is now only the fourth largest manufacturer of cars in Europe¹⁷. Despite this it is still an important sector for the UK economy, accounting for around 11% of our goods exports and employing either directly or indirectly over 700,000 people¹⁸.

In order to grow the sector and ensure long-term sustainability, UK policy has increasingly taken on a co-ordinating role between the different industry players. This reflects the importance and fragility of supply chains in the industry. Car manufacturers consider their access to components as vital, since they form between 60-75% of the value of a car¹⁹. They need to be able to source these components quickly, meaning distance from suppliers is highly important. These forces lead the bigger car manufacturers to make location decisions based on proximity to supplier firms. Problems have arisen for the UK when these supply chains get hollowed out, with highly specialist supplier firms closing down due to lack of finance or lulls in demand and this reducing the incentive for assembly plants to locate in the UK.

¹⁷ The International Organisation of Motor Vehicle Manufacturers publishes statistics on the number of cars produced by country. The UK ranked fourth in 2011, after Germany, France and Spain.

¹⁸ Rumfitt (2012) *Give them some credit! A survey of the barriers to funding the UK's automotive supply chain* The Smith Institute

¹⁹ Holweg, Tran, Davies & Schramm (2011) *Growing the Automotive Supply Chain: The Road Forward* The Automotive Council

The last government set up the 'Automotive Council' to act as an over-arching body for the industry. It aims to secure a long-term future for UK automotive manufacturing by developing a vision with consensus around what the industry needs, in terms of its future technological trajectory and skills needs. Run by leading figures from the industry in conjunction with government, the council provides a strong example of the co-ordinating role government can provide to bring together the different actors in a market.

Government also provides support for the automobile supply chain indirectly through programmes like the advanced manufacturing supply chain initiative, which awards funding to industries to improve competitiveness in their domestic supply chains. It also provides ad hoc support, such as when it acted alongside the Unite union as a lobbyist and co-ordinator between workers and Vauxhall to ensure the Ellesmere Port manufacturing facility stayed open in early 2012, articulating its long-term strategic commitment to the UK automotive industry.

This form of state involvement in existing, established sectors is fairly widespread and uncontroversial, but it is a framework less commonly applied to new and emerging technologies, which often lack a large, stable base of established businesses and sectoral organisations with which the government can easily co-operate.

Skills in supply chains

One of the potential barriers to the growth of a market is a shortage of skills in the supply chain. Just like other inputs such as raw materials and components, a shortage of expertise can increase the price of specific inputs in a supply chain, harming the economic viability of other downstream businesses. Often access to a strong skills base throughout the supply chain is a driving force behind the international location decisions of businesses.

At the same time, skills are costly and time-consuming to acquire, so the unpredictable nature of fast-growing markets founded on new technologies generally leads to acute skills shortages, especially where an emerging market does not have its basis in an existing supply chain. The UK computer services sector, a relatively emergent part of the economy that has experienced rapid growth in recent years, consistently reports the greatest sectoral shortages of skills.

The state acknowledges the importance of skills in supply chains, especially in sectors where they already have a particular infrastructural or strategic interest and are a large buyer. The government recently published their procurement strategy for large-scale tunnelling projects, focusing on ways to strengthen supply chains in this highly specialised sector. By taking a long-term view on their likely procurement pipeline for tunnelling works, they highlighted the opportunities that would emerge for apprentice training and up-skilling amongst existing workers, in order to build up a strong skills base in the sector. They also

highlight the benefits this could bring to UK businesses in terms of exporting tunnelling skills to meet growing demand elsewhere in the world²⁰.

This illustrates the state's focus on skills as a fundamental component of supply chains. Other generic policies target skills in supply chains, including the growth and innovation fund, which awards money to businesses and sector organisations to fund training to meet gaps and needs in their supply chain.

Regulation²¹

Regulation, of health and safety, of competition, and in other areas, can have a positive impact on markets. By increasing user confidence and incentivising innovation, regulation can increase the size of markets and lower costs. But it can in some cases have a negative effect, making it important that regulation is monitored and used intelligently.

Users may be less willing to buy a product if they are unsure of its safety, so regulations that ensure a sufficiently high safety level on products can help to increase the size of its market, as more customers are willing to purchase products. Concentrated market power can lead to uncompetitive behaviour and higher prices, so regulation on competition grounds can help to lower prices and increase innovation, by allowing businesses to enter the market and incentivising incumbents to create new and better products. Environmental regulation can increase innovation, by incentivising firms to conduct research and development to increase the energy efficiency of products. By restricting carbon emissions, businesses have a greater incentive to develop low-emission sources of energy and means of production, since the regulation increases the cost of current methods of production.

Government regulation can also make markets indirectly, with the private sector helping businesses meet regulatory obligations. The UK Ship Recycling Strategy, for example, set out how the UK would meet its international commitments on sustainable development, and also outlined how UK capacity in ship recycling could be generated to meet this objective. Essentially, by stipulating to private sector actors requirements they need to meet, a market is created that helps businesses with their legal obligations²².

But regulation can also act to stifle markets. Excessive health and safety or environmental regulation on products are sometimes used as a hidden barrier to trade, preventing low-cost goods being imported and increasing domestic prices. Similarly, some markets are a natural monopoly or oligopoly, and competition regulation to increase the number of players in such markets can be economically inefficient and increase prices. Excessive regulation on

²⁰ See BIS (2012), *Tunnelling: A Capability Analysis*

²¹ This section draws upon BERR (2008) *Regulation and innovation: evidence and policy implications* BERR Economics Paper No. 4

²² Defra (2007) UK Ship Recycling Strategy

competition may also prevent collaboration between businesses to develop new products and processes, as this can lead to accusations of uncompetitive behaviour such as price-fixing.

New and emerging markets can face significant difficulty in their relationship to regulation. Often the regulatory system may be geared towards older market structures and technologies, and this can have a perverse impact on newer business models. For instance, UK copyright regulation, formulated in the era of physically embodied creative works such as books and CDs, has had a perverse effect on the development of new digital services that provide digital content, potentially limiting innovation in this high-growth market.

Occupational licensing²³

One way to improve the labour market for certain skills is to regulate certain occupations so that practitioners need a licence to trade. This aims to increase the skill level in those occupations in order to protect consumers from low quality services, although there are significant problems with this approach.

Because consumers often lack expert knowledge about complex and skilled products such as accountancy, legal and medical services, they have little way of choosing between the different suppliers of those services. Without strict occupational licensing or accreditation, this reduces the incentive for practitioners in those occupations to train and for employers to invest in that training, and may reduce the general level of service quality in a particular market. This leads consumers to be less willing to purchase from those markets. Licensing is a particularly important consideration in those occupations where service quality is related to the health and safety of consumers, such as medical professions and gas appliance installation and maintenance. Licensing can therefore serve a real need to increase skill levels in certain occupations and increase consumer confidence in some service markets.

There are pitfalls with this approach, however. Many see it as return to the guild system of the medieval era, where groups of practitioners restricted entry into their profession in order to generate a premium price for services. There have also been concerns that it can legitimise and give undue authority to practices such as alternative medicine that are viewed as unsuitable for professionalisation.

Therefore it is essential the state can strike a balance on occupational licensing. The cost of the licensing regime through increased service prices needs to be weighed against the foregone consumer purchases and other effects of a lower-skilled, unregulated market for those services.

Regulating innovative finance

²³ This case study draws upon UKCES (2011) *A review of occupational regulation and its impact*

The growth of digital communications and the internet offers great opportunities to develop new methods of funding innovative businesses. Many potentially high-growth firms face significant barriers to accessing finance, with around a third stating it is an obstacle to growth.

Perhaps partly as a response to this, several innovative methods of raising finance have started to be developed. The Kickstarter website lists potential projects that users can donate money to, in return for goods and other perks when the project is completed. Funding Circle allows investors to lend money to businesses online, after the businesses have been screened via credit ratings and other criteria.

But the regulatory system, developed for older forms of business finance such as bank lending and venture capital, may be standing in the way of these platforms achieving their full potential. As it stands financial products like equity shares, issued through a public offering, can only be promoted to those with specialist investment knowledge or to individuals with a high net-worth. Opening up this kind of equity investment to a wider group, who may have specialist sectoral knowledge but a lower net worth, could increase the pool of finance available to innovative business.

At the same time there may be a lack of regulation of these new finance models. While many new finance platforms have developed, this has often been outside the traditional regulatory system. This has meant a lack of accreditation from a trusted regulatory body, and may increase the perceived risk to investors of using these platforms. For instance, in the UK, by being outside the regulatory system, lenders in these platforms are not covered by the compensation scheme extended to more traditional methods of lending, and this is likely to ration the amount of funds on offer, and increase its price.

These examples raise two points. Firstly, regulation needs to move with the times, and adapt in an intelligent manner to new, technology-enabled finance business models. Secondly, growth markets can face barriers that arise from a lack of regulation, with this decreasing confidence among market players and limiting the scope for growth. The state needs to be alert to these considerations and be willing to adapt the regulatory system as appropriate.

Legal rights

Legal rights are vital to the development of many markets. They often define what it is that is traded in a market, and allow businesses to fully capture the value of investment in new product development. At the same time, they can restrict the growth of some markets, and need to be adapted to fit the changing needs of technology and the economy.

Legal rights form the basis of trade in many markets. A large proportion of the value of a book is derived from the intellectual property (IP) of the author, not the raw materials that go into making the product. Without assigning legal rights to authors via the IP system, the

market for books would not function as effectively. Similarly, legal rights can aid business in recouping the value of product development. Pharmaceutical companies spend vast amounts of money developing new medicines, and are often granted an exclusive legal right to produce the resulting products, which allows them to recoup the initial cost. Without this exclusive right, pharmaceutical companies would be likely to have their medicines copied by other businesses and sold at a lower price, harming their ability to recoup development costs, and acting as a disincentive to carrying out initial R&D.

The value embodied in legal rights and their ability to underpin markets depends on the ability of businesses and legal regimes to enforce them. The rise of the internet and the ease of peer-to-peer file sharing have fundamentally challenged this ability in the markets for a variety of creative works (see case study below). Similarly, the increasingly globalised nature of production has led to difficulties in the ability to enforce IP, with widespread copying of products in countries out of the reach of national IP systems.

At the same time, legal rights can stifle the growth of markets. Competition in the market for smartphone devices has been hampered by excessive litigation between Apple and Samsung, who each claim the other has infringed their IP. This type of action can lead to new products not being released, reducing competition and the incentives for innovation. At the same time, some businesses have developed which do nothing other than purchase IP and collect settlement fees from infringing businesses, which can impose costs and stifle product development, without generating innovation among the holders of patents.

The state is fundamentally involved with legal rights and the IP system. Through legislation they set out the legal framework that underpins business decisions. They need to be alert to developments in the use and efficacy of rights and be prepared to change the IP system accordingly. Also, they have the ability to create legal property rights in markets where they are missing. For example, governments in the UK and elsewhere have awarded carbon permits to business, a legal right that permits a restricted level of carbon emissions and can be traded, thus creating a market for carbon (see case study below).

Intellectual property rights in the market for music

Developments in the music industry in recent years illustrate how markets sometimes have to radically adapt to changes in the efficacy of legal rights. The growth of the internet and its open architecture nature has facilitated easy file-sharing, meaning users can share copyrighted musical works with many others for free and largely without detection. This seriously challenges the ability of rights holders such as musicians and publishing houses to enforce their property rights. While part of the response from affected groups has been to attempt to limit file-sharing through the closure of file-sharing websites and other methods, some have seen it as more fundamentally altering the market for music.

Increasingly, digital businesses such as Spotify or Youtube offer free streaming of music to users, funded through advertising. The customers in this market are now the advertisers who

are willing to pay for access to listeners. Others provide a package of services around music streaming and downloads to customers, so that they are willing to pay a subscription or similar for access to music. Users can pay a monthly charge for advert-free access to Spotify, for instance.

What this illustrates is the way in which markets and business models adapt to technology-induced changes in the functioning of legal rights. The music industry was founded on the idea that exclusive rights could generate revenue and profit. As that model has become unworkable, businesses have had to alter what they are selling and who they are selling it to.

The recent Hargreaves review of intellectual property (IP) in the UK acknowledged that digital communications technology has fundamentally altered our relationship to intellectual property. It recommended that the evolution of the IP system should not act as a barrier to the creation and growth of new, innovative markets and businesses such as those described above. The government has taken this forward, and is currently carrying out a consultation with a view to modernising copyright.

Carbon trading

In many areas of the economy well-functioning markets do not exist. For instance, until recently there was no market for the carbon emissions of industry. This means that businesses do not have to pay for the environmental impact of the carbon they emit, despite the fact it imposes real costs on others in the UK and elsewhere, through its effect on climate change and on pollution in general.

As an attempt to rectify this situation governments in the European Union have introduced the EU Emission Trading Scheme, which either auctions or issues free permits to emit carbon. Businesses' carbon emissions are monitored, and they trade permits between them to cover emissions greater than their initial allocation. In this way a market is created for carbon, with the number of permits issued in any given trading round determining the carbon price, which should be high enough to encourage innovation in reducing emissions in production, but low enough not to stifle too much economic activity.

This offers an example of direct state involvement in the making of a market through the issuance of property rights, in this case by giving business the right to emit a given level of carbon and the ability to trade these rights.

Chapter 4 What role should government play in making markets?

Much of the work of making markets is done by businesses, and sometimes by imaginative customers. Businesses tend to be very good at finding new customers, and shaping or reflecting their tastes. They often invest in their own infrastructure, and can sometimes organise themselves easily around market standards. But there are many cases, especially for more radical ideas, where businesses alone do not have the reach or the influence to fashion new markets. It is at this point that the state can play a role.

There are two ways in which governments should get involved in market making. The first is in the state's role as operator or funder of various institutions, and as guardian of the legal system. Governments are in charge of regulation, have the power to set intellectual property laws, and fund many of the bodies that help these provisions work effectively. They are also major investors in and operators of infrastructure, and can shape customer behaviour through a range of levers.

Secondly, the government can play a role as coordinator, facilitator and convenor in new markets. The challenge of making markets is often one of co-ordination, where individual agents need to work together but lack the ability to make this work effectively. Governments are often well placed to provide coordination in this way, helping bring different interests together. This may mean government forming new institutions or councils of interested parties within a new market, and enabling collective decisions to be taken effectively.

These two roles must inform any government approach to market making. The state should never aim to make new markets itself – it tends to be a poor judge of such things – but should ensure it puts in place the conditions for new markets, and acts as coordinator where there are obvious coordination failures. This requires government to be proactive and forward-looking, but also effective at working with businesses and institutions.

The levers of market making

There are many areas of government policy that can play a role in market making, and the state has a wide range of levers it can use to help support the creation of new markets. This diversity can make the process of market making harder, because it requires coordination between numerous different departments and institutions. The state can fund technological innovation and large-scale infrastructure, it sets the laws and regulatory landscape within which market making takes place, and it operates many of the agencies which set up non-governmental bodies to oversee the enforcement of regulation and other functions.

Understanding these different levers, and how they can influence the development of new markets, is important if the government is to act in a coordinated fashion.

The state as funder

The state is a major funder of innovation and infrastructure, either directly or via economic incentives. The different approaches to funding are summarised below:

- **Basic and applied research funding:** One way in which the government provides funding for technological research is via the seven Research Councils. They allocate money for research and research training, often for programmes of particular interest or importance to the groups of academics and business leaders who sit on research councils. The state also provides research funding to universities based on quality rankings. These are metrics designed to assess the quality of different institutions research, and are compiled along a number of dimensions, including the number of prestigious research articles written and the wider business and societal impact of research at each institution. This form of funding comes without specifying the topics it should be used to research. Both types of funding are important to market-making – they operate in an early stage in the process, and help to develop and refine new ideas. A research council may award funding for research into a specific technology of interest, or general funding may be used to conduct research into unknown technologies that have the potential to be the basis for future markets.
- **Competitions and prize challenges:** Both the National Endowment for Science, Technology and the Arts (Nesta) and the Technology Strategy Board (TSB) provide funding for research through competitions. These work by setting a goal and a prize allocation, and awarding the prize to the first researchers to develop a successful innovative solution. Examples include the 18th century Longitude prize, for the first solution to measuring a ship's longitude. Prize competitions can be a useful way to harness business and academic ideas to solve specific problems or gaps within a potential new market. Besides the financial incentives they offer, they can help to raise the profile of particular issues, and galvanise interest in them.
- **Catapult Centres:** Another funding model involves setting up joint public-private research centres, which bring together leading academics with innovative businesses. These types of programme typically use public funding to leverage private sector investment. The government, through the TSB, have recently awarded £200m in funding for the creation of seven 'Catapult Centres', which follow this model to develop business applications of scientific knowledge. Each is based on a particular theme of interest such as 'advanced manufacturing' or 'the connected digital economy'. Their potential for market making is that they may ease the diffusion of knowledge to businesses, speeding up the private sector adoption of new technology. This approach tends to work best for technologies that are approaching commercialisation, and need to be translated effectively into marketable products and services.
- **Tax breaks for innovation:** As an alternative to funding specific projects directly, the government can also offer tax breaks or incentives for businesses that undertake

innovative activities. The government has for many years offered economic incentives to business investment in research and development, through R&D tax credits. The policy aims to reduce the costs to business of conducting R&D, even where that activity resulted in a loss to the business. There are different provisions for small and medium enterprises than for large enterprises, and an extra provision for businesses engaged in vaccine R&D. Whilst it is unclear that R&D tax credits provide greater value for money than the direct funding of R&D (the return is estimated to be between 40p and £3 for every pound of subsidy), the policy is believed to increase the amount of private spending on R&D, and further use of specific provision, increasing the subsidy for key technologies or areas of interest, could become a key pillar in policy for market making.

- **Infrastructure funding:** Large-scale infrastructure projects often require significant state funding. The long time-horizon over which the infrastructure is used, and the wider public benefits of provision, make it unlikely that the private sector on its own would be able to invest the required resources. The government uses a variety of methods for funding infrastructure, increasingly trying to leverage in private sector resources for this purpose. Much of the new infrastructure underpinning markets in emerging technologies is likely to require similar state assistance.

The state as legislator, regulator and enforcement agent

Besides acting as a funder, the state is also responsible for the laws and many of the bodies which frame the conditions within which markets take place. There is a wide range of public bodies which have a stake in market making, as set out in Table 4 below.

In certain cases, especially where property rights are concerned, the government will need to change laws to help make new markets work. That often requires legislation to be passed through parliament, which can be a slow process. In other cases, public bodies can act more directly through their powers as regulatory or enforcement agencies. The distinction between the different types of action needed from government means that a degree of coordination and foresight is needed when engaging in market making.

Among the key regulatory levers that the state holds, the following stand out:

- **Property Rights:** The state is the guardian of the UK's legal system, and has the power to alter the provision of property rights and create new rights as they are needed. This is a vital part of market making. Property rights need to be updated as they become unenforceable or redundant. And, as illustrated by the carbon market example above, the creation of property rights is one of the most direct ways for government to create a market where it is missing. Intellectual property rights are particularly challenging, and have increased in importance in the digital age.
- **Competition policy:** One specific area of regulation that is important to market making is competition policy. Government can intervene on competition grounds where it suspects that anti-competitive behaviour is taking place. This could involve predatory pricing by a business, or collusion between businesses in a market.

Competition policy is important to market making. It can break user lock-in to an inferior proprietary standard, and help new businesses selling innovative products or with a new business model to enter markets.

- **Sectoral regulation:** Some parts of the economy face sector-specific regulation. These include financial services, regulated by the Financial Services Authority (FSA). The regulator in each case has been awarded specific powers to intervene in markets by the state. The justification for intervention varies in each case. The FSA, for instance, is needed to offer protection to consumers and businesses when they buy complex financial products, and to ensure that macroeconomic stability is not affected by the actions of financial firms. The statutory objectives of regulators is set out and updated by policymakers.
- **Infrastructure licences:** The state regulates the use of some publicly-funded infrastructure. This can range from auctioning off radio spectrum for use by telecommunications firms, regulating rail franchises that use the rail infrastructure and charging drivers for the right to use parts of the road network. This can promote more efficient use of public resources eg by limiting costly congestion in town centres. How the state allows the private sector to use public infrastructure can determine the shape of markets in services that use that infrastructure. For instance, the UK telecommunications market is highly influenced by how the government auctions off radio spectrum to business.

Which public bodies are involved in market making?

There is a wide range of public bodies that have a role to play in making markets. The exact breakdown of bodies will vary from one market to another, but Table 4 lists the main bodies that would normally be involved in such exercises.

Table 4: Overview of the main public bodies involved in market making

Department/Government body	General function	Market making functions
Government departments		
Department for Business, Innovation and Skills (BIS)	Oversight of business policy	Oversees many of the public bodies and sectoral regulators relevant to market making
HM Treasury	Fiscal and macro-economic policy	Plans and funds major infrastructure projects. controls business tax policy and R&D credits
Other Government Departments	Various	As and where high-growth markets have an impact on a department's policy areas
Public bodies		
Intellectual Property Office (IPO)	Administering IP policy and overseeing changes to legislation	Oversees the system of legal rights that underpins many markets

British Standards Institution (BSI)	Standard setting, provision of guidance and certification	Works with the private sector to select standards and provide standards guidance
Trading Standards	Enforcement of consumer legislation, ensuring quality and safety of consumer products	Can help to increase consumer confidence in new and emerging markets
Office of Fair Trading (OFT)	Protecting consumer interests and regulating competition	Monitors anti-competitive behavior, which may restrict new market entry and innovation
Competition Commission	Assesses competition issues where cases are referred to it by the OFT	Enforcing competition policy where anti-competitive behavior is constraining market development
Technology Strategy Board (TSB)	Main funder and supporter of technology development and commercialisation	Funds and selects Catapult Centres, runs prizes and competitions, funds the commercialisation of technological research
National Endowment for Science, Technology and the Arts (Nesta)	Research and support for UK innovation	Funds prizes and competitions
Sectoral regulators - examples		
The Office of the Rail Regulator (ORR)	Rail regulation	Furthers and protects consumer interests, promotes competition and encourages investment
The Financial Services Authority (FSA)	Financial services regulation	Enforces regulation and has a statutory duty to facilitate market innovation
The Office of Communications (Ofcom)	Regulation of telecommunications and related industries	Enforces regulation and has a statutory duty to facilitate market innovation
The Water Services Regulation Agency (Ofwat)	Regulation of water utilities	Enforces regulation, promotes competition and furthers consumer interests
The Office of Gas and Electricity Markets (Ofgem)	Regulation of gas and electricity markets	Enforces regulation, promotes competition, ensures sustainable gas and electricity supplies and furthers consumer interests
The Civil Aviation Authority (CAA)	Regulation of airports and carriers	Protects consumer interests and encourages investment
The Postal Services Commission (Postcomm)	Regulation of postal services	Enforces regulation, promotes competition and furthers consumer interests
The Pensions Regulator (TPR)	Regulation of the pensions market	Enforces regulation and consumer protection

The state as coordinator of market making

Market making involves a wide range of players and policy levers, but it requires a significant degree of coordination and coherence. The state not only needs to coordinate the various different public bodies with an interest in this, but must also be able to integrate businesses, entrepreneurs and academics into the process of market making. That requires leadership from government, and an ability to form a link between the worlds of business and policy.

Because of this, we believe the government has a vital role in setting up and managing **Market Making Councils**, groups of stakeholders well-placed to collaborate and implement an appropriate government response to emerging technologies and markets. All too often policy that responds to new and innovative ideas in business is developed in an ad hoc manner, inhibiting the rapid growth of those new branches of the economy essential to UK economic growth. At best, such policy failures can slow the development of innovative new markets; at worst, they can stifle disruptive and innovative businesses altogether, by favouring the status quo.

A Market Making Council would be set up by government for potential new technologies or ideas that are close to creating large, new markets. By harnessing the views of entrepreneurs, innovative businesses and leading academics in the field, while being able to coordinate the various levers of government policy, these councils should provide a suitable forum for getting the government response to new markets right. But such an approach would raise a number of further challenges. How can the state identify future markets with potential, without risk of stifling other markets? How can government ensure it has the right stakeholders involved, and doesn't exclude important players?

How does the state identify potential new markets?

One of the key challenges involved in market making is the job of identifying and selecting the right potential markets to focus on. There are a number of approaches government can usefully adopt to do this:

- **Technology foresight** – Technology foresight involves identifying key emerging technologies, and assessing their potential uses in future markets. This involves interviews with academics, technology experts and relevant businesses, and can provide useful insights into expectations of future technologies. Current work by the government's Foresight office and the Technology Strategy Board adopt this approach, but there is scope for government to use this information more proactively.
- **Business foresight** – Government should not focus solely on future technologies, but also seek to understand the needs and challenges faced by businesses. Focusing on new markets means looking at the business applications of future technologies and ideas, particularly those that meet current or potential economic need.

- Enterprise-led – Government should not attempt to second guess the private sector in selecting the technologies and markets of the future. Selecting which potential markets to focus on should instead follow the lead of the private sector. It should focus on entrepreneurs who are already experimenting with new technologies and business models that have great economic potential, but are facing policy challenges around regulation, legal rights and other issues. The government is far more likely to identify the right markets if it takes a lead from entrepreneurs rather than from within itself.

None of these approaches will give a complete picture of potential future markets on their own, but by combining them, the government should be able to build a solid picture of which markets have the greatest potential for growth.

Which stakeholders need to be involved in Market Making Councils?

Getting the right bodies involved in market making initiatives, and balancing their competing interests, is an important and challenging part of market making. It can be particularly difficult for government to engage with small businesses or with innovative start-ups, but it must ensure that disruptive businesses are able to access and take part in market making activities. Market making initiatives will normally need to include:

- Both start-ups and incumbent businesses – High-growth sectors are often driven by new or disruptive businesses, which can pose a threat to large incumbent businesses. Government must balance the interests of both, but must adopt a clear bias in favour of disruption, and ensure that incumbents are not able to stifle innovation.
- Academics – Academics, both on the technology and policy side, can provide a valuable input into the future development and shape of markets, as well as offering impartial expertise.
- Public bodies – As detailed above, policy relevant to market making falls across a number of different public bodies, and it is important that these different bodies are included and coordinated.
- Policy makers – There should be involvement from civil servants and politicians who have the power to adapt and enact policy and draft legislation.
- Consumer groups – Consumer groups provide an efficient way to harness the opinion of consumers, who are vital to the uptake of innovative technologies and markets.

Bringing together these different groups, and getting them to work towards a common goal, presents a challenge for government, but it is a challenge that only the state can feasibly undertake.

What approach should a market making commission adopt?

To bring together these different bodies, and ensure that government supports but doesn't stifle the growth of new markets, Market Making Councils should adopt the following principles:

- **Co-ordinating policy** – The central role of Market Making Councils should be to co-ordinate the right policy response across government to the disruptive policy challenges presented by emerging high-growth sectors. That means setting a common purpose for the group, and ensuring that policy changes and support are coherent and timed correctly.
- **Technology and business neutral** – It should not aim to promote specific businesses or proprietary technologies, giving them undue economic advantage due to their closeness to policymakers.
- **Goal not process** – Market Making Councils should focus on removing barriers from entrepreneurs in high-growth sectors, rather than prescribing what a future market should look like. The best way to achieve these ends will vary from market to market, and it is vital that outcomes are put before processes.

The pitfalls of market making

There is a clear rationale for governments to play a role in making markets, but there is plenty of potential for such action to misfire. New technologies and new markets are unpredictable, and do not emerge in a linear, discrete fashion. Technologies tend to build on one another over time, and tend to improve and adapt in response to customer reactions. To avoid locking the economy into the wrong markets, government must ensure that it operates as flexibly as possible in this area. There are also a number of specific pitfalls that governments must be wary of:

- **Unpredictable technologies and tastes** – disruptive technologies are by their nature unpredictable. The rates of development and cost levels for new technologies can vary significantly. For instance, the costs of some forms of renewable energy have fallen more slowly than expected, while some digital technologies have undergone rapid cost reductions. It is also hard to guess whether new technologies are actually useful, and can be turned into things that people want. That means governments can easily end up pushing technologies that don't work, and cannot be turned into a working market;
- **Technological evolution and lead users** – technologies rarely develop in a linear fashion. They often need to be tested by well informed lead users, and refined to better meet mass market tastes. This interaction between technologies and their

early adopters takes time, and rushing this can lead to under-developed technologies receiving too much investment;

- **Path dependencies** – where technologies have a high degree of lock-in – through early standardisation, high investment costs or network effects – it is possible for society to get locked in to inferior technology. Examples of this happening include the French Minitel system (which was superseded by the internet) and the QWERTY keyboard, which appears to be slightly less user-friendly than other layouts; and
- **Stifling competition** – when governments get involved in collaborative market making, they are likely to interact with some firms over others. There is a risk that, in doing so, governments limit access to the market, and hamper competition in new markets.

What can government do to avoid these pitfalls? None of them can be completely guarded against – they are all risks of getting involved in market making. But the state's approach to market making can be sufficiently flexible and non-prescriptive to mitigate against the consequences of these problems.

It is important that the state hedges its bets to an extent when engaged in this kind of activity. It must not over-commit towards particular markets and technologies, and it must have a strategy for quickly dropping interventions that do not work. Equally, the state must not try to predict exactly what new markets will look like, and must treat different firms equally. It is easy for the state to confuse individual companies with new markets, or to pick a market that is unlikely to take off. It must seek to be led by credible signals from business and customers, and not allow individual players to hold too much sway over its decisions. Such action is not always easy for a government to pursue, but it should not be impossible.

Chapter 5 Conclusions and next steps

When it comes to new, breakthrough technologies, the issue of creating new markets should not be taken for granted. Many of the biggest barriers to innovation and economic growth are not to do with technology or skills, but to do with a lack of coordination or a failure to remove certain barriers. These barriers can hold back the growth of the economy, and can easily leave the UK unable to turn its ground-breaking ideas into commercial successes.

There is clearly a role for the government to play in facilitating the growth of new markets. The case for doing so becomes especially strong in radical, disruptive areas. But the state's approach to market making must be smarter and more flexible than much of the policy options currently being discussed. Government must focus on enabling, rather than determining, new markets, and must take its lead from private sector players. It cannot afford to adopt blanket policies, and must recognise that each market has its own unique features and ecosystems.

This paper has set out some of the key themes around market making that governments and businesses should consider. It is not the final word on market making, but gives a flavour of the challenges involved in making disruptive innovation work in practice. We believe that this is an area of government policy that could offer significant benefits, and merits further development.

Potential opportunities for market making

There are many disruptive technologies around today that have the potential to create large, new markets. Three of the more obvious opportunities for market making initiatives are outlined below; they are interesting both because of their innovative potential and because of the policy challenges they pose.

3D Printing

3D printing, the ability to print one-off physical objects quickly and cheaply using additive manufacturing technology, has great potential as a future growth area for the UK. Being able to print high-quality goods without the need for mass-production allows for much greater personalisation of products, and could also lead to the re-shoring of much manufacturing back into the UK.

But 3D printing also raises many policy challenges. Being able to copy patented technologies cheaply and easily will put strains on the intellectual property system. There may need to be new regulation to ensure that 3D printed products are safe and of a high

enough quality. And there needs to be a greater range of sustainable materials for use in 3D printing.

These and other policy challenges that may prevent 3D printing becoming a widespread market mean there needs to be a co-ordinated consideration of these issues from government. Published alongside this report is another Big Innovation Centre paper, 'Three Dimensional Policy'²⁴ which goes into greater detail about the economic potential of 3D printing and the policy challenges it raises.

Peer-to-peer finance

As described in a case study above (p.35), peer-to-peer lending has great potential as a method for small and high-growth businesses to obtain finance. But it faces significant regulatory challenges to greater innovation and uptake; at the moment, regulations governing financial services are the key barrier to its growth.

There may be a case for financial regulators, the Treasury and business policy-makers to work together with both peer-to-peer finance businesses and the traditional banking sector. There may be a need to modify regulations that prohibit low net worth individuals from making small investments, and to increase regulatory oversight where that would increase consumer confidence in this sub-sector.

This could take the form of a Market Making Council for peer-to-peer lending, acting as a forum for collaboration between this group to develop policy in this area.

E-learning

The application of digital technologies to education is becoming increasingly widespread. One area of interest is the online provision of degree-level courses. By providing video lectures and electronic assessment online instead of in physical lecture halls and classrooms, the cost of learning is greatly reduced. You can now take degree-level courses for free and from anywhere, by watching lectures by some of the most respected academics in various fields and completing automated and peer-reviewed assessments, without the need to physically attend classes.

This form of e-learning has the potential to transform how degree-level skills are acquired and greatly increase the productivity of higher education, but it faces challenges that policymakers need to address. Qualifications obtained through e-learning will only be useful if their quality is high and it can be easily verified that students are not cheating, something that is difficult to do with current models and may require regulation. Also, the globalised nature of e-learning, with students taking courses provided by institutions based in other

²⁴ See Sissons, A. and S. Thompson (Big Innovation Centre, 2012) *Three Dimensional Policy: Why Britain needs a policy framework for 3D printing*

countries, mean there may need to be greater cross-border translation of the worth of different courses to reduce confusion amongst employers. Finally, it is unclear how universities, clearly well-placed to provide high quality content for e-learning, can make money from online rather than physical courses.

In order to make the most out of e-learning, it will be necessary to bring together various stakeholders such as student groups, universities and employers, to discuss these issues and outline an appropriate policy response. Past policy experiments to provide e-learning proved unsuccessful. The UK e-university project, which was wound up in 2004, used £50m of public funds to develop an online learning platform but only managed to attract 900 students. A select committee report into the project concluded that there was insufficient market research before implementation, and that similar future projects should take a much more demand-led approach. Future policy in this area may have to look to incentivise universities and the private sector to innovate in e-learning, rather than the top-down approach which proved highly problematic in this case²⁵.

In the future the Big Innovation Centre will be carrying out research on e-learning, outlining the benefits and policy challenges to greater innovation in this area.

We believe that market making presents a smarter, cheaper and more realistic alternative to government policy, and that government should adopt this approach as a key part of its economic growth strategy. Creating new markets for innovative technologies is a cornerstone of economic growth, and it makes sense for government to focus its efforts here. Focusing on markets, rather than on industries or technologies alone, would be a smarter way for government to organise its efforts on the economy. It could help to break down silos around individual policy levers and departments, and ensure that government focuses on consumers and entrepreneurs as well as technologies.

Such an approach will require government to be more intelligent and flexible in the way it interacts with the economy. Governments need to be able to move with the changing technological landscape, and must be aware of how the economy is changing. Large subsidies to favoured companies and heavy-handed regulation in support of incumbent industries have no place in today's economy; but ignoring the needs and challenges of innovative businesses is also not an option.

Government must seize the initiative on market making. It should begin by identifying the markets that could transform the UK economy. It must set up more meaningful and more regular conversations with businesses and academics about where new technologies are heading, and it must become more aware of how its policies will affect them. Where opportunities for growth exist, the government should set up Market Making Councils, and

²⁵ House of Commons Education and Skills Committee (2005) *UK e-University*

adapt their actions to the needs of that market. The lead for this is most likely to come from the Department for Business, Innovation and Skills (BIS), but it will require backing from all parts of government, including HM Treasury. Without such action, the UK is at risk of remaining slow to adopt new technologies, leaving its economy imbalanced and sluggish.

Bibliography

The following articles and sources have been used extensively in this paper, in addition to the sources cited in footnotes in the text:

Agar, J (2004) *Constant touch: a global history of the mobile phone* *Icon Books*

Andersson, P., Aspenberg, K., Kjellberg, H.,(2008) The configuration of actors in market practice. *Marketing Theory* 2008 8: 67

Araujo, L. (2007) Markets, market-making and marketing. *Marketing Theory* 2007 7: 211

Arthur, B. (1989) Competing Technologies, Increasing Returns, and Lock-In by Historical Events. *The Economic Journal*, Vol. 99, No. 394. (Mar., 1989), pp. 116-131.

BERR (2008) Regulation and innovation: evidence and policy implications *BERR Economics Paper No. 4*

BIS (2011) *A Strategic Vision for UK e-Infrastructure*

BIS (2012), *Tunnelling: A Capability Analysis*

Cochoy, F. (2008) Calculation, qualculation, calculation: shopping cart arithmetic, equipped cognition and the clustered consumer. *Marketing Theory* 2008 8: 15

Dosi, G. (1982) Technological paradigms and technological trajectories. *Research Policy*, Vol. 11, Issue 3, pp. 147 - 162

Finch, J. and Geiger, S. (2010) Positioning and relating: Market boundaries and the slippery identity of the marketing object. *Marketing Theory* 2010 10: 237

Holweg, Tran, Davies & Schramm (2011) *Growing the Automotive Supply Chain: The Road Forward* *The Automotive Council*

House of Commons Education and Skills Committee (2005) *UK e-University*

Kjellberg, H. and Helgesson, C-F. (2007) On the nature of markets and their practices. *Marketing Theory* 2007 7: 137

Mason, K. and Spring, M. (2011) The sites and practices of business models. *Industrial Marketing Management* 40 (2011) 1032–1041

Office for Low Emission Vehicles (2011) *Making the Connection: The Plug-In Vehicle Infrastructure Strategy*

Rumfitt (2012) Give them some credit! A survey of the barriers to funding the UK's automotive supply chain *The Smith Institute*

Schilling (2006) *Strategic Management of Technological Innovation* *McGraw-Hill/Irwin*

Shapiro & Varian (1998) *Information Rules: A Strategic Guide to the Network Economy*
Harvard Business School Press

Simakova, E. and Neyland, D. (2008) Marketing mobile futures: assembling constituencies and creating compelling stories for an emerging technology. *Marketing Theory* 2008 8: 91

UKCES (2011) *A review of occupational regulation and its impact*

Acknowledgements

This report is a publication from the Big Innovation Centre, an initiative of The Work Foundation and Lancaster University. The content of this report reflects the opinions of its authors and not necessarily the views of the Big Innovation Centre or its supporters. The Big Innovation Centre is supported by the following companies, public bodies, universities and private trusts.



Contact details

Big Innovation Centre

The Work Foundation
21 Palmer Street
London SW1H 0AD

info@biginnovationcentre.com

www.biginnovationcentre.com

www.theworkfoundation.com

All rights reserved © Big Innovation Centre (The Work Foundation and Lancaster University). No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form without prior written permission of the publishers. For further information please contact info@biginnovationcentre.com. The Work Foundation Alliance Limited, 21 Palmer Street, London, SW1H 0AD, UK. Registered Charity No. 1146813. Registered as a company limited by guarantee No. 7746776. Registered address: Lancaster University, Bailrigg, Lancaster LA1 4YW, UK.

