Redesigning Manufacturing

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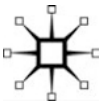

Softcover reprint of the hardcover 1st edition 2015 978-1-137-46521-4

First published in 2015 by
PALGRAVE MACMILLAN

Palgrave Macmillan in the UK is an imprint of Macmillan Publishers Limited, registered in England, company number 785998, of Houndmills, Basingstoke, Hampshire RG21 6XS.

Palgrave Macmillan in the US is a division of St Martin's Press LLC, 175 Fifth Avenue, New York, NY 10010.

Palgrave Macmillan is the global academic imprint of the above companies and has companies and representatives throughout the world.

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ISBN 978-1-349-49945-8 ISBN 978-1-137-46522-1 (eBook)
DOI 10.1057/9781137465221

This book is printed on paper suitable for recycling and made from fully managed and sustained forest sources. Logging, pulping and manufacturing processes are expected to conform to the environmental regulations of the country of origin.

A catalogue record for this book is available from the British Library.

A catalog record for this book is available from the Library of Congress.

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Preface

In writing this book three very different people came together who through their separate experiences concluded that manufacturing needed redesigning and reimagining. Perhaps it required a makeover too as a bit of a Cinderella dimmed by the service sector's rising star.

In reaching this shared conclusion each came via a very different route: a professor of marketing at the University of Bath with practically focussed branding expertise whose fascination about the links between creativity and making prompted this book and who has provided the bulk of its content; a renowned economist with experience at the highest echelons in Whitehall and worldwide in economic development; and an individual who by working at the interface of business, policy and academia gained some insights into the often overlooked gaps sitting at the connection points – and all bringing their fresh perspectives.

We have shared views, with our partnership clarifying the need for a greater understanding of how manufacturing works, and what it needs to work better. We make a heartfelt plea for a reassessment of this sector's vital contribution. Our aspiration is for a STEAM skills agenda, with the 'A' representing 'art', 'design' and 'entrepreneurship', for, as a nation, we have been at our best where our creativity, craft, design, science capacity and inventiveness combine.

The book is written to provide greater practical insights into the many ingenious ways manufacturing thrives, competing successfully globally to generate jobs, drive productivity and innovation, and contribute to our trade balance, quality of life and global reputation. We urgently need to build on current success by constructing 'mind to market' and 'learn by doing' cultures and a connectivity helping our producers in all parts of our economy link with sources of talent, expertise, knowledge and skills development.

As our economy depends increasingly on the interactions between companies coming together and sharing ideas, this intangible creativity, often applied as a design input and manifested through strategy as a branding output, is the brainpower fuelling growth. It seems insubstantial, it is the stuff that dreams are made of and yet when we get it right and produce something great it changes the world and the way we live.

To grow faster, quicker and with more success in this environment we need to nurture curious cultures and our 'free spirits of enterprise'. We have the creative capacity; it is just not sufficiently aligned to meeting and shaping market need. To deliver this, real long-term leadership is required, as well as courage and commitment, and a clear focus on developing the very best products and services to meet emerging lifestyles, which requires innovation to be properly integrated across multiple areas of expertise.

Acknowledgements

In reaching our conclusions we conducted interviews with 60 senior-level decision-makers between June and November 2014. Having written well over 30 full case studies there was too much material to include a reference to each business. We have tried to focus on illustrations providing insights into a wider spectrum of successful business models than is often portrayed.

We would like to thank everyone who gave their time, freely sharing their insights and experience with great generosity and genuine desire for improvement.

Several academics advised us in the early stages of this project including Mike Lewis, Andrew Graves and Pietro Micheli.

Many businesses involved have supported the Birmingham City University think and do tank Idea Birmingham. These include Jaguar Land Rover, GKN, Rolls-Royce Aerospace, JCB, AGA Rangemaster, Acme Whistles, WB the Creative Jewellery Group, Brandauer, Brooks England, Emma Bridgewater, Morgan Motor Cars, Westfield Sports Cars, Pashley Cycles, Amtico, Premier Group, Alucast, MAN Group, Glenn Howells and Brintons Carpets.

Special thanks are due to the University of Bath, Professor Cliff Allan and colleagues at Birmingham City University, William McGrath at AGA Rangemaster, Simon Topman at J. Hudson & Co., Steve Norgrove, Phil Swash, Lord Chris Fox at GKN, and to the CBI and John Cridland for providing so many invaluable introductions and insights (over the years).

Warm thanks go to Mike Wright, Richard Butler, Sally Hannah, Julia Fox and West Midlands team, to Sir Albert Bore and many others at Birmingham City Council, Jerry Blackett, Greater Birmingham Chamber of Commerce, Philip Singleton and Millennium Point, the many LEPs spoken with, especially Stewart Towe in the Black Country, George Gillespie and Martin Yardley in Coventry & Warwickshire and Greater Birmingham and Solihull, Manchester's strategic economic hub New Economy, UKCES, The Work Foundation, Big Innovation Centre, University of Cambridge Service Alliance and ESADE Business School, WMG, the University of Warwick, Politecnico di Milano, West Midlands Economic Forum, Centre for Cities, IPPR, IoD, EEF, MAS, BIS, ONS, the All Party Manufacturing Group, the Design Commission and the

Design Council, and to the emerging entrepreneurs who contributed including Jack Row, Rebecca and Craig Struthers of Struthers-London, Zone V – wishing them and many others the best of good fortune in their ventures.

Finally, most importantly, we thank our families for their enduring support, without whom nothing is possible.

1
Introduction

A modern manufacturing morality tale

By all accounts the 2012 London Olympics were a triumph. As well as heroic sporting performances, fantastic organization and wonderful opening and closing ceremonies, the Games were also a triumph for the British creative sector (broadly construed), including architecture, arts, business and design. The design of the Olympic torch was a high-profile example of what Britain's creative sector could do. Edward Barber and Jay Osgerby's triangular design drew inspiration from three trinities – the Olympic motto "Faster, Higher, Stronger", the fact that the 2012 Games were the third to be held in London, and the vision for London 2012 which was to unite sport, education and culture. The torch (made from gold PVD-finished aluminium) involved an innovative design balancing weight, an easily viewed fuller flame and, of course for safety, dissipation of the flame away from the handle. The design included 8,000 holes to represent the same number of runners and the miles run in the Olympic torch relay. Such was its success that the torch was listed among the Design Museum's 2012 designs of the year and Barber and Osgerby each received an Order of the British Empire for services to design.

The triumph of genius designers is a common twenty-first-century story and one that owes much to heroes such as Jonny Ive at Apple, Chris Bangle at BMW, the success of Dyson, as well as a cast of hundreds of architects, fashion designers, creatives and commercial artists. However, this official account of the torch is incomplete – who and what is left out reflects the modern-day image of another economic sector, manufacturing.

Although the genius of the Olympic torch is attributed to designers who in essence broke the rules of physics – a problem resolved by the

engineers in determining how to deal with the displacement of mass as a shape collapses from a wider cone into a narrower tube – the transformation of this inspiring concept into a real product required some significant engineering, metal craft and making skills. A quick Internet search on the London Olympic torch fails to uncover this part of the story, and it appears nowhere in that bastion of historical fact, Wikipedia. Without the skilled West Midlands team bringing together Premier Group in Coventry, producing the body of the torch, Black Country foundry Alucast Ltd producing the top and bottom caps, and Bullfinch (Gas Equipment) Ltd in Birmingham who produced the LPG burners, Barber and Osgerby's design would have remained little more than an interesting concept.

Although the design concept is ingenious, bringing it to life in many ways was an engineering nightmare. The process involved a skilled team of including designers, engineers, machine operators, quality controllers, casters, craftspeople and metal finishers. In fact, so complex was this design that reverse engineering proved impossible as the scanners were unable to form a point cloud as a result of the 8000 holes on the prototype. Premier Group's making solution came down to experience and understanding of metals, drawing on artisan and craft skills to manipulate the metal, machine out the 8000 perforations, generate press tools, forming the shape through trial and error to reach the stage where they were able to weld it together with a laser, drawing on an aluminium alloy to create the lightest torch ever made at 1kg.

Delivering the torch also involved supply chain management, financial and quality control expertise in order to ensure the torch was delivered on time and within budget, and at a standard acceptable to the Olympic Organising Committee. The project drew on traditional craft and metal-cutting skills as well as a range of more modern business capabilities including flexibility, quick prototyping and problem solving. While the design studio leveraged this project to achieve further success, and Alucast was recognized as Made in the Midlands Manufacturer of the Year in 2012, the companies that together made arguably the most striking and globally recognizable design of the 2012 Games a reality were not fully recognized for their extraordinary creative making capabilities.

In contrast with the inspirational designers, the Midlands manufacturing team did not win OBEs, various magazine design awards or institutional legitimacy courtesy of London's Design Museum. These contrasting fortunes reflect the different popularly held images of the two sectors – Britain's once glorious manufacturing sector fading quickly

into irrelevance while the present (and presumably the future) belong to creatives solving intractable problems through design thinking. Despite the tone of the previous paragraphs, this book is not an attack on design (which we view as essential to manufacturing and value creation). Rather, we want to attack the popular image of manufacturing as dead, dying, a sunset sector, in perpetual decline, part of this country's glorious industrial past, or something of little relevance to a post-industrial economy built around services, biotechnology, information technology and the creative sector.

Reimaging manufacturing

Although the negative image of manufacturing is a far cry from the reality of the sector's success, nevertheless image matters. A sector's image affects its ability to attract employees (not to mention the very best talent this country has to offer), capital, policy support, media interest, encourage universities to develop specialist programmes to support the sector and so on. American manufacturing researchers have identified how an "industrial commons" is essential to sustained sector success (Pisano and Shih 2012). However, as firms locate production and even more proprietary capabilities such as design, marketing, and research and development offshore, the industrial commons declines. This decline is exacerbated by the fact that the sector struggles to attract the best minds, not just those from STEM (science, technology, engineering and maths) subjects but also from business, design, creative arts, social sciences and the humanities (which as we will make clear are just as, if not more, crucial than their STEM counterparts).

The image of manufacturing may not reflect reality, but it certainly has real world effects. For this reason, we argue manufacturing needs to be rebranded. In this book we examine the reality of modern UK manufacturing. We look behind the statistics, we interrogate the assumptions underpinning many policy analyses and initiatives, and with reference to a broad range of exemplar cases, identify how UK manufacturing competes globally and draw on these strategies to identify policy options as well as opportunities for other stakeholders including universities and training organizations. Our aim is to not only to give the sector an image makeover, but also to reframe some of the debates around manufacturing. We believe economists, operations management and STEM researchers have driven much of the historic debate regarding the future of manufacturing. Although important, disciplinary experts bring with them a set of assumptions and tools that constrain as much

as they explain complex subject matter (we hope our multi-disciplinary team avoids at least some of this). As well, many of the value-creation activities behind the UK's manufacturing success stories such as design, creativity, craft and, critically, branding are left out of this debate.

In highlighting the practices, strategies and frustrations of the UK's manufacturing stars, we draw heavily from examples from the broader Midlands area. First, one of the co- authors, Beverley Nielsen, is intimately acquainted with this area, having spent many years working for AGA Rangemaster and more recently as the "making" champion for Birmingham City University, launching the university's "think and do" tank Idea Birmingham as a collaboration with brand-led Midlands' manufacturers and hosting among other things industry events such as Birmingham Made Me Design Expos (2012, 2013 and 2104), showcasing the Midlands excellence in innovation, design and production. Second, the Midlands represents a significant amount of the UK's manufacturing base and output from this region has steadily increased (Moffat 2013). Although we scarcely touch on important sectors such as aerospace and even pharmaceuticals, these have already been well covered by other authors who have highlighted the success of these sectors over the years.

We were lucky to have so many companies willing to talk to us. We conducted 30 reviews of manufacturers and other leaders in skills and economic development for this book. The results were a real insight into the actual and specific – and in many cases urgent – needs of manufacturers. It was clear that all the manufacturers spoken with are looking for creative and STEM skills combined – whether they are larger businesses like JLR, Rolls-Royce and GKN, or the amazing start-ups, or the considerable number of middle-sized businesses forming the core of our manufacturing heartland.

For these businesses design and innovation form the bridge between, as Will Hutton put it, "the consumer questing for the experiential and the business trying to provide that". Because we need to remember that consumers these days are not buying because they need products but, as Ian Callum has said, "because they *like* them". And it's probably a bit more than like – it's that people want products that they think say something about who they are, that are imbued with personal meaning (Beverland and Farrelly 2010).

What was also clear is that the business community is looking for people who are very specialist in terms of science and technological capability but are also highly "creative". They want "thinking doers" which means that for educators the old divide between academic and vocational is not so relevant any longer to their competitiveness.

Now we have an industrial strategy, after some years of lobbying by the Confedereation of British Industry (CBI) and Trades Union Congress (TUC) and others, and this is seen as a "good thing" by business. But it is relentlessly STEM focused. There is one mention of design – indeed within automotive the UK's excellence in car design is mentioned. However, what is immediately evident is that there is no further view on how to develop more of the design talent that has led to new product introductions enabling new market share acquisition – at home and abroad.

Our survey made it clear that what businesses want is to see the scope of the industrial strategy extended beyond the 11 sectors identified. In fact, business wants all manufacturing to be valued by policymakers and supported, whether they be low tech or high tech, if they are delivering high-value returns. They believe that this recognition is lacking even though in their view our manufacturing base is now highly productive and competitive, indeed more so in the Midlands than in Germany, France and even in parts of China – showing that the sector can indeed "do it". It is not just what they think – interestingly the case studies assessed in preparation for this book suggest companies as diverse as Amtico and Acme Whistles are adopting strategies enabling them to compete directly against the Chinese in lower priced or lower value added market segments. Companies are facing many new trends and challenges in globalized markets. New technologies including digitization are enabling rapid product development and growing consumer expectations have fuelled demand for new product introductions which have rapidly accelerated over the past decade. For example, 50 per cent of AGA Rangemaster's revenues in 2014 were composed of products not introduced before 2011. New products introduced by Jaguar Land Rover have opened up new overseas markets with the Evoque in particular being responsible for great growth in China as sales there have grown from 431 vehicles in 2003 to over 77,000 cars in 2013. The small specialist education chair producer Hille have seen sales and profits grow over the past six years through highly targeted new product launches each year.

The new reality is that increased connectivity demands a combination of "hard and soft" skills in response to increasing complexity around, for example, the development of user-focused haptics involving the development of attractive interface options for consumers, especially in the higher value added consumer markets. Consumers themselves expect products that they are able to customize increasingly to meet the requirements of their own lifestyles, whilst also enabling them to make public statements about who they think they are and how they see

themselves within society – not just in higher price brackets but from very competitive price points.

At the same time new challenges are arising that require a different approach to meeting them. The focus on developing low carbon sources of energy and products that have lower energy consumption is becoming even more pressing, along with the search for lightweight materials. With a greater proportion of the world's population living in cities, urbanization is a trend businesses are grappling with, whilst the internet has brought challenges around the fragmentation of retail routes to market and the ability to micro specialize and compete in increasingly focused market segments.

This requires also a rethink of funding of academia – arguably it would suggest an urgent need for a shift away from traditional basic research-focused universities to more applied research. Mike Wright's 2014 report shows that less than one fifth of all research funding is on applied research and this primarily through tax credits and patent assistance. And within academia fragmentation is creating a lack of transparency and ease of access with the result that industry is unaware of pockets of specialism they could access, thus constraining collaboration and investment.

What our survey demonstrates, as the case studies spread across this book testify, is that businesses overwhelmingly believe that greater collaboration lies at the heart of the future proofed economy. Centres of excellence within universities making clearer to business the degree of technology readiness of research developments and a greater focus on impact measures in assessing applied research would be beneficial in incentivizing a greater market focus for academics. The gains for the economy cannot be underestimated.

What this book is not

We also feel the need to identify what we are not trying to achieve. First, in promoting manufacturing we do not wish to be seen as being against other sectors. We are not arguing for a move away from services, denigrating the UK's global expertise in advertising and marketing, design, primary or creative industries, or all the other sectors that contribute to a vibrant post-industrial economy. Services, in particular, are crucial to the UK economy in terms of value and relative employment. Services are critical to manufacturing export success, both in terms of their inputs and also the recent move towards "servitization" where much of the value of goods sold overseas includes significant services components.

Manufacturers are also significant purchasers of services, and if this analysis has taught us anything, it is the interconnection between sectors that is vital to understand.

Neither are we attempting to turn back the clock on globalization and naively argue for a return to the past where the UK was the world's manufacturing powerhouse. Much of the "decline" of manufacturing reflects a relative shift away from this sector to others. Manufacturing output and value in many economies worried about manufacturing decline is actually higher than it was 40 years ago; it is just the relative shares of output, value and employment that have changed. Not surprisingly, manufacturing in the UK has declined faster relative to other countries partially because as the first nation to go through an industrial revolution we started from a higher base. Therefore we are not arguing for some form of protectionist industrial policy.

As a result of these disclaimers we are not arguing for "rebalancing" in the purest sense whereby jobs will flow from services to manufacturing, and off-shored plants will be re-shored (although we recognize that for a variety of reasons some shift in the latter is already occurring). That is, we are not arguing for reindustrialization. While we want to ensure that manufacturing in this country remains viable, replacing existing employees (many of whom are near retirement age) and/or just meeting the sector's requirement of 800,000 new employees by 2020 is a big enough challenge. We are more interested in ensuring that the wider contribution of manufacturing to the rest of the economy is well understood and appreciated and that as a result policies and attitudes towards the sector ensure its long-term sustainability.

We are not alone in thinking that. Peter Marsh in his 2013 book *The New Industrial Revolution* argues that a resurgent manufacturing sector can help sustain a lasting UK recovery and that there are increasing signs that a cadre of strong and globally focused production businesses based in Britain can prosper for a prolonged period with the right strategies at the level of business and also of government. We are not seeking large-scale shifts back to making, simply because much of the UK's manufacturing success (and that in developed economies) is due to increases in productivity, primarily through the replacement of labour with machines and the greater use of digital technology (thereby further increasing worker productivity) (Rowthorn and Coutts 2013b).

What we are seeking is greater understanding that a focus on narrow manufacturing alone – even a sectoral focus alone – often ignores the importance of the surrounding ecosystem to sustain it. And we argue that the ecosystem itself, properly defined and observed, forms a

very substantial part of what makes manufacturing and the economy succeed, that it has spill-overs both ways – from and back to manufacturing – and creates world-class "industries" in its own right which are exportable and highly productive. Ignoring this is a sure way of ensuring that manufacturing is unable to compete internationally and will slowly wither further with negative impacts on growth, skills and ultimately prosperity.

Redesigning manufacturing

This book is split into nine chapters. Chapter 2 will explore the manufacturing image problem in detail. Various politicians, relevant ministers, industry insiders and experts have identified that manufacturing's crisis is more myth than reality. That said, image matters, and negative images are particularly hard to shift given the media (and our) predilection for dwelling on the negative rather than the positive. Few studies have examined the reality of manufacturing's poor image, but those that have identify the potential dangers of failing to tackle this issue head on. Poor image affects the industry's ability to attract capital and investors, not to mention talent. In this chapter we explore where this image came from, the effect it has and how to change it. In particular, we identify that while manufacturing's image seems poor (despite its real success), making has never been more popular. We suggest that manufacturing image makeover needs to work with this interest in making and move beyond historic or narrow images of the sector.

Chapter 3 focuses on the future of manufacturing debate. We review the large number of excellent reports and research studies examining ways forward for UK manufacturing. In reviewing this literature we identify four common themes: the need to pursue high value; the centrality of innovation which is credited with accounting for "70% of economic growth in the long term" (BIS 2014); the importance of the right business model; and the role of ecosystems. Although these four things seem self-evident, further analysis reveals that there are some common assumptions across these studies that unnecessarily restrict strategic and policy options. The pursuit of high value, for example, is simply a proxy for "high technology". Having the right business model is mostly focused on "efficiency". Innovation is really just a proxy for STEM-driven research. Finally, ecosystems are primarily modelled in terms of links between manufacturers and STEM-based university departments.

Chapter 4 picks up where Chapter 3 left off. Ignoring the normative focus of much research we examine what successful UK manufacturers

actually do. While we find that the pursuit of high value, a focus on innovation, well-tuned business models and the benefit of ecosystems account for much of the sector's success, the reality of each of these is much broader than has previously been discussed. UK manufacturers certainly do focus on high value, but they do so primarily through brand-driven strategies. Innovation certainly matters, but UK manufacturers employ many different models of innovation, including those driven by STEM, design, marketing, engineering and craft. Business models certainly matter, but again the focus on efficiency through productivity gains or improvements in cycle time are only parts of the ways in which manufacturers organize to compete. Finally, ecosystems do matter, but they are much richer and more complex than simple relations with trade associations or university STEM departments.

The above two chapters provide the basis for the rest of the book. The material in Chapter 3 forms the basis for much of the current policy debate including, we argue, an overemphasis on reacting to external conditions rather than trying to shape them to one's advantage. Furthermore, by narrowing the debate in ways that reflect the disciplinary foci of economics, operations management and STEM, policy often underestimates the needs of manufacturers, particularly in relation to employment needs and management capability. We propose that the practices of successful UK manufacturers (Chapter 4) should play a role in policy discussions regarding the future of manufacturing. If high value is achieved primarily through branding and design rather than high technology, why do so few reports even mention brand equity as a key value driver? If brands, design, management, consumer insight, creativity and so on matter, why is so much of the manufacturing debate concerned solely with encouraging school leavers to study STEM subjects, and attracting university graduates from the same subjects? The next set of chapters explores each of these value drivers in order to build the basis for policy options in Chapter 9.

Chapter 5 explores how manufacturers brand and how branding builds value. Furthermore we identify why branding is critical for addressing many of the challenges faced by the sector, including employee retention and attraction and access to capital. We challenge many of the extant views about branding in the manufacturing debate. Arguing against the idea that branding is a post-production add-on we identify how branding considerations drive what is produced and how it is produced (and vice versa). We then identify the full consequences of a brand-driven model identifying the mutual independence between brand image, innovation and design, and business models. We challenge some common mistakes

many firms make about branding before ending by identifying the UK's branding expertise and manufacturing's heritage as part of a symbolic "manufacturing commons".

Chapter 6 explores the rich and varied ways in which UK manufacturers innovate. Innovation is often cast as a research and development challenge usually focused on creating scientific breakthroughs and then taking them into the market. However, this is just one way to innovate. The UK has a huge depth of expertise in design for example. Design-driven innovation is user-centred but also focused heavily on breakthrough products. Classical innovation models are also relevant, particularly among business-to-business firms. These models typically focus on incremental innovations that help claw back much of the sunk cost invested in breakthrough innovations. Although disparaged in many reports, craft-based innovation is central to the value of many UK manufacturing brands. Far from being inimical to change, craft innovation is often characterized by long periods of incremental improvement punctuated by significant breakthroughs. Process, scientific and engineering models are also important creators of value for manufacturing. Finally, we identify how marketing innovations actually lead to revitalized manufacturing sectors.

Chapter 7 focuses on business models. We review much of the literature focusing on the capabilities and strategies underpinning manufacturing success. Apart from the focus on operational issues (supply chain management, cycle time) we examine issues of location, sourcing, and servitization. We also examine the skill level of UK manufacturing managers. Although important, we believe many of these strategies are concerned with simply keeping up, or running faster to compete. We argue that investments in these capabilities very much needs to be brand driven and focused on growing value in the long run.

Chapter 8 focuses on the importance of developing the right ecosystems. In so doing we build on US research identifying the strategic benefits flowing from a so-called "industrial commons". We propose that the ecosystem per se can offer much in terms of value creation, and even provide the basis for market-shaping innovations. While links with universities and trade associations remain critical, we identify the benefits of having access to suppliers, the brand benefits of having a mix of large and small firms, and the need to link more closely with other parts of this nation's fine universities. A number of studies identify the benefits that other countries' manufacturers derive from ecosystems (for example, Germany). They then look at ways in which those can be emulated here (for example the experiment in the UK at present

with the "catapult" centres of innovation which are aimed at specific sectors and which borrow the concept from Germany's Fraunhofer Institutes). They are certainly worth trying and we welcome the focus in terms of funding finally being put through those centres and the addition of two new ones on energy systems and precision medicines. But though this is a step in the right direction and at least shows government commitment in this area, we argue that simple transfer from one socioeconomic context to another is fraught with difficulty. Rather, we identify some home-grown ingredients that can form an ecosystem for manufacturing, including the UK's long tradition of informal associations, professional societies and universities. Finally, we also explore the notion of a symbolic ecosystem by identifying the latent value of the UK's manufacturing heritage for future success.

Chapter 9 draws from the previous analysis to identify considerations for national and local policy-makers, business practitioners, sector representatives and academia. For academia, the future of manufacturing is far from just a STEM challenge. With brands, innovation, strategy, services and therefore people management critical drivers of high value, UK manufacturers must attract and retain the very best talent from a range of disciplines, including those often seen as offering little practical value by many policy-makers. The needs of this sector also challenge the ways in which universities train students. The narrow discipline focus, both in STEM and non-STEM subjects, is unlikely to meet the needs of a manufacturing sector built around the integration of the two. With much of this expertise spread out among members of the UK industrial commons, initiatives are also needed that allow students and practitioners to draw from these sources for specialist sector courses.

Conclusion

We began this chapter with a modern manufacturing morality tale that very much reflects the differences in image between two making sectors – design and manufacturing. Design is sexy, creative, innovative and valuable. Manufacturing is, well, invisible. However, the real moral is that manufacturing or making is imminently more complex and intertwined than any commentators note. Far from being a sunset industry as part of the UK's glorious past, manufacturing is very much one of this country's economic success stories. However, this is a story that one rarely hears, apart from the few announcements of growth in export orders and increases in profits, job numbers and confidence that contradict the typical media narrative about manufacturing's terminal decline.

Redesigning Manufacturing seeks to tell the story behind the headlines by drawing directly from a number of those firms that have seemingly bucked the trend of manufacturing's decline. We hope that our analysis will contribute to existing debates regarding the future of manufacturing. In particular, we hope to broaden the range of inputs and considerations researchers, policy-makers, practitioners and commentators draw upon when framing policy, advice or training courses. Manufacturing matters to the UK. The next chapter details why.

2
Why Manufacturing Needs an Image Makeover

Introduction

In this chapter we explore the nature of manufacturing's image problem and identify why it persists in spite of the sector's many successes. We then identify the implications of this poor image for the sector, in particular focusing on future employment, investment and policy requirements. Since the main focus of this chapter is to give the sector a much needed makeover, we compare the reality of modern manufacturing to the image, and also draw more widely on emerging trends that highlight a general interest in making things. We argue that while manufacturing has a poor image, consumers, investors, future employees and other stakeholders view creating, making and selling highly positively. Drawing on these insights we propose that manufacturing can be reframed more positively as the business of creating and making.

Why manufacturing matters

Following the period of de-industrialization in the last quarter of the twentieth century the industrial make-up of the UK changed, lessening the importance and appeal of manufacturing in the UK with competition from emerging markets at various stages hitting the UK badly. The rapid growth of the financial sector after the "big bang" in the 1980s and the increase in the salaries and bonuses offered by banks and other financial institutions relative to actually "making things" meant that the new generation of graduates opted for work in "financial engineering" rather than in "real engineering", as Lord Mandelson famously put it. This had a real impact on people's willingness to study STEM subjects and work in manufacturing (Hinton Lectue 2009). As banking and other areas

in the financial sector expanded, the contribution of manufacturing shrank – by 2012 manufacturing gross value added (GVA) was down to just 10 per cent of gross domestic product (GDP), compared with 27 per cent in 1970. But with the exception of Germany, whose share still remains about 24 per cent, the UK is very similar to most other industrialized countries in having seen manufacturing's share fall quite substantially – France is also at 10 per cent and the US only 1 per cent higher at 11 per cent.

But it is this share that seems to have received most attention. Latest data (2014) from the UN Conference on Trade and Development (UNCTAD) suggested that in 2012, for which comparable figures exist, the UK ranked 114th out of 237 countries in the world in terms of the share of GDP accounted for by manufacturing. The result has been that the UK is not regarded as a manufacturing economy. And yet the same report also ranked the UK seventh in the world in terms of manufacturing output at ($233 billion). Car production is booming. The Society of Motor Manufacturers and Traders (SMMT) expects just under 1.6 million cars to roll off UK production lines in 2014 (Monahan 2014) – and that if forecasts prove correct car production in the UK by 2017 will exceed the 1972 record of 1.92 million cars produced in that year. Last year automobile exports were the highest they have been since the height of car production in the 1970s and it is estimated that some 5 million cars have been exported from the UK in since 2010. Eight out of ten cars produced in the UK are exported.

There are many reasons for this, including sterling's depreciation after the recession. But there are deeper and more fundamental positive factors that have helped here. David Bailey, Professor of Industrial Strategy at Aston Business School in Birmingham, while acknowledging that other external factors have contributed to this, also suggested that the UK was benefiting from "world-class manufacturing [and] excellent industrial relations and to an extent the government's industrial strategy" (quoted in Monahan 2014). And the impact is much wider than those narrow figures suggest. Will Hutton and the Work Foundation estimated that each manufacturing job creates at least four service jobs. The importance is highlighted in a BIS occasional paper on manufacturing in the UK, produced in 2010 (BIS 2010). It found that in 2009, just after the financial crisis had hit the UK, manufacturing was the third largest sector in the UK economy, after business services and the wholesale/retail sector in terms of share of UK GDP. In that year alone it had generated some £140 billion in gross value added, which represented some 11 per cent of the UK economy. Although employment numbers had been falling it

was still employing some 2.6 million people, which at the time was over 8 per cent of total UK employment.

Manufacturing has traditionally been the most productive sector of the economy as it needs to remain internationally competitive in the face of rapidly changing global economic environment. It tends to be more innovative than the rest of the economy, spending more on research and development (R&D) than other sectors – accounting for some 70 per cent of total business R&D. Its goods are more exportable and contribute most to the balance of payments. The UK has world-class capability and a true competitive advantage in areas such as defence, aerospace and pharmaceuticals. Because of its excellent universities and research capability, the UK is an attractive location for foreign R&D and receives more direct R&D foreign investment than any other country in Europe. Foreign-owned companies now spend more on R&D in the UK than domestically owned ones (BIS 2014). OECD (2007) research also suggests that the UK has a comparative export advantage in high and medium high technology sectors, surpassing that of most European nations.

The 2010 BIS paper points out that if you look at patent activity as an indication of areas of potential relative strengths in the future we seem to be relatively strong in a number of exciting sectors such as organic chemistry, biotechnology/pharmaceuticals and medical technology, though somewhat weaker in the areas of electronics, optics and nanotechnology and information technology. It also contributes hugely to the skills development in the economy – people working in manufacturing are on average more skilled than the rest of the economy with considerable spill-overs into other sectors. It is also the sector with the highest investment patterns of all others as exemplified by spending in R&D. Indeed innovation surveys consistently indicate that some 70 per cent of UK manufacturing firms are engaged in product, process and wider innovation activities (BIS 2010). And those that do so persistently tend to have 13 per cent higher productivity than those that do not engage in R&D at all.

In addition, because of the "servitization" of manufacturing (of which we speak again in later chapters), in other words the increase in services that manufacturing companies also increasingly provide as part of their overall activities, the sector contributes significantly to overall service export levels of the UK economy. Research suggests that the proportion of UK manufacturing firms that offer complementary products lags behind those in countries such as Germany and the US (Neely 2009). Nevertheless this is still an important part of their activities that isn't

routinely tracked. The type of services UK manufacturing firms provide are mainly design and development services, systems and solutions, maintenance and support, and retail and distribution. An EEF report in 2009 found that revenues from manufacturing services accounted for between 15 and 20 per cent of total revenue earned by UK manufacturers. The BIS 2010 report in fact suggested that the manufacturing sector and the service sector are increasingly difficult to separate and quoted a study by Kneller et al (2010) who had estimated that in 2005 manufacturing firms with their service activities accounted for some 14 per cent of the total value of UK services exports in 2005. Moreover, that percentage was much higher in some sectors – it seems that manufacturing firms in that year accounted for around a third of total exports of technical services (e.g. architectural and engineering services) and a third of total export income earned from royalties and licence fees.

Finally, the role of manufacturing in "intangibles" is also significant. They are distinct from traditional technical R&D and in reality form a large part of what this book is all about. Intangible assets are wide ranging and, according to BIS's (2010) definition, include things such as economic competencies (e.g. management training, market research and branding); scientific and creative property (e.g. patents, licences and design); and computerized information (e.g. software and databases). Intangible assets are calculated to have accounted for 0.4 percentage points of the annual growth in labour productivity between 1998 and 2006 (Riley and Robinson 2011).The manufacturing sector has a key role in this. Jon Haskel developed a model for ONS, calculating that intangible investment in 2011 stood at £140 billion with over £40 billion invested by the manufacturing sector alone, making this sector the largest investor in intangibles.

The importance of manufacturing to economic resilience, innovation through R&D, export value, internal spending, skills development and, to a lesser extent, employment (among other things) is clear. And yet it has never been more important to focus on refreshing the image of the sector. In this chapter we argue that in spite of the sector's value and successes, among many stakeholders the image of manufacturing is less than positive. Post-industrial economies are characterized by hyper-reality or the dominance of image over reality. This means that decision-makers struggle to differentiate image from reality, and may in fact prefer the hyper-real rather than the genuine article. Although industry insiders argue manufacturing's image problem is more myth than reality, nevertheless the persistence of those myths creates very real challenges for the sector.

Manufacturing's image problem

Imagine for a second that you are not a manufacturing industry insider. If you were stopped in the street and asked, "What springs to mind when you hear the phrase 'UK manufacturing?'", what would you say? What words, questions, emotions and memories would spring to mind?

We imagine that words such as "decline", "dying" and "sunset" might spring to mind. You may even be tempted to ask, "Does the UK make things anymore?" Emotionally you may feel a tinge of sadness, remembering how once Britain was the workshop of the world, how factories often defined the local landscape and provided well-paying secure jobs for all who were willing and able. Negative images may also spring to mind as you recall the experiences of poor quality and inefficient work practices in firms such as British Leyland. You may recall newspaper headlines announcing another plant closure, or a decision to move manufacturing jobs offshore. Finally, if you've worked in manufacturing you may have mixed emotions – manufacturing jobs could be repetitive, mindless and boring or generate pride in one's ability to make things. Regardless of your response, manufacturing is unlikely to be viewed as having a strong present, let alone a future.

The answers listed above are far from hypothetical. Rather they reflect enduring perceptions (and many would say "misconceptions") of the sector. These perceptions are reinforced in often unexpected and unintended ways, run counter to much of the reality of modern manufacturing in the UK, and present a significant problem for firms seeking to attract employees, investors, policy support and other stakeholder interest. For example, if the sector is in perpetual decline, why would investors show interest? Would any school leaver desire a job that had little future, or was perceived as boring, mindless and insecure? If the sector is declining, are policy-makers likely to spend political capital on manufacturing? Finally, are other stakeholders such as academics and university leaders likely to invest resources in specialist research capabilities or sector-specific programmes in a sector with little future potential?

These outcomes are also not hypothetical – they represent the very real challenges reported by manufacturing insiders time and again across multiple studies and reports on manufacturing's future challenges. In each case, manufacturing competes with other sectors for the best talent, capital, skills, policy interest and resource decisions by other stakeholders. Image therefore matters, and changing that image is essential to the future of manufacturing in the UK. In this section

we unpack the "what" and "why" of manufacturing's image problem. Understanding the nature of image problems and why and how they persist represents a necessary first step in manufacturing's image make-over. In so doing, we examine the nature and impact of manufacturing's image problem with various stakeholders before identifying why such an image persists.

Unpacking manufacturing's image problem

Researchers and policy makers on manufacturing often identify "image" as a significant challenge for the sector. But what is the nature of this image problem? Although manufacturing has changed in significant ways from the past, the media and policy-makers often continue to refer to the sector in terms suggestive of obsolescence such as "smokestack", "sunset" or "rustbelt" (Pike et al. 2013, p. 16). For example, a recent report by the New Automotive Innovation Growth Team (NAIGT) (2009, p. 40) stated that, despite improvements,

> The industry has an image problem. The case for taxpayer support for the industry is not widely accepted – in fact many in government and parliament, independent commentators and potentially the wider public still have an out-dated and negative "British Leyland" perception of the car industry and view the industry as being in terminal decline.

The NAIGT goes on to note that this image persists despite the sector's many successes and represents a critical constraint to attracting and retaining the best staff, gaining public support for a raft of political interventions and attracting institutional investors. These perceptions are not just confined to the automotive industry. As Vince Cable, Secretary of State for Business, Innovation and Skills, stated, "How many people do we meet who repeat the silly and inaccurate observation that 'we don't make things any more'? This message has had a deeply corrosive effect in discouraging a younger generation from seeking a career in engineering or taking up industrial apprenticeships. […] The negativity about the perception of manufacturing has become a bigger problem than the reality" (quoted in Livesey 2013, pp. 7–8).

In the first (and to our knowledge so far the only) review of the empirical evidence on public perceptions of manufacturing, Livesey (2013) sought to understand how people really thought about manufacturing and its prospects in the UK. Many of the questions posed in the surveys he

and others conducted asked people to agree or disagree with commonly repeated statements, including whether the UK makes things anymore, whether the UK is good at commercializing ideas, whether manufacturing involves high technology and high skill levels, whether manufacturing jobs are most likely to be sent offshore, whether the UK economy can grow without a strong manufacturing sector and whether manufacturing provided good career prospects. Given that Livesey (2013) examined public perceptions of manufacturing it is worth exploring his findings in more detail.

Livesey started by observing that the reports about how the public viewed UK manufacturing seemed to be at odds with the reality of modern UK manufacturing and were largely anecdotal in nature. As a result he measured perceptions of manufacturing amongst three important groups: secondary students, careers advisors and the general adult population. His findings suggest that manufacturing is seen as necessary to "rebalance the economy" but is hampered by associations stemming from previous work practices and the decline of the sector in relative terms. As such, students (particularly female) are unlikely to consider manufacturing as desirable and although parents may view it as important for the economy, they are unlikely to encourage their children to pursue a career in the sector.

The primary focus of Livesey's report is on understanding perceptions of manufacturing among potential employees (students) and those who advise them (teachers, careers advisors and parents). Estimates suggest manufacturing requires 800,000 new employees by 2020 just to maintain its current state. In his review Livesey found that young people saw manufacturing as boring, repetitious, dirty, insecure, masculine and factory-based. Only 15 per cent of 15–17-year-olds believed a career in manufacturing would be well paid. Studies of 12–16-year-olds found manufacturing to be rated much more lowly in terms of desirability than service jobs such as law, medicine, accounting and teaching. Unsurprisingly given such results, only 15 per cent of students surveyed would consider manufacturing as a career. Such results were also found across all age groups (seven through to 19) and were stronger for female students than for men. Such outcomes were also stable over time across several surveys of different groups of young people.

Livesey also reported on studies of influencers including teachers, careers advisors and parents. Although sample sizes were small, 62 per cent of teachers surveyed would recommend manufacturing as a career even though most thought the image of the sector was poor. However, those who would not recommend the sector to their students

did so because they believed it provided unreliable employment, poor pay, and was a dying industry. Although the public had a generally positive view of manufacturing they were much less positive about the future prospects for the sector. For example, despite recognizing that the UK economy needed a strong manufacturing sector and that manufacturing jobs require high levels of skill, the general public saw these jobs as insecure (i.e. they were most likely to be sent offshore) and comparatively poorly paid. Not surprisingly, despite viewing manufacturing as necessary to a strong economy, when asked if they would encourage their children to pursue a career in manufacturing, few would (particularly among younger respondents).

Given these results, unsurprisingly, Livesey concluded that manufacturing had an image problem that could have long-term consequences for the sector. However, his results also identify that there is what marketers call "latent support" for manufacturing among the public. What this means is that the public want to see UK manufacturing be successful, mainly because of beliefs about the need to rebalance the economy and partially because of a positive disposition towards making things. Furthermore, Livesey noted that knowledge of the reality of modern UK manufacturing was low, suggesting that the negative perception of manufacturing may be easy to counter with campaigns highlighting the range of opportunities within the sector including a focus on career paths and success stories.

Why does this negative image persist?

Livesey's review suggests the negative associations of manufacturing are if anything hardening over time, especially among the very people the sector needs to appeal to (the young, university students and parents). Marketers understand that image is how consumers perceive a product, brand, person or organization. Image in this sense is more important than reality and, critically, may run counter to the truth or what the sender of information intended. Marketers also recognize that formal communication is only one means by which consumers form images (and often it is the least influential medium). Knowledge can also be gained through other influencers including the media, pressure groups, social networks and direct experience. Finally, the ways in which messages are framed may have unintended consequences, potentially undermining the original intention of the sender.

Building on these ideas, manufacturing's image problem arises from genuine changes in the UK economy, media reports of decline, media

representations of manufacturing's past, a lack of direct experience with manufacturing, commentators repeating manufacturing myths, the absence of coherent positive campaigns and paradoxically the ways in which many promoters of manufacturing frame their arguments. Consistent with much academic marketing research, people form perceptions not only through exposure to formal messages, but also through more subtle cues including how information is framed. We tackle each of these issues below.

Manufacturing's decline is inevitable

There is a lot of truth to manufacturing's decline in the UK. Since the mid-1960s UK manufacturing has shed more than six million jobs, falling from more than nine million to just under three million in 2013 (Fothergill and Gore 2013, p. 4). As Moffatt identifies, "manufacturing has experienced the most dramatic falls in GVA [gross value added] of all the sectors considered" (2013, p. 15). Figures 2.1–2.3 bear this out.

However, these figures need to be viewed in context. As the first country to industrialize, the UK's manufacturing base arguably fell from a further height than later industrializing nations. This is particularly true in low-value industries with little proprietary technology (Fothergill and Gore 2013; Pisano and Shih 2012). The decline also pertains to relative contribution to the UK economy. Although manufactured output and value is as high today as it was in the mid-1960s, the percentage contribution of this sector relative to services has declined, both in terms of the percentage of gross value added and employment:

> All countries considered have experienced falls in the proportion of GVA and employment accounted for by manufacturing. However, it is the UK that has experienced the largest fall with manufacturing accounting for around 10% of GVA and employment in 2010, down from over 30% for both variables in 1970. (Moffat 2013, p. 18)

As well, the rate of change has been faster in the UK than in many other developed economies. Much of these changes are structural and reflect a shift towards services, the offshoring of low-value manufacturing to low wage countries and increases in productivity arising from increased mechanization (Fothergill and Gore 2013; Hay et al. 2013).

That said, these structural shifts are often viewed as inevitable or natural. Economists have often attributed the decline in manufacturing as part of the shift towards a "post-industrial society" (Bell 1976). This

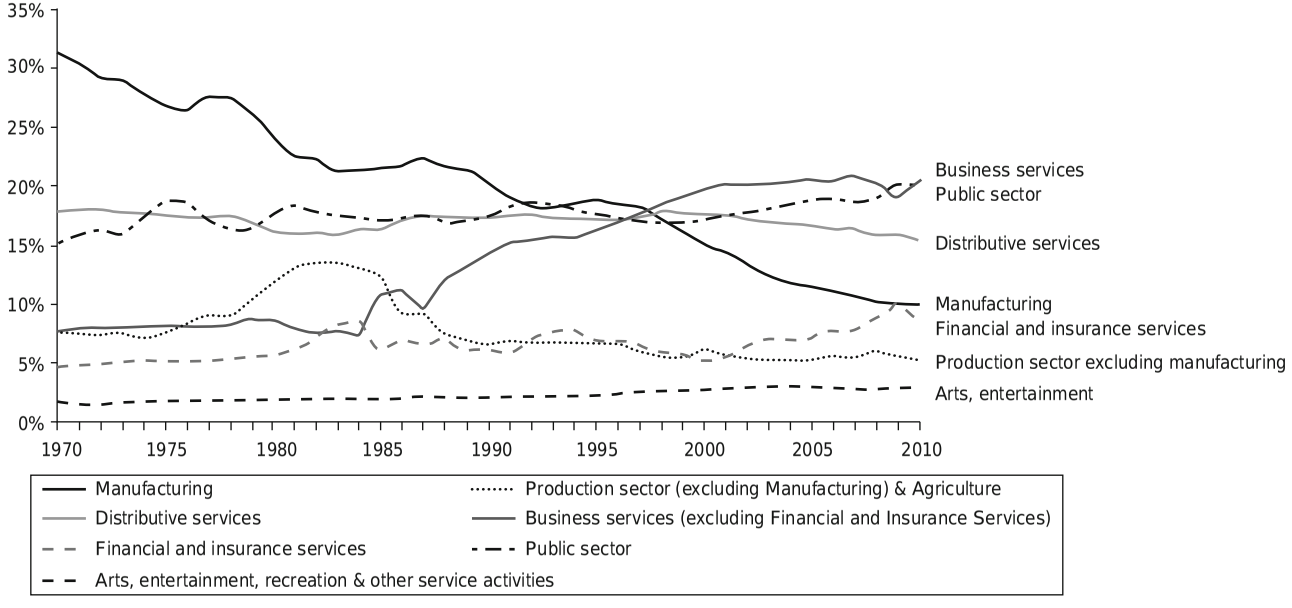

Figure 2.1 Percentage of UK GVA accounted for by selected sectors, 1970–2009

Source: Moffat (2013, p. 14)

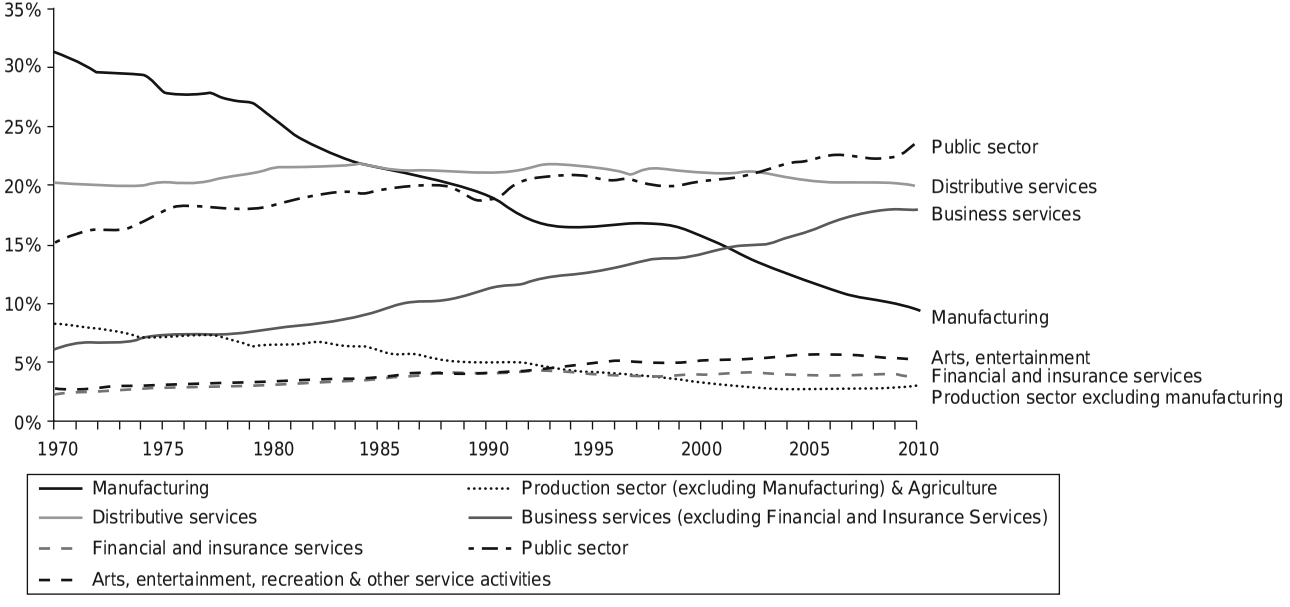

Figure 2.2 Percentage of UK employment accounted for by selected sectors, 1970–2009

Source: Moffat (2013, p. 15)

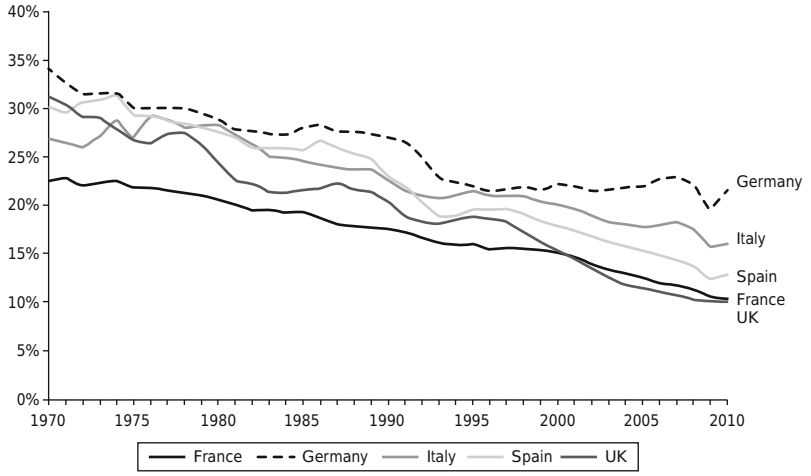

Figure 2.3 Percentage of GVA accounted for by manufacturing across countries, 1970–2009

Source: Moffat (2013, p. 18)

theory proposed that economies develop through a series of stages including the shift from agriculture to manufacturing and, in turn, the relative shift away from manufacturing to services. In this model, the decline of manufacturing stems partly from improvements in productivity (often through mechanization) and the emergence of low-cost labour in countries going through industrialization (Berger 2013; Rowthorn and Coutts 2013a). In this sense, the decline of one sector is due to the invisible hand of the market, and is therefore part of the natural economic order. This theory has been widely adopted among policy-makers, academics and media commentators (even if the latter do not know it) and not only suggests manufacturing's decline is inevitable, but that such a shift is to be celebrated as part of the development process (Pisano and Shih 2012). All too often those advocating natural decline due to a post-industrial society underestimate the prospects for manufacturing and misunderstand the complexities of modern manufacturing (Fingleton 1999).

A story by Andy Beckett in the *Guardian* is representative of how this "natural decline" narrative reinforces negative perceptions about manufacturing (even when, in this instance, this was not the intention of the author). Under the heading "The North-East of England: Britain's Detroit?" Beckett examined the decline of a once prosperous manufacturing heartland. The contents of the story are less important than the

way in which the story is framed. Consistent with how subtle framing can influence perception, the use of "Detroit" cannot be accidental. Detroit in many ways has ceased being a place and has become a metaphor for the decline of a bygone age. Once seen as archetype modernist city, the shift away from manufacturing in favour of services, globalization and offshoring, and the resulting decline of businesses and population have resulted in a lower tax base, the decline of services, bankruptcy and a city that is quickly being reclaimed by nature.

This perception that manufacturing is part of a bygone age is reinforced in unusual ways – ways that are powerful precisely because they are emotionally subtle (Heath 2012). Consider, for example, the impact of redevelopment of former industrial sites has on people's perceptions of manufacturing. Former factories are often turned into nightclubs, cafes, innovation centres, apartments and/or mixed-use developments. Popular web-based stories shared across social media sites often feature essays exploring the beauty of decay that typically feature factories, manufacturing plants or abandoned municipal buildings in former manufacturing powerhouses. Unintentionally, projects focused on reusing abandoned spaces reinforce perceptions that manufacturing was part of the UK's past, but has little place in the country's future. Unintentionally photographs exploring the beauty of decay or the reclaiming of manufacturing spaces by nature also reinforce notions of natural decline, historical determinism and the lack of future for manufacturing.

Media representations of manufacturing also reinforce this sense of decline, often in quite subtle ways. Plant closures often have such a significant impact on a region that they are naturally front-page news. Consumer studies have also demonstrated that we pay more attention to negative information than we do to positive ones, which often explains why positive stories about manufacturing are relegated to the business section of many newspapers. Finding these headlines is not hard – in preparing for a presentation on this book, our cursory Internet search quickly resulted in the following stories:

> "As a history of British shipbuilding comes to an end, why the lure of abroad?" (*Daily Echo*, 10 November 2013)
>
> "End of an era in British car manufacturing: Inside the Ford's Southampton factory that will close its doors for the final time after a century of car production." (*Daily Mail*, 16 July 2013)
>
> "More than 20,000 take to the streets to protest Johnnie Walker plant closure (700 jobs lost)" (*Telegraph*)

> "After 160 years of pride, the last steel plant in the North East is shut down" (*Daily Mail*, 19 February 2010)

Although many manufacturing organizations believe media portrayals of their industries are neutral (Livesey 2013), these headlines and the prominence of these stories reinforce many manufacturing myths, particularly when success stories are often relegated to special feature sections in newspapers, are reported solely in terms few can relate directly to (such as the quarterly reports of manufacturing orders), or have to compete with other news items in televised broadcasts. Livesey's (2013) survey work identified that in spite of beliefs about the necessity of manufacturing to future UK growth, the general public also believe that the UK will continue to decline as a manufacturing power. It is perhaps no wonder that few students, teachers or parents consider manufacturing to be a growth industry when they are exposed so often to stories of decline, plant closure, offshoring and "end of an era" type headlines.

Those advocating for manufacturing often (unintentionally) frame their messages in counterproductive ways. Some are obvious – Jeremy Clarkson of *Top Gear* fame has long lamented the decline of manufacturing in the UK. In one feature, he drove a beautiful new Rolls-Royce across Brunel's Clifton Suspension Bridge in Bristol. Overlooking the bridge he lamented how Britain used to be a home to great industrialists with bold vision who used to make things before describing the current state of manufacturing in the UK as "pathetic". Likewise, IDEO designer Tim Brown's inspirational TED talk contrasts modern designers' preoccupation with thinking small with Brunel's focus on thinking big. Although the talk is a call to arms for designers to move beyond creating more landfill, the framing reinforces manufacturing as something that Britain once did.

Do advocates for manufacturing unwittingly reinforce negative stereotypes?

Politicians genuinely focused on reindustrialization also often frame their goals in ways that romanticize the past, including the desire to attract large manufacturing plants, lamenting the loss of smokestacks on the skyline and the closure of factories that provided jobs for thousands. Although it's easy to be cynical of such yearnings, one can also empathize with politicians seeking to return to what seemed to be a golden age. After all, large plants providing lots of jobs bring with them wealth,

lower rates of crime, taxes, a sense of community and attract other businesses, all of which translate into satisfied voters. However, all too often stories of the past reinforce notions that manufacturing is dirty, monotonous, for men, unskilled and, of course, part of a bygone age, things Livesey (2013) found young people associate with manufacturing.

Even advocates for a return to making or a new industrial policy often unintentionally reinforce perceptions that manufacturing has little future. Livesey (2013) identifies how previous prime ministers and advisors have created a policy narrative that reinforces perceptions of manufacturing's decline (inevitable or otherwise). As a result, until recently, there has been a belief that the public has little appetite for a new industrial policy. Sir James Dyson, for example, often laments the fact that as a nation Great Britain no longer makes anything. Identifying the shift from making sciences (engineering, science, technology), to business services such as advertising, design and marketing, his call for reinvestment in productive capacity paradoxically reinforces perceptions that manufacturing may represent a risky career choice. Even those advocating for a rebalancing often frame manufacturing as something requiring specialist government intervention and support, which reinforces the notion that the sector cannot survive on its own (Graves 2010; NAIGT 2009).

Finally, ignoring the above for a minute, consider how low our exposure is to manufacturing. In the Q&A session following Michael's May 2014 University of Bath MBA masterclass on the thesis of this book (and reinforced by delegates at a fringe session we co-chaired at the 2013 Conservative Party Conference in Birmingham), an engineer in the audience commented on this issue, by comparing the experience of German and UK children. He made the excellent point that in most German towns and cities, even if one's parents do not work in manufacturing, it is likely that neighbours, friends, extended family members and so on do. That is, German children are exposed to manufacturing as a viable stable career option on a daily basis through direct experience. Many of the cars they drive are "Made in Germany" and if their parents work in services there is a good chance they will have clients in manufacturing. UK children have a different experience. Leaving aside the chance they may have friends or family exposed to plant closures and offshoring, they are more to be exposed to role models who work in services (broadly rendered). Regions are often devoid of manufacturing hubs or plants, and many of the goods they purchase are typically made elsewhere. This perhaps explains why knowledge of manufacturing remains low and associations of it remained firmly rooted in the factory lines of the past.

Summing up the image problem

In summary, manufacturing has an image problem. Despite the fact that this image is often more fiction than fact, the enduring image of UK manufacturing as boring, dull, insecure, old-fashioned, poorly paid factory work primarily for men acts as a very real impediment to attracting and retaining talent. The sustained belief that manufacturing is a sector in natural decline, something that is part of the UK's industrial past, and that the public has little appetite for policies focusing on reversing this is a barrier to investment, the expenditure of political capital, and investments in research and specialized training. This image is reinforced in a number of ways, many of which are subtle and unintended. However, research also reveals manufacturing is viewed as necessary to the growth of the UK economy and that knowledge of modern manufacturing is low. Any attempt to give manufacturing an image makeover must address these negative perceptions but also draw on the positives and fill in knowledge gaps.

Remaking manufacturing

How can manufacturing's image be improved? The first step involves understanding how big the challenge is. Is the image so toxic that nothing short of dispensing with the term "manufacturing" will do? Are there any trends that can be used to refresh or even reframe the UK manufacturing brand? Have those promoting manufacturing placed too much emphasis on the wrong issues, thereby reinforcing perceptions of irrelevance, or ensuring that messages rarely cut through with the target audience? Finally, are those advocating the importance of manufacturing targeting the right people? Once these questions have been answered, the second step is to develop communications that help improve the image of sector among relevant stakeholders.

The previous section identifies how the negative image of manufacturing persists and how key audiences view the sector. Government ministers, industry analysts and insiders also identify how such myths often do not reflect the reality of modern UK manufacturing – a claim supported by the relatively low levels of knowledge about manufacturing among young people (a point we will examine below and in the next Chapter). Likewise, despite enduring myths, manufacturing is still viewed as important to the economy by members of the general public. This suggests that the UK manufacturing brand is not toxic but, rather, those seeking to improve the image are not stressing the right issues. On top of this, trends suggest

that the urge to "make" is widespread among members of the public and that those involved in what we call the making arts are viewed extremely positively by any number of stakeholders (including consumers, investors, senior management, policy-makers and universities).

Members of the manufacturing sector identify image as a barrier to attracting and retaining employees, and gaining policy support and investors. The previous section has identified many of the negative associations young people have of the sector. On top of the reasons identified above for the persistence of manufacturing's negative image, we also believe that a key problem relates to the narrow way in which manufacturing is framed in public discourse (we will cover this in more detail in the next chapter). Livesey, for example, identified that knowledge of manufacturing among young people was relatively low. However, this result is driven by how the questions were framed. In his review, Livesey identified that when measuring young people's attitudes towards manufacturing, surveys typically ask them about their knowledge and perceptions of engineering. Furthermore, surveys seeking to capture what young people associate with manufacturing identify terms such as "production" (80 per cent) and "technology" (65 per cent) (Livesey 2013, p. 14). Likewise, in countering the view that manufacturing is dated, surveys explore whether the general public views manufacturing as a high or low technology sector (finding that 50 per cent of the public view the sector as a high-tech one).

Many insiders frame manufacturing in this way. As we identify in the next chapter, industry analysts typically equate the future of manufacturing with "high tech" and, as a result, often stress the need for more engineers, scientists and technology experts as a key challenge for the sector. When coupled with reports of factory closures, job losses, offshoring of production, and more subtle stories regarding the re-use of industrial sites it is perhaps no wonder that many of the people the sector seeks to appeal to view the sector in negative terms (e.g. "boring," "dirty", "repetitious"). The sector is also viewed as "male" and studies show that young women are the least likely to consider manufacturing as a career. Does framing manufacturing as engineering turn women off the sector? Less than 10 per cent of professional engineers in the UK are women. Just 12% per cent of women in the final year of university are interested in a career in manufacturing and engineering and surveys reveal that the same young women view engineering and manufacturing as "male centric", "dull" and unexciting.

There is a sense among many writers on manufacturing that the sector is not doing as good a job as it could do in selling its successes and in

refreshing its image. To overcome perceptions like those identified by Livesey (2013), we believe the sector needs to take an expanded view of what manufacturing is and can be, and also to more stridently sell its successes. In expanding the view of manufacturing, we also believe the sector can tap into the positivity associated with other creative sectors including design and craft and also pick up on the emerging interest among investors and the public in the maker movement. Combining this with stories focusing on very real successes would also help encourage more people (beyond just engineers, scientists and technologists) into manufacturing and also dispel many of the enduring myths about the nature of work and career prospects in the sector.

Modern manufacturing

Initiatives such as the Smart Industrial Strategy identify the need to be more explicit about the diversity and variety of UK manufacturing activity in an effort to improve the image of the sector (Mazzucato 2011). Industry insiders are keen to stress that manufacturing has not only changed dramatically since the days of Henry Ford's production lines, Charles Dickens's novels and factory lines featured in many news stories. For example:

> Images of towering smokestacks and huge assembly lines still dominate the popular perception of manufacturing, but they a long way from reality. UK manufacturing is a sophisticated and complex industry, which occupies a place at the cutting edge of global innovation and at the heart of the knowledge economy. (Sissons 2011b, p. 5)
>
> Suzanne Berger, co-chair of MIT's high profile Commission on "Production in the Innovation Economy", argues that for many important emerging technology sectors it is becoming extremely hard to separate R&D, design and production. (O'Sullivan and Mitchell 2013, p. 11)
>
> Manufacturing has evolved but our understanding of it has not, manufacturing firms turn ideas into products and services. In today's globally competitive landscape manufacturers are inventors, innovators, global supply chain managers and service providers. What was once seen just as production is now production, research, design, and service provision. (Livesey 2006, p. 1)

These quotes typify the views of many writers on manufacturing who remain frustrated with how the sector is still perceived. We think the

sector can go even further than simply identifying a broader range of career opportunities attributable to modern manufacturing. Others have identified how manufacturers are just as likely to earn income from services as they are from goods. A recent *Harvard Business Review* article on the future of manufacturing in developed economies identified several European exemplars generating value through customized service solutions (Chick et al. 2014)). Sissons (2011a, p. 6), for example, identifies the future of UK manufacturing as *manu-services* (or the broad group of activities that involve combining manufactured goods with services), highlighting the need to shift classifications of manufacturing to reflect this. In so doing he calls for the sector to broaden its approach to skills and careers to include scientists, designers, marketing executives, engineers and many others.

The reputation of makers

Consider for example the difference in reputation enjoyed by those who make and manufacturing. While few students consider manufacturing as a career, design professionals and industry representatives such as the Design Management Institute (DMI) worry about the ability of their sector to soak up the large numbers of graduates being provided by universities, colleges and polytechnics. Many designers are treated like rock stars and business managers are embracing new strategic notions such as "design thinking" (Brown 2008) in order to generate more value, while academics celebrate the personal, spiritual, moral and social benefits of the craft of making (Charny 2011; Crawford 2009; Sennett 2008). Value (not price) conscious consumers flock to buy handcrafted goods that are often locally designed and/or made and attribute greater value to brands with a strong heritage of making (Beverland 2009).

Even tech writers and investors are excited about the analogue world of making, especially in relation to the so called "maker movement" and mass additive manufacturing (or 3D printing) (Anderson 2012; Hatch 2013). *Wired* editor Chris Anderson is so excited about the potential for what he identifies as the new industrial revolution that he has left his job as editor to start a business using 3D printing. What caused the editor of one of the main proselytizers of the digital age and writer of *The Long Tail* to quit in favour of the analogue world of making? Anderson's view is that the re-emergence of making – from 3D printing to home workshops – represents an even bigger business opportunity and shift than the Internet and its infinite number of niche markets. His logic is

simple – underneath every digital process, application and business is physical stuff.

Others have highlighted the latent desire among many in the developed world to make things, or re-engage with an inner desire to create and produce. This can be represented in a number of ways, including demand for allotments to grow food (author of Maker Manifesto Mark Hatch recommends growing stuff (and cooking it) as the first step for people interested in making things but unsure of where to start), interest in arts and crafts, attendances at farmers and craft markets, the popularity of crowd funding sites such as Kickstarter, the emergence of Etsy (the eBay for handcrafted goods), all sorts of guerrilla activities (guerrilla gardening), brands using their making heritage (real or imagined) as points of difference, the popularity of maker labs, and attendances at exhibitions celebrating design, manufacturing, or made objects at various institutions such as the Design Museum and the V&A. Interest in making things is also reinforced by the popularity of Richard Sennett's book *The Craftsman* and the even more popular ode to repairing and making, *Shop Class as Soulcraft* by Matthew Crawford.

Building on this, many universities are reacting accordingly. The University of Chicago has its own maker lab, which provides business students with much desired hands on experience of moving beyond a product concept to producing and selling it. TU Delft, one of the world's best design school's with a similar program, faces almost unlimited demand for places in its making programs. One of the author's previous universities has rebranded as a university of technology *and* design, requiring all its faculties to engage with design in their respective research and teaching programs. Firms are also embracing a heritage of making in order to enhance the value of their brands. Levi Strauss for example has leveraged its catalogue of jeans (they retain copies of every model ever made) to emphasize a history of craft expertise and to launch new "vintage-inspired products" to respond to consumer demand for authenticity and quality.

The problem of definitions

Why have policy debates and/or stakeholder perceptions failed to pick up on the shift in the nature of manufacturing and the increased interest among the general public in making more broadly? Much of it has to do with how manufacturing is defined and normative beliefs about how manufacturers in advanced economies need to compete. In regards to the first point, the Standard Industry Codes (SIC's) used

by analysts and policy makers split manufacturing, services, and creative industries, thereby underestimating the value of *manu-services* and the numbers of firms engaged in their provision (Bryson et al. 2013). Sissons (2011a) uses Apple as an example of *manu-services*, identifying how value is generated through a combination of product innovation and manufacture, content provision, and sales support. Each of these would be classified separately under SIC codes but would fail to capture the reality behind one of the world's most valuable brands.

Although, we will cover the second point in more detail in the next chapter, the dominant view in much policy discourse has been that the future of UK manufacturing lies in "high technology". In some ways this is not surprising – much low technology manufacturing has moved offshore because of cost advantages (Rowthorn and Kenneth Coutts 2013a), while the UK does have competitive advantages in areas such as pharmaceuticals, aerospace, industrial chemicals, computers and office machinery, non-electrical machinery and communications equipment (Broadberry and Leunig 2013). It is perhaps not surprising that with aligning the future of UK manufacturing to high technology, policymakers then seeking to improve the image of manufacturing with students focus narrowly on STEM subjects or even just engineering, while also missing the resurgence of interest in making (broadly construed).

These definitions of technology also remain rather arbitrary and obscure more than they enlighten. And such a push underestimates the value that can and is being gained through so-called low technology industries. Sissons (2011a), for example, has argued the high-tech/low-tech binary is a false distinction. As Pisano and Shih (2012) argue although the item being manufactured may be high tech, the actual production process may be relatively low tech. Likewise, low technology production may actually involve proprietary skills and knowledge much of which cannot be replicated elsewhere (e.g. wine production). This last point is particularly important given that the UK has a long history in handcrafted high-quality products that, when strongly branded, generate high levels of return (Beverland 2009). And, operations management researchers have recently begun to realize that emphasis on high technology alone does not always deliver value for end-users – for example, despite their technological and quality superiority Japanese and Korean automotive brands have not replaced their more brand-savvy German counterparts (Oliver et al. 2007).

We also believe the narrow definitions arising from SIC codes and the equating of high tech with manufacturing's future place unnecessary limits on how some view potential for the sector. For example,

although we added a caveat about re-balancing in Chapter 1, the use of high technology to improve productivity leads authors to underestimate the potential for jobs growth in the sector since productivity increases have come at the expense of job growth (Sissons 2011a), while the stress on STEM ignores the actual performance of many low- and mid-tech manufacturing sectors. For example, the outlook for food and drink manufacturing remains strong (Fothergill and Gore 2013). This sector alone needs an estimated 160,000 new employees by 2020 just to maintain existing levels. Such definitions also lead to narrow policy objectives and ignoring the real needs of much of the sector, especially when it comes to recruitment such as the need for 650,000 replacement employees by 2020 mostly in skilled manual and plant and machine operative occupations as well as managerial, professional and technical jobs (Fothergill and Gore 2013). And it leads policy-makers to ignore the groundswell of support for making and creating things, and/or the value of the connection to a maker to the value of brand in the mind of consumers.

Remaking manufacturing's image

Our first recommendation in regards to remaking manufacturing's image is to change the definition to reflect the current reality of the sector and the underlying emotional nature of making. Manufacturing is a major investor in intangibles, including knowledge-intensive processes such as product development, design and brand management (Sissons 2011a), all of which are viewed as positive career options by students. O'Sullivan and Mitchell (2013) reviewed how different countries approached the tricky problem of defining manufacturing. Definitions ranged from a focus on certain technologies to those focused on the entire industrial value chain. Some focus on traditional sectors such as steel or automotive while others addressed all product-based sectors including emerging science and technology-based sectors. In their review, O'Sullivan and Mitchell make the important point that how we define an industry drives policy choices. What was particularly interesting is the Japanese definition *monozukuri* or the "process of making things" (*mono* means thing and *zukuri* means process of making). As O'Sullivan and Mitchell (2013, p. 21) stated:

> "In particular, *monozukuri* contains as almost spiritual sense associated with the desire to craft excellent products and an ability and pride in constantly striving to improve production systems, processes and craftsmanship."

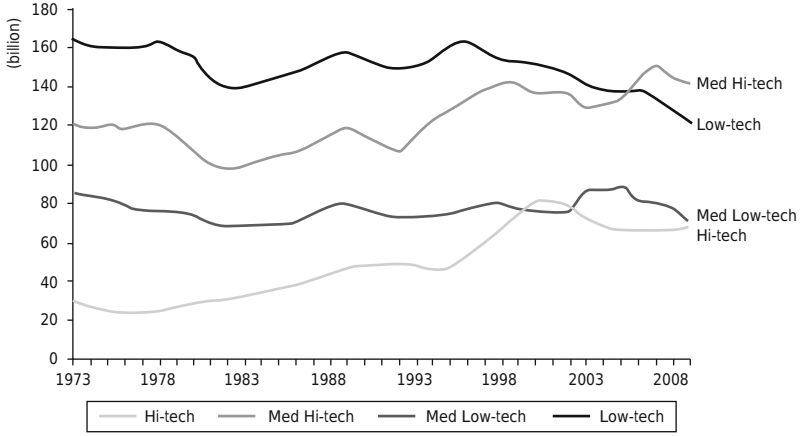

Figure 2.4 Real gross output by sector in UK manufacturing, 1973–2009 (2000 prices) (defined by the technology employed)

One further benefit of this definition is that it is open-ended. For example, the current *monozukuri* debate in Japan has been extended to include the pursuit of advanced technologies, capture of more diverse markets, sustainability concerns and other key social trends, and responding to increasingly complex manufacturing systems.

Remaking an image involves refreshing long held truths and adding new associations. To do this, the manufacturing sector needs to do the following three things: (1) move away from a narrow high-tech focus and talk about the broad range of making activities including fashion, food, luxury and even digital products such as apps; (2) focus on the art of making to remove many of the anachronistic associations with smoke-stacks and factory lines and build new associations with design, craft and innovation; and (3) discuss the very real economic achievements of the sector with a particular focus on exports, innovation and national reputation (as identified in Chapter 2). Finally, the sector also needs to counter the myth that the "UK no longer makes things" by pointing out that Britain produces more manufactured goods in absolute terms now than ever before (Broadberry and Leunig 2013, p. 4); it is just that the composition of what is produced has changed (see Figure 2.4).

Conclusion

Manufacturing insiders agree that the sector has an image problem despite having a good story to tell. However, the sector needs to think

bigger when it comes to remaking its image. For example, while the automotive industry recognizes the reasons for its poor image and the need to overcome it in order to attract and retain staff and encourage stakeholder support, it often focuses on narrow arguments, for example identifying their environmental innovation or low-carbon innovations as being attractive to young people. We believe these approaches are bound to fail, simply because they do not address the reasons for poor image, the resulting associations people have of the sector, and build a strong enough case to overcome them. Instead, manufacturing needs a complete makeover by being embedded in the re-emerging interest in making and creativity, selling its successes, informing people of the realities of modern manufacturing, and moving on from simplistic one-shot solutions such as high technology that often reinforce negative perceptions or at the very least under-sell the potential of the sector as career path, investment opportunity and political opportunity.

3
The Future of Manufacturing Debate

Introduction

This is far from the first book to examine the future of manufacturing in the UK. In this chapter we review much of the research and policy work on the subject. Individually, the vast majority of reports and academic articles are well researched, thoughtful, empathetic to manufacturing, and rigorous. That said, as with all debates they do share some underpinning assumptions that are worth surfacing and even challenging. In reviewing this work, we have identified four key drivers or foci believed to be critical for sustained manufacturing performance in the UK. We've labelled these "high value", "innovation," "ecosystems" and "business model". On the surface these all seem uncontroversial, and certainly critically important. On closer investigation, however, we believe the future of UK manufacturing debate is framed too narrowly, oversimplifies the challenge and ignores too much of the reality of this sector's success.

As we identify below, "high value" is all too often code for "high technology", "innovation" all too often equated with STEM (science, technology, engineering and maths), "business model" often relates to productivity improvements, and "ecosystems" all too often limited to industry–university partnerships (particularly linkages between manufacturers and STEM departments). Like the proverbial blind men and the elephant, each of these drivers is not wrong; rather they represent small pieces of the puzzle and if given prominence lead to incorrect conclusions and missed opportunities. Defining manufacturing's future in this way all too often narrows the focus of the manufacturing debate, ignores many of the challenges facing the sector and limits the potential of the sector to grow in the future. We also believe they limit the ability of the

sector to improve its image and appeal more effectively to potential and existing employees, investors and policy-makers.

The pursuit of high value

On the face of it, moving up the value chain makes perfect sense for manufacturers in the UK. As an advanced economy with high wages and living standards, the UK has moved (along with others) away from low value added into high value added sectors where it has particular expertise. These include aerospace, plastic and silicon electronics, biotechnology and pharmaceuticals, new materials and composites, and nanotechnology (Foresight 2013; Pike et al. 2013). Also, many advanced economies have what Pisano and Shih (2009) call an "industrial commons" or a rich set of shared resources including research institutes, expertise, skills, knowledge and industry networks that often provide much of the raw material or ideas for advanced innovations. Commenting on the resilience of the German manufacturing sector, Hanckè and Coulter (2013, p. 20) stated:

> German manufacturing firms innovate by systematically exploiting particular technologies in a variety of high value-added niches. Much innovation is undertaken inside the firm by groups of workers with a high degree of technical skill who are endowed with considerable operational autonomy ….

German manufacturing according to these authors is successful because of its "relentless focus on a small number of high-quality products" (p. 26) produced to quality performance levels that competitors cannot match. Many of the UK's exemplar companies also fit this bill, including Rolls-Royce, JCB, GKN, Jaguar Land Rover, Airbus/EADS, Dyson and so on. As a result many authors identify the need to move up the value chain, often through the development of flexible manufacturing, investments in IT, customization, design and increased productivity through mechanization. Since the UK still has a large low value-added manufacturing sector focused on price competition many believe that this sector needs to move up the value chain to survive (Hanckè and Coulter 2013; Hay et al. 2013; Moffat 2013; Mudambi 2008).

Given the long lead times of many of these innovations, the pursuit of higher prices and margins becomes a necessity in order to amortize the cost of the initial research and development costs. One response to this has been to shift away from standardized manufacturing, in favour

of knowledge intensive value-adding activities including inputs such as research and development and design, and post-production value-adding activities such as marketing, advertising, branding, logistics and service support (Mudambi 2008). The pursuit of higher value is often an economic necessity as well as strategically sensible. As a result, one key to manufacturing's future is to move up the value curve, or to focus on high-value added. The economic imperative driving the push towards higher value is clear when one examines the nature of post-1960s decline in the UK manufacturing. For example:

> Since the mid-1960s, UK manufacturing has shed more than 6 million jobs. One of the results is that most low-value low productivity manufacturing has already disappeared. In the face of competition from low-wage economies such as China, for the vast majority of UK manufacturing there has simply been no alternative to going down the high-value route. (Fothergill and Gore 2013, p.4)

Fothergill and Gore suggest that much of the decline in the UK manufacturing base can be attributed to the closure (or offshoring) of low-value manufacturing jobs (see Table 3.1). Furthermore, they argue that there is no likelihood of these jobs returning given the current political and economic climate and the intensity of international competition from countries

Table 3.1 Manufacturing employment by industry, Great Britain, 1966–2011

Sector	**1966**	**2011**
Food, drink & tobacco	800,000	460,000
Chemicals, pharmaceuticals, etc.	540,000	190,000
Metal manufacture	630,000	230,000
Mechanical engineering	1,260,000	340,000
Instrument engineering	160,000	130,000
Electrical engineering	910,000	130,000
Shipbuilding & marine engineering	210,000	40,000
Vehicles & transport equipment	850,000	270,000
Other metal goods	590,000	90,000
Textiles, leather, etc.	810,000	70,000
Clothing & footwear	530,000	40,000
Bricks, pottery, glass, cement, etc.	360,000	100,000
Timber, furniture, etc.	310,000	160,000
Paper, printing & publishing	640,000	210,000
Other manufacturing	330,000	270,000
All manufacturing	**8,940,000**	**2,740,000**

Source: Fothergill and Gore (2013, p. 8)

such as China as well as other low-cost, fast-emerging nations. While they suggest some low-value-added firms may be able to survive in specialist niches, competitiveness for the majority of the sector will be driven by a combination of high value and high productivity.

It is widely accepted that moving up the value curve is a strategic necessity for UK manufacturers. Not only has manufacturing in the UK declined relative to other sectors, but share of whole-economy value added has also fallen. Hay et al (2013) identify others such as France, Germany and Japan experienced similar declines, although the rate of decline was much less than that experienced by the UK (see Tables 3.2 and 3.3). This also occurred during a period where UK economic growth was higher than in other competitor countries. Since manufacturing's share of employment also fell more sharply in the UK than in other industrialized nations, it is perhaps not surprisingly that analysts link the two, arguing that the pursuit of high-value added is essential for maintaining current job levels not to mention ensuring those jobs remain in the future.

The pursuit of high value is often why many manufacturing firms relocate their production offshore while retaining local operations for research and development, design, marketing and service support (Foresight 2013). Dyson is one such example, retaining its value-adding expertise in the West Country but shifting most of its manufacturing to Malaysia. As Pisano and Shih (2009) explain, where production involves no specialized expertise it should largely be contracted out to overseas suppliers or located offshore. Thus niche manufacturers such as the Morgan Motor Company retain their production base in Malvern Link precisely because so much of the value added in their cars is derived from very specialized craft skills that are difficult to replicate offshore. The outlook for job retention in food manufacturing also reflects this dynamic. While some have suggested some reshoring will occur as costs rise in China, or concerns emerge about quality control and the protection of proprietary technologies, most predict this will be relatively modest (Fothergill and Gore 2013).

What do policy analysts mean by high value? A close reading of a range of reports indicates that high value is really code for "knowledge-based or knowledge-intensive" activities that are usually captured in "high-technology" investments (often under the rubric of "advanced manufacturing") (Hay et al. 2013). As the authors of *The Factory of the Future* state: "The study is clear – the FoF [factory of the future] will require world

Table 3.2 Trends in GVA competitor countries

Real GVA growth (% pa):									
Whole economy				**Manufacturing**			**Manufacturing as % of whole economy**		
Country	**1990–2007**	**1990–99**	**2000–07**	**1990–2007**	**1990–99**	**2000–07**	**1990–2007**	**1990–99**	**2000–07**
UK	2.5	2.4	2.5	0.5	0.7	0.1	22.5	17.4	12.4
France	1.9	1.8	1.8	1.5	1.7	0.9	18.6	16.2	12.5
Germany	1.9	2.0	1.5	1.3	–0.1	2.4	28.1	23.0	23.8
Japan	1.4	1.3	1.3	1.2	0.2	2.2	26.1	21.3	20.7
US	2.9	3.2	2.3	3.6	4.6	1.9	17.2	15.7	12.7

Source: Hay et al. (2013, p. 15)

Table 3.3 Trends in employment competitor countries

Employment growth (% pa):									
Whole economy				**Manufacturing**			**Manufacturing as % of whole economy**		
Country	**1990–2007**	**1990–99**	**2000–07**	**1990–2007**	**1990–99**	**2000–07**	**1990–2007**	**1990–99**	**2000–07**
UK	0.6	0.3	0.7	–2.9	–1.8	–4.2	19.3	15.2	10.7
France	1.0	0.8	0.8	–1.6	–1.7	–1.9	20.4	15.9	13.1
Germany	0.2	0.2	0.0	–2.0	–2.9	–1.1	29.7	22.1	20.5
Japan	0.0	0.3	–0.3	–1.8	–1.8	–1.9	23.4	19.1	17.4
US	1.2	1.6	0.6	–1.3	–0.1	–3.0	15.7	13.3	10.3

Source: Hay et al. (2013, p. 15)

class organization, people and technology working to find creative and innovative ways of adding value" (Ridgway et al. 2013, p. 7). Table 3.4, for example, identifies how analysts frame manufacturing in terms of technology – low, medium and high (the latter being viewed as the most desirable). High technology is simply equated with high value (necessary to recoup high costs) whereas low technology is associated with low cost. Moffat highlights the relationship between future strategy, technology levels and competitiveness: "This move towards more advanced manufacturing is a more obviously beneficial process as high-tech manufacturing has higher levels of productivity and is therefore likely to pay higher wages and offer higher returns to investors" (2013, p. 61). Why? First, high-technology sectors enjoy strong global demand and require expertise in innovation and rapid new product development. Thus, they represent a smart bet for the future and enable developed economies to draw on capabilities in research and development, design and innovation. For example, the Department of Business, Innovation & Skills (BIS) (2010) note that the UK has a competitive advantage in this area and urge a further up-skilling of the workforce to sustain this edge. Moffat's (2013) analysis also highlights that although all sectors of manufacturing declined in GVA, high tech suffered the smallest fall. Second, there is a belief that high technology is where high-cost countries have a competitive advantage since the manufacture of these goods is knowledge intensive and less likely to therefore suffer from commoditization (Hay et al. 2013, p. 20) and a highly skilled workforce is able to deploy technology to adapt quickly to market-place changes or add value through services and supply chain management (Foresight 2013). Third, high technology is often viewed as a means of increasing productivity (through labour substitution) (Moffat 2013).

The emphasis on high technology as the means to achieve high-value added underpins many reports on the future of manufacturing (see, for example, Ridgway et al. 2013). The stress on technology relates not just to the production of high-tech goods, but also to the use of technology to add value at every stage of the production process (including the innovation and post-purchase stages) and to use technology to adapt more quickly to shifts in demand and the competitive landscape (Ridgway et al. 2013). For example, framing much of the policy suggestions in the Office of Science's "The Future of Manufacturing Report" (Foresight 2013) is the recognition that manufacturing has shifted from being about merely transforming raw materials into physical products primarily through semi-skilled workers to the strategic combination of highly skilled employees and high technology as a means of competing

Table 3.4 SIC Definitions of manufacturing technology

Manufacturing Sector	SIC (2003) Definition
High-technology manufacturing	Manufacture of pharmaceuticals, medicinal chemicals and botanical products
	Manufacture of office machinery and computers
	Manufacture of radio, television and communication equipment and apparatus
	Manufacture of medical, precision and optical instruments, watches and clocks
	Manufacture of aircraft and spacecraft
Medium-technology manufacturing	Manufacture of coke, refined petroleum products and nuclear fuel
	Manufacture of basic chemicals
	Manufacture of pesticides and other agro-chemical products
	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
	Manufacture of other chemical products
	Manufacture of man-made fibres
	Manufacture of rubber and plastic products
	Manufacture of other non-metallic mineral products
	Manufacture of basic metals
	Manufacture of fabricated metal products, except machinery and equipment
	Manufacture of machinery and equipment
	Manufacture of electrical machinery and apparatus
	Manufacture of motor vehicles, trailers and semi-trailers
	Building and repairing of hips and boats
	Manufacture of railway and tramway locomotives and rolling stock
	Manufacture of motorcycles and bicycles
	Manufacture of other transport equipment
Low-technology manufacturing	Manufacture of food products and beverages
	Manufacture of tobacco products
	Manufacture of textiles
	Manufacture of wearing apparel; dressing; dyeing of fur
	Tanning and dressing of leather, manufacture of luggage, handbags, saddlery, harness and footwear
	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
	Manufacture of pulp, paper and paper products
	Publishing, printing and reproduction of recorded media
	Manufacture of furniture; manufacturing
	Recycling

Source: Hay et al (2013, p. 19)

in global markets. For example, the following three quotes represent new definitions of manufacturing:

> The new era of manufacturing will be marked by highly agile, networked enterprises that use information and analytics as skilfully as they employ talent and machinery to deliver products and services to diverse global markets (McKinsey & Company 2012, cited in Foresight 2013, p. 16)
>
> The application of leading-edge technical knowledge and expertise for the creation of products, production processes and associated services, which have strong potential to bring sustainable growth and high economic value to the UK. Activities may stretch from R&D at one end to recycling at the other. (Technology Strategy Board 2012, cited in Foresight 2013, p. 16)
>
> The world is in the midst of a paradigm shift in the 21st century – one that integrates diverse sets of ideas, products and services globally through the lens of highly complex, integrated and self-morphing resource webs … Highly talented skill people are necessary to effectively and consistently apply cutting edge science and technology, systems thinking, smart services and processes, and supply chain excellence. (Deloitte 2013, cited in Foresight 2013, p. 16)

These quotes frame how the Government's Office for Science views the future of manufacturing. Competitiveness will be driven primarily through investments in technical skills that feed into product development, customer-focused services and business models. By 2050, the factory of the future is predicted to be very different from today and in particular will involve developing and exploiting technology to respond faster to market changes (Foresight 2013; Ridgway et al. 2013). Investments in cutting-edge science and technology are given particular prominence as these are believed to be the basis of future competitiveness given the UK's high cost base and recognized expertise in particular scientific and technological disciplines.

In summary, policy analysts equate high value added primarily with the use of high technology. In so doing, they focus much of their energies on the needs of those sectors they declare are high tech (see Table 3.4). High technology is identified as a source of competitive advantage because the skills involved in developing and using it are difficult to imitate, the outputs can be protected via copyright and are thus less likely to be copied and subject to commoditization, and developed economies such

as the UK have an industrial commons which gives them advantages in certain high-tech clusters such as those listed in Table 3.4. In framing the value debate this way, policy analysts and industry insiders often stress the need for certain investments including greater attention to research and development, commercializing these innovations and investing in STEM based subjects – all of which form the basis for the next section.

Success through innovation

In order to capture high value and remain competitive, UK manufacturers are urged to invest in the capabilities necessary for product, service and process innovations. Drawing on the same logic that encourages advanced economies to move up the value chain in the face of low-cost competition from abroad, economists, policy analysts and industry insiders argue that innovation is critical to future manufacturing success since it enables firms to stay ahead of competitors, draw on knowledge capabilities that often developing economies do not have, capture high margins, first-mover advantages and market share, and protect against imitation through the development of proprietary technologies and skills. Innovation in this sense does not just involve pure science, research or invention, but the successful commercialization of these into desirable products that can be sold globally. For example:

> "But, prosperity flows not from invention or patents but innovations that translate into a stream of new products and services, which are then scaled-up in a way that creates jobs and opportunities for the whole population" (O'Sullivan and Mitchell 2013, p. 42).

Although manufacturing is the major private sector investor in research and development investment, evidence suggests the UK still lags significantly when compared to other OECD nations. The UK ranks just 19th in the OECD, spending just 1.1 per cent of GDP on research and development (well behind the US for example at 2.5 per cent (fourth), Japan at 2.0% (eighth) and Germany at 1.9% (ninth)). Also, half of this investment is done by foreign owned firms operating in the UK, while 60 per cent comes from just five sectors: pharmaceuticals, computer and software services, motor vehicles, aerospace and telecommunications.

Such results led the European Innovation Commission to characterize the UK as an "innovation follower" when compared with "innovation leaders" such as Sweden, Denmark, Germany and Finland (Hay et al. 2013, p. 36). Despite strengths in human resources, openness, research

systems and finance and support, the UK lagged in firm-level investments, intellectual assets such as patents and innovators. In relation to this last point, UK firms struggle to commercialise (or take to market) new products and introduce new product and process innovations. Importantly, despite strengths in human resources, as Hay et al. (2013) note, this relates primarily to the percentage of the population with university degrees rather than possessing the skills necessary to engage in the type of innovation manufacturing requires – surveys among manufacturers regularly identify skill shortages as a key challenge (Foresight 2013; Livesey 2013).

As a result of these limitations, Hay et al. (2013) suggest UK manufacturers should specialize in early stage innovations or the research and development and design stages of the innovation process (standard innovation models such as the stage-gate model allocate these functions to the front end of the innovation process whereas manufacture and launch occur at the latter stages) as these are the areas where local manufacturers have the most capability and also are most likely to generate intellectual assets such as patents that can be protected and exploited. Others have suggested a similar focus. Ridgway et al.'s (2013) survey of leading manufacturers finds support for product rather than process innovation, simply because process innovations involve a wider scope of change including working practices, organizational structures, measurement systems, technological investments and so on. Managers also stressed product innovation takes precedence in many of their firms and often drive subsequent process innovations. Mudambi (2008) suggests a similar approach, calling on high-cost countries to focus on high value-added activities that leverage research and development and marketing knowledge and leave production to low-cost labour countries that have advantages in low-technology production processes.

In their analysis of the "factory of the future", Ridgway et al. (2013) identify that "people" investments will be key to future competitiveness. In particular, manufacturers must be able to attract and retain talent, encourage creativity and innovation, and develop multi-disciplined teams to generate new innovations. In order to achieve this type of strategy, investments in the knowledge base in necessary. Given that value is thought of in terms of high technology, and the focus is on the early stages of innovation, it is not surprising that many authors equate innovation capabilities with investments in STEM skills and identify a need to increase the number of graduates in these subjects (Foresight

2013; Hay et al. 2013). (One further reason for the stress on STEM is that 30 per cent of the most experienced engineers will retire over the next decade – as the previous chapter identified engineering is not seen as a positive career choice by students.)

An emphasis on STEM partially reflects identified future areas of potential for high-value manufacturing in the UK. Bryson et al. (2013, p. 51) suggest that the next industrial revolution will involve innovations that integrate new materials, coatings and electronics into new products, for example. This emphasis on STEM skills as the basis for manufacturing innovation and future competitiveness is widely shared among sector analysts in developed economies, with the Foresight team (2013, p. 31) identifying a greater need for suitably STEM-qualified apprentices and technicians, and degree-qualified staff particularly in the areas of product design and development (and an improved sector image to attract them). For example, in their review of international approaches to manufacturing futures, O'Sullivan and Mitchell (2013, p. 41) drew on the post-Second World War experience of many Western nations to identify key success factors for manufacturing competitiveness:

> Key framework conditions that set the stage for advances in manufacturing include government investments, availability of a high-performance workforce, IP regimes, cultural factors and regulations. Also critical to manufacturing are capital, especially early stage VC [venture capital]; a workforce knowledgeable in science, technology, engineering, and mathematics disciplines; immigration policies; and industry standards.

The connection between high value = high tech and the stress on early stage innovation reinforces the emphasis on STEM-based skills. Researchers, for example, stress the need to move away from mid-level and low-skilled roles towards higher-qualified staff. Ridgway et al. (2013) call for the sector to deskill traditional process and craft skills such as machining and welding in favour of re-skilling in new advanced technologies including an emphasis on information technology. Furthermore, policy analysts often equate Britain's strong performance in science (reflected in Programme for International Student Assessment (PISA) scores) as being "favourable to manufacturing" (Broadberry and Leunig 2013, p. 47) or, as we saw in the previous chapter, equate knowledge of manufacturing with an understanding of engineering (Livesey 2013).

This is now increasingly identified as an issue by policy-makers. A review by Tera Allas (2014), former BIS Chief Economist in early 2014,

which benchmarked the UK's performance in science and innovation, highlighted the areas that were constraining the UK against comparable countries. Despite undoubted research excellence, strong higher education institutions and a favourable business environment the report found that the UK was still experiencing weaknesses in its talent base by lacking skills at almost all levels required – basic skills, STEM skills and management skills. It also stressed that the persistent underinvestment in R&D, which amounted to just £27 billion in 2011 and which has been more or less static since the early 1990s as a percentage of GDP was threatening to jeopardize "the breadth and depth of science excellence required to underpin our industrial success and the capacity of our firms to absorb and apply new knowledge and ideas". As the report reminds us, given that 80–90 per cent of innovation in advanced economies in the now increasingly globalized world is based on technology transfer from other countries, the UK must have the ability and skills to exploit cutting-edge global research. Nowhere is this more relevant and critical than in manufacturing where remaining competitive carries such a premium.

In summary, by equating high value with high tech, and identifying the UK's expertise in early stage innovation, a focus on filling perceived skill gaps in science, technology, engineering and maths follows. Such an approach suggests a very particular approach to innovation – in this case a STEM-push model whereby manufacturers focus on developing in-house or through collaboration with research institutions breakthrough products that can be patented and thus provide a source of advantage over low-cost competitors. This will be combined with the use of technology to drive further process innovations in order to ensure greater productivity and improved quality. One further result of this is to identify the importance of leveraging links with universities as a means of both generating new innovations but also improving the supply of suitably qualified employees – a topic we examine next.

Ecosystems

Historically the dominant model for manufacturing was vertical integration. That is, firms did everything in-house, from research and development through to design, manufacturing, and sales and marketing. This model has long since given away to a much more networked model, involving global supply chains, sub-contractors, alliance partners, and relationships with research institutions and local government and financial providers. In order to achieve high value through innovation manufacturers increasingly work within what we call an "ecosystem".

As Chief Scientific Officer Sir Mark Walport stated in a BIS press release, "The UK needs to look at manufacturing in an integrated way" (14 December 2011). The Foresight (2013) report identifies the need to strengthen what we call an ecosystem, including greater use of the High Value Manufacturing Catapult Centre as well as greater links between science, technology, innovation and industrial policy. Bryson et al. (2013) add to this view, identifying how the majority of the UK's manufacturing sub-sectors are clustered together, suggesting that future resilience will be a function of regional strength (and vice versa).

Analysts have highlighted the advantage of this ecosystem across different nations (Berger 2013; O'Sullivan and Mitchell 2013; Pike et al. 2013), identifying the benefits German manufacturers derive from their *Mittelstand* system and US firms gain from what Pisano and Shih (2009, p. 3) call an "industrial commons", defined as "the shared industrial engineering know-how and capabilities in a manufacturing-based industrial cluster".

By analogy with common pasture in medieval villages where residents grazed their livestock together, Pisano and Shih argue that the "industrial commons" provides clusters of manufacturing-related firms (in particular small and medium-sized enterprises (SMEs)) with an opportunity to draw upon a set of clustered capabilities and know-how: materials, machine tools, production technologies, fabrication facilities, technical standards, measurement, testing and so on, thus enhancing innovation capabilities. The latest Innovation Report by BIS (2014) seems to have taken these thoughts on board, at least in terms of the language it uses as it argues in its executive summary that "the phrases 'innovation' and 'innovation system' have a broad meaning in the report which covers the full range of inter-connected institutions, policies and practices". By that they mean the "whole innovation system including the knowledge base in universities and elsewhere, the innovation infrastructure and the business community".

In their review of international approaches to the future of manufacturing O'Sullivan and Mitchell (2013, pp. 52–53) identify a number of factors that reflect an industrial commons including the need for policy-makers to take an ecosystem view of manufacturing, the interdependence between manufacturing and innovation (e.g. the UK Catapult initiative), public–private partnerships, technical standards and competitiveness, leveraging science and technology foresight studies, and using manufacturing to address future societal challenges. For example:

> Not only are many of the most important modern high tech products themselves systems, but their manufacture relies on a range of

> industries contributing and integrating components, applications subsystems, production systems and service systems. Furthermore, modern manufacturing systems are constructed around supply chains which may interact in highly complex ways. Many policy-related recommendations point to the importance of government taking an "ecosystem" view of manufacturing; also highlighting that many of the most important manufacturing-related challenges (e.g., industrial sustainability) require "whole systems approaches". (O'Sullivan and Mitchell 2013, p. 5)

Given the stress on STEM as the driver of innovation it is not surprising that a key actor in studies on UK manufacturing ecosystems is the university sector – as Bryson et al. (2013, p. 58) state,

> "manufacturing policy provides an opportunity to reframe the engagement of research universities in national and regional innovation systems".

Since manufacturing sectors are often clustered in regions, local universities often have established expertise in important subjects such as engineering or chemistry. The new automotive group, for example, emphasizes the need for wider collaboration between the sector and universities as well as gaining support for such initiatives with the relevant research councils (NAIGHT 2009). Rolls-Royce, for example, have a global network of university technology centres and advanced manufacturing centres although, as many note, this firm's practice is the exception rather than the rule. Bryson et al. (2013) suggest that links between research institutions and innovation represents one (albeit complex) aspect of an ecosystem's infrastructure. As they state: "Ideally there should be a supportive research and innovation ecosystem with developed relationships between research institutions, universities and private sector businesses". (p. 42) Ridgway et al. (2013, p. 36) stress the need for manufacturers to "make greater use of the "untapped potential" for collaboration between manufacturing companies and UK universities". Why? Partly because this will enhance the employability of graduates and the supply of those highly skilled workers – skills that universities are best placed to develop (Bryson et al. 2013). The following quote identifies what these authors mean by a whole-systems approach as well as drawing the links between high-technology outputs and inputs, the

innovation underpinning a high-tech value focus, and the supportive ecosystem:

> Thus, manufacturing companies have a need for the latest thinking, for new ideas, for innovation (and not just in engineering and technology). Universities have thousands of talented people potentially looking for projects, R&D opportunities and exposure to the day-to-day reality of operations. Furthermore, universities are perpetually refreshing their skills and capabilities through young talent and aspiration. (Ridgway et al. 2013, p. 26)

Regions with strong universities often attract start-ups and manufacturers looking to capitalize on such links – the large number of start-ups surrounding Cambridge are just one example of this, the established expertise in engineering of the University of Birmingham supports the strong manufacturing sector in the Midlands area, while the University of Sheffield provides similar services. As well as closer links between researchers and the manufacturing sector, many call for closer alignment between university education provision and the needs of major industrial sectors (Bryson et al. 2013).

In summary, a "systems" or "ecosystems" view of manufacturing is identified as a key driver of current and future manufacturing success (see further elaboration in Chapter 8). In particular, greater links between university departments, research granting bodies and manufacturers are believed essential to the innovation necessary to achieve high value added through knowledge-intensive high-tech products and processes. International reviews of manufacturing systems identify the benefits deriving from an industrial commons of which many universities and research institutes form part. As well as universities, ecosystems are made up of other firms, standards setting bodies, policy-makers and suppliers, all of which provide many of the inputs to the modern factory that were once provided in-house. Together these three interrelated drivers of success (high value, innovation and ecosystems) need to be underpinned by successful business practices – the subject of the final section.

Business model

The final driver of future success for UK manufacturing involves considerations of the strategies, structures and skills needed to compete, or what we label "business model". Much of the analysis here is driven

by standard strategic techniques such as PEEST (political, economic, environmental, social and technological trend) analysis. When done well, this type of analysis attempts to make accurate predictions of likely future scenarios based on extrapolations from emerging trends and current practice as well as careful assessments made regarding the likelihood of such trends occurring and their level of impact should they occur. Although this type of forecasting is always difficult and invariably subject to error, nevertheless much of the material we reviewed draws from a wide range of reports, shifts and trends that are believed to shape how UK manufacturers need to compete in the future.

For example, Bryson et al. (2013, p. 51) identify the need for greater resource efficiency, improvements in the efficiency and effectiveness of manufacturing systems, new streams of innovations, agile and cost-effective manufacturing processes, and new business models to enhance profitability, competitiveness and the global position of the UK manufacturing sector. Hay et al. (2013) identify that global demand will change due to an aging population in developed economies and increased wealth in the developing countries, an increased rate of technological change, the continued shift towards global supply chains and the increased use of value adding services by manufacturers. Drawing on these trends, Hay and colleagues propose that future competitiveness will require UK manufacturers to exploit new markets, increase investment in research and development, continue to move up the value chain through investments in quality (as a means of covering relatively high costs), increasing investments in STEM skills and focusing in areas of comparative advantage such as (but not limited to) investing in value-adding services.

Such an approach focuses on trying to adapt to changes in the external environment. This environment is considered to be an exogenous factor over which individual firms, and as a result of globalization individual nations have little control. Thus manufacturing firms are encouraged to invest in practices that enable them to maintain an edge over their competitors while policy-makers draw on these external shifts when considering their options (such as the belief in the need to move up the value chain or engage in high-tech innovation). The UK has performed relatively well here with output growth driven primarily by investments in productivity-enhancing technologies and processes (Bryson et al. 2013). One of the most dominant discourses in manufacturing policy is the focus on productivity. Productivity is important because it enables firms in high-cost countries to maintain price competitiveness with those in low-cost countries. Productivity increases are also sought

because of beliefs held by many economists that productivity improvements will lead to increases in market share, which in turn will increase productivity and enable decreases in marginal costs (Broadberry and Leunig 2013). Finally, firms with high levels of productivity are believed to be in the strongest position to export (Foresight 2013).

Others have identified others business-model drivers of future success. One of these is combining manufacturing with added services (Foresight 2013). Rolls-Royce and BAE systems, for example sell not just goods but integrated packages that emphasize solutions, outcomes and experiences (Pike et al. 2013, p. 31). Rolls-Royce estimates that close to 50 per cent of their sales involve services. Sissons (2011a) identified that 28 per cent of manufacturing firms in UK consider themselves to be providers of what he calls "manu-services", and suggests many more are without realizing it (it is difficult to calculate accurate figures because services and manufacturing are classified under separate SIC codes). Sissons estimates at least 2 per cent of GDP or £24–35 billion is derived from manu-services. UK manufacturing firms export 14 per cent of services in comparison to the US with 55 per cent and just 2 per cent for China (Sissons 2011a).

A recent *Harvard Business Review* (2014) article entitled "Europe's Solution Factories" identified how adding value through services was the means by which many of Europe's leading manufacturers were competing against lower cost competitors (Chick et al. 2013). Analysing the strategies of Europe's Industrial Excellence Award winners they found:

> The award winners use one or more of four distinct strategies: They leverage data flows to integrate closely with their supply chain partners; they optimize customer value across the whole chain, not just their part of it; they cooperate with suppliers to rapidly improve their manufacturing processes; and they harness their technical capabilities to offer a high degree of product customization for their customers. (Chick et al. 2013, p. 112)

This strategy is known as "servitization". As Pike et al. (2013) note the shift to servitization or manu-services represents a different form of innovation – what they call "soft innovation" or non-technological innovation. As they state:

> This raises the challenge for manufacturing businesses in thinking how new packages of goods and services can meet existing, new and unmet needs and how this might be profitably and sustainably

> delivered. This may involve the ways in which manufacturers interact with their customers and suppliers a well as how they organise their innovation activities and marketing. (p. 32)

Servitization is the latest in a range of strategies believed to provide manufacturers in high-cost countries with an enduring competitive edge. In this case, providing the types of solutions identified by the *Harvard Business Review* authors draws on resources that are hard to replicate because they involve access to and use of proprietary customer data, relationship management, flexibility or rapid adaptation, and the ability to customize products (particularly business-to-business ones), all of which draw on very specific knowledge-based capabilities. This emphasis on knowledge-intensive capabilities underpins much of the analysis on value adding through high-tech and STEM-driven innovation, as well as alternative manufacturing models (Voss 1995, 2005), while investments in technology are believed to be central to any future business model (Foresight 2013).

As well as servitization, productivity and innovation, there is a range of other proposed capabilities that UK manufacturers need to invest in, in order to keep up with or move ahead of other global competitors. These include leveraging customer data (often called "big data"), making further improvements in time to market especially for mass customized products (although the jury is out on whether such a strategy can be profitable), using design to generate customer-desired innovations, further investments in supply-chain management, focusing on emerging market niches (as identified above), upskilling the workforce and becoming more sustainable. In regards to the last opportunity, the Foresight (2013) report identified the need for manufacturers to address the challenge of the emerging "circular economy" whereby firms develop "cradle to grave" innovation policies that see them taking responsibility for their products once they have reached the end of their life. The Foresight team identify a number of areas requiring manufacturers' attention including reuse, remanufacturing, salvaging, recycling and recovery. This will require not only clever design solutions but also investments in resource efficiency and material substitution.

McLaughlin (2013, p. 5) described these as future-oriented best practices. Future oriented was contrasted with the types of practices needed to manage in existing markets (such as lean production or quality management) while best practices were identified from trend reports, and are defined as the soft skills necessary to meet marketplace challenges in the future. In particular he focused on ten future-oriented best practices:

supply-chain agility and clustering, application of new technologies, engagement with universities, education of manufacturing personnel, new product development and innovation management, knowledge management, data analytics, leadership practices, change management and implementation of best practice, productivity in product-service systems and sustainable manufacturing systems. McLaughlin's findings identified that on these measures the skill level of UK managers was below global competitors such as the US, Japan, Germany, Sweden and Canada while on a par with Australia and France. These skill deficiencies are particularly critical when one considers Moffat's (2013) finding that the UK-owned manufacturing sector accounted for much of the underperformance in total factor productivity between 1997 and 2007.

In summary, on top of (and as part of) investments in high value added, innovation and ecosystems, manufacturers need to develop business models or capabilities in a range of areas in order to keep up with other developed nations and stay ahead of lower-cost, developing countries. This section has skimmed the surface of the work done in this area primarily because much of the focus has been on capabilities that are necessary for competing today (for example, lean production, strategic outsourcing, quality management and cycle time improvements) rather than in the future. Instead we identify a range of emerging skills believed to offer UK manufacturers commercial opportunities as well as being necessary to future competitiveness. In so doing, we identify the logic underpinning this argument – the need to adapt or fit one's skill base to changes in the environment.

Assessing the evidence

The above sections identify what we believe are the dominant discourses surrounding the future of manufacturing debate in the UK. We identify how these interrelate in Figure 3.1. Although alternative views may exist they do not reflect the dominant policy narrative. And, even though many of the authors cited above qualify their findings, the centrality of the four themes above remains. This is not to say the advice is necessarily poor or misguided. Much of what is proposed is entirely necessary – moving up the value chain makes very good sense, innovation is indeed necessary for survival not just growth, an ecosystems view of manufacturing is essential and the right business model is critically important. Also, much of the content of this advice is good. However, the assumptions driving these studies need challenging as we believe the current debate does the potential of the needs sector a disservice and

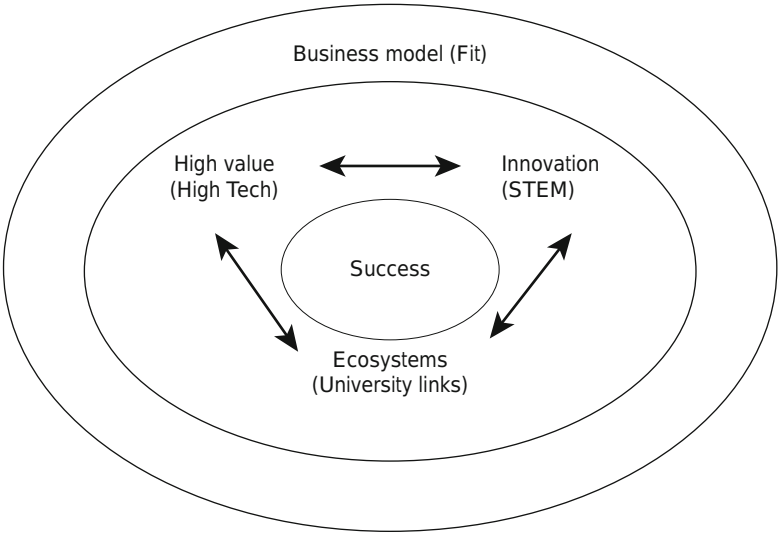

Figure 3.1 The future of manufacturing debate

indeed, may ignore or obscure important drivers of UK manufacturing success.

The sections above identify several assumptions underpinning future manufacturing competitiveness. First, that high value added is a function of the use and production of high tech. Second, that innovation is primarily achieved through a science or technology push model. Third, ecosystems primarily require greater links between the university sector and manufacturing. Fourth, firm competitiveness is achieved by building a closer fit between firms and their shifting environments. We consider each of these briefly. In Chapter 4 we will explore in more detail what we believe are some crucially omitted strategies underpinning the UK manufacturing sector.

A number of authors have challenged the value of splitting up industries into technology clusters. Sissons (2011a) for example argues such a low- vs. high-tech binary is false and fails to reflect the reality and diversity of the sector. First, studies suggest that process-embedded innovations may be extremely low tech but also are unlikely to be outsourced since it is the knowledge embedded in the doing or making of these products that provides a competitive advantage and thus protects against low cost competition (Pisano 2009). Thus, low-tech production such as food and drink offers much potential for employment. In contrast, although

so-called high-tech products such as pharmaceuticals require a lot of specialist knowledge to develop, the manufacturing of these products is fairly straightforward and thus likely to be subject to cost competition (Pisano and Shih 2012). This work will be explored further in Chapter 6 where we consider a range of possible innovation models.

This point is also important when one considers that the UK's performance in high tech has been below that of other nations and much of the UK manufacturing base is still medium and low tech. In regards to low tech, areas subject to cost competition (textiles and clothing), declining demand and margins generally (paper) or locally (tobacco – in which manufacturing was shifted offshore to meet demand in export markets) have fared poorly. However, so called low-tech sectors such as food and drink and paper, printing and publishing actually grew in terms of employment between 1973 and 2009 by 4 and 5 per cent respectively (in comparison high-tech employment grew by just 2.34 per cent over the same period (Moffat 2013)). In regards to food and drink, while agriculture contributed less to the overall economy, evidence suggests that a focus on value adding through manufacture, a focus on quality, and increased emphasis on branding and uniqueness is generating results (Hay et al. 2013). While advanced economies may struggle to compete in low-tech sectors on price many of them compete in very high-value markets by drawing on strong brands, craft traditions, early-mover advantages, high quality, reputations for purity and cleanliness and so on (issues we will cover in Chapters 5 and 6).

Second, a number of authors promoting what is called "smart industrial strategy" suggest that arbitrary technology classifications result in poor policy solutions and potentially lead policy-makers away from sectors with significant potential for value added. Instead, these authors suggest a greater appreciation for the diversity of the sector and targeted policy support. For example:

> Going beyond the overly broad categories of high, medium and low technology, smart approaches seek more tailored and targeted forms of support. These attempt to respond to very different requirements and geographies, for example, between traditional manufacturing such as food processing and science-based industries such as medical instruments. (Pike et al. 2013, p. 23)

The call for greater appreciation of the diversity of the sector is especially poignant given that many of those using technology classifications question their value. For example, Hay et al. (2013, p. 43) find the

available evidence suggests there is little evidence that the UK specializes in adding value through high technology if one equates high tech with knowledge-intensive processes, and conclude "an industry sector analysis is not sufficient in identifying those manufacturing activities and types of products that are high-tech" (p. 43).

Third, part of the narrative regarding the shift to high tech also involves the need to use technology as an input to achieve many of the business solutions identified above (all of which are very good things and should be pursued) and improve productivity. In regards to productivity however, a high-tech focus is likely to involve labour saving technology, thus limiting employment growth (Rowthorn and Coutts 2013). In regards to high-tech sectors such as aerospace and pharmaceuticals, Moffat (2013, p. 24) concluded: "As these manufacturing sectors are those in which the UK may be thought to have a comparative advantage, it is concerning that they have not increased their employment, even during periods in which output has been rising rapidly." Bryson et al. (2013, p. 5) identify that the sector's relative decline in the UK economy is attributable more to a fall in employment rather than output, characterizing output growth as "jobless growth based on improvement in productivity". Further evidence in the UK and Germany suggests this is the case, with Moffat (2013) attributing the continued resilience of Germany's large manufacturing sector (still 20 per cent of GVA) to increased productivity through employment-saving technologies. In the UK, low-tech manufacturing still accounts for 39 per cent of share of manufacturing employment, while medium tech is 48.9 per cent and high tech 12.1 per cent. Importantly, the former two are relatively stable with low tech having grown slightly (Hay et al. 2013).

One can also question whether STEM driven innovation is also the only or even main way forward. The focus on STEM skill shortages obscures the real needs of the manufacturing sector – as many commentators note, the complex reality of modern manufacturing means employers will need to access and retain the very best of talent from a range of disciplines of which STEM will play just one part. For example, quoting a World Economic Forum (2010) report, O'Sullivan and Mitchell (2013, p. 50) state: "Today's skills gap will not close in the near future. Companies and countries that can attract, develop and retain the highest skilled talent – from scientists, researchers and engineers to technicians and skilled production workers – will come out on top." Others have noted that since manufacturing is more than making things, non-STEM skills are just as essential to future manufacturing success. For example, with the shift towards servitization as

well as the need for unique designs and strong brands Sissons argues that manufacturers need to attract large numbers of designers, operations managers and marketers as well as engineers and scientists. As he states: "Knowledge intensive processes, such as product development, design and branding, are becoming increasingly important as sources of value to manufacturers" (Sissons 2011a, p. 13). In their analysis of the factory of the future, Ridgway et al. (2013) echo this predicting that future competitiveness will involve a highly skilled IT literature workforce, greater emphasis on product design, optimization and processes management, and the soft skills in managing operations effectively and understanding the customer.

Despite this several authors continue to preference STEM-based skills. For example, although Hay et al. (2013) identify the need to add value through services for some reason they assume that such services will require STEM skills, particularly technical professionals. The Foresight (2013, p. 6) report identifies the need for a workforce with a wider skills base – one that combines commerce and technology – but then concludes that this will likely come from STEM. While a technology or science push model of innovation drives the debate, other reviews suggest this is far too narrow a view. Sissons (2011b), for example, suggests economic growth in a developed economy requires many forms of innovation, not just high tech. As he notes, customers are often a core driver of innovation for manu-service firms (Sissons 2011a), and a customer-centric model of innovation is at odds with science or technology push-models focused on new to the world innovations. This view obviously also applies to beliefs about ecosystems too.

Finally, although much of the work on business models is certainly excellent we believe that many of the suggestions will only provide temporary respite from global competition. Take, for example, the shift to servitization. Although several authors identify this as a means of competing without lowering price or attempting to eke out small quality improvements (which themselves can be easily imitated), the shift to adding value through services is viewed as simply the latest phase of "staying in the game". For example: "Until about a decade ago, the best way to make your manufacturing operations competitive was to apply the practices of lean management. But as those practices have become more universal, they are yielding less differentiation in costs and quality" (Chick et al. 2014, p. 111). By treating historic shifts and current market conditions as relatively fixed or immutable, it is no surprise that research on business models have focused on the next source of staying ahead of the game (be it productivity, cycle time and

benchmarked performance). We believe that much of the present debate fails to appreciate that historic shifts do not equate to "laws" or that present market conditions are far from fixed or immutable. Too much of the present debate treats these as exogenous variables or "givens" and then works back from them to identify how high-cost economies such as the UK can continue to compete successfully. Too much of this debate is framed around a "fit-logic". Although critical, focusing on fitting is like trying to run faster on a treadmill – at some point you either collapse through exhaustion, or realize it's time to try something different.

Conclusion

In this chapter we have examined the dominant discourses driving the future of the UK manufacturing debate. We identified four main foci: the pursuit of high value added, innovation, ecosystems and business models. In examining these four foci, we identified assumptions underpinning each. In particular, high value added is equated with high technology, innovation via STEM push approach, ecosystems are defined as university–business links, and business models focus solely on adapting to future exogenous changes in the environment. We then examined evidence for each of these, identifying that defining the future of manufacturing in this way unnecessarily narrows the debate, limits the potential of the sector and is unlikely to provide the basis for future competitiveness.

The first three drivers are related – that is, if high-technology is the means to added value, unsurprisingly STEM becomes critical for innovation (especially when the UK is believed to have a competitive advantage in early stage research), which then requires closer links with universities and research institutes. These three drivers are also underpinned by the same logic as identified in the discussion about business models – that is, this approach is derived from an assessment of the UK's ability to respond to predicted environmental shifts. Again, while we do not want to downplay how significant these four drivers are, it is important to recognize the assumptions underpinning these debates as well as their implications (for example, do manufacturers really *just* need to attract the best of this country's STEM talent in order to compete?).

While we have briefly criticized this, we have stopped short of identifying an alternative approach or approaches. The next chapter addresses this issue, focusing on the actual practices of UK manufacturers and how they capture value, build capabilities and maintain competitiveness.

4
How UK Manufacturers Create Value

Introduction

Given the conclusion of the previous chapter, it is fair to ask, "How do UK manufacturers compete?" First, we generally think that relating UK manufacturing success to (on top of the necessary macroeconomic policies) value added, innovation, business model and ecosystems is broadly correct. However, we disagree with how these are interpreted. We propose the reality of manufacturing success in the UK (and many other advanced or post-industrial economies) is more complicated and nuanced than much of the extant research would have us believe. In this chapter we offer an alternative approach – one that complements rather than rejects entirely the extant literature. We will support our contentions with case examples.

One cannot but help notice that while high value matters, UK manufacturers, or at least the ones regularly highlighted as exemplars, have invested heavily in branding. This strategy may or may not go hand-in-hand with a shift to high tech – strongly branded manufacturers are just as likely to rely on ancient craft skills as they are on additive manufacturing or pushing back the frontiers of science. This observation has implications for the other three factors behind manufacturing success. The strategic use of branding to drive value implies a business model much more focused on shaping one's environment than on merely fitting existing or predicted future conditions. Under a branded model, the type of innovation is driven by the brand's position or identity – instead of just a STEM-driven approach, there are a range of options including technological push, design-driven, craft, customer-focused, marketing and process innovations. Finally, ecosystems do matter, but under a brand-driven logic not only does an industrial commons count

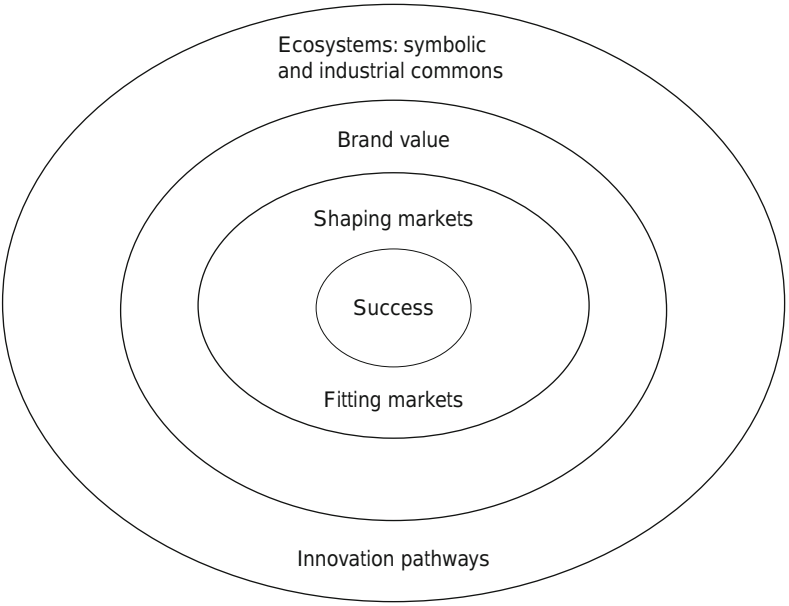

Figure 4.1 The UK manufacturing business model

so too does a "symbolic commons". Figure 4.1 provides a summary overview of this chapter. Although each of these factors will be covered in their own chapters, in this chapter we identify how they interact to drive long-term manufacturing success.

Value added through branding

When you think of UK manufacturing success stories, which companies spring to mind? Assume for a second you are not an industry insider but rather one of the respondents in surveys on manufacturing's reputation (i.e. someone the sector needs to convince of its future potential). We're prepared to bet that the same names would come to mind – AGA, Airbus, BAE Systems, Dyson, GKN, GlaxoSmithKline, Jaguar Land Rover, JCB and Rolls-Royce (which in one sector competes against another brand, General Electric, for global dominance). If one accepts our argument that manufacturing is framed too narrowly, we could add any number of high-profile clothing manufacturers such as Gieves and Hawkes, food and drink manufacturers (e.g. various Scotch whisky manufacturers), as

well as niche producers such as Acme Whistles, Brompton Bikes, Brooks Saddles, the Morgan Motor Company and Pashley Cycles among many others. Also, let's not forget how the revitalization of tired brand icons such as the MINI (by BMW) has helped reinvigorate automotive manufacturing. Each of these seems very different, but the one thing that unites them is the way in which they create value through branding.

Although it's tempting to dismiss branding as wasteful or trivial, or "just a logo", bear in mind that intangible value accounts for over 70 per cent of share-market value today (Arvidsson and Peitersen 2013), and among the largest intangible is a firm's brand. Bryson et al. (2013) identify the need to develop capabilities that develop non-price forms of distinctiveness, among which is branding. Sissons (2011a) identifies that UK firms had invested over £15 billion in brands by 2008 (the last available figure), which represented over 1 per cent of GDP. NESTA (2011) identify investments in intangibles (including research and development, design and brand equity) by UK manufacturers is £35 billion compared with £12 billion in tangibles. This amount represents 20 per cent of the sector's measurable value-added (Pike et al. 2013). Given the difficulties in measuring brand value it is likely this figure significantly underestimates the value of branding to the UK. The NAIGT (2009) team identify the existence of premium brands as being a key strength of the UK automotive sector (second only to Germany in global market share). Sector insider Professor Andrew Graves (2010, p. 10) noted "A company's reputation has begun to matter more now than it has in decades", in a discussion paper on the future of manufacturing. Such is the value of branding activities that while the making of stuff is often sent offshore UK (and US) manufacturers such as Dyson retain their design and marketing expertise at home (Fothergill and Gore 2013; see also Pisano and Shih 2009).

While many myths surround brands (see Chapter 5), firms that view their brands as assets drive their businesses very differently from those who view their brand as a corporate logo or identity system (Aaker 2014). If you're thinking that identifying the importance of branding seems obvious, bear in mind that branding is rarely if ever mentioned in reviews of the UK manufacturing industry, debates about the factory of the future or revitalizing the sector. At best, branding is lumped in with "marketing investments" or "getting close to the customer" and identified as "important", before authors focus on what they view as the real drivers of value (usually a mix of technology, productivity and STEM innovation).

Branding is important because it is the main way whereby firms *shape* buyer demand (Sissons 2011b), which is especially critical for increasing

manufactured exports (Fothergill and Gore 2013). However, this underplays how important branding is to the manufacturing sector. Since strong brands attract a significant margin over their commodity counterpart – some estimates put it as high as 27–33 per cent (Interbrand 2001) – businesses with them are more resilient in the face of low-cost competitors with better functional performance (Bryson et al. 2013). Studies identify that branded firms earn higher margins than those without, suggesting a brand-driven strategy is important for attracting investors (Aaker 2014; Gregory and McNaughton 2004; Madden et al. 2006).

Firms also use their brands to appeal to potential employees and/or retain existing ones (this strategy is known as "employment branding"). As those who are involved in higher education know all too well, students have very clear preferences when it comes to gaining their first job, and all of these firms are typically strongly branded. Finally, while it's tempting to think of brands as only appealing to consumers, branded business-to-business or industrial firms also enjoy higher margins, stronger returns, customer preference and better employee outcomes than their commodity counterparts (Beverland, Napoli and Lindgreen 2007; Gregory and McNaughton 2004). This is particularly important given that UK manufacturing demand is very dependent on final demand than services (Hay et al. 2013) – a point we take up in Chapter 5.

Given that the future success of the UK manufacturing requires capturing higher margins, growing market share, attracting and retaining skilled employees, and attracting capital, it would appear branding has much to offer the sector in terms of value creation. However, how many manufacturing sector analysts view branding, assuming they consider it at all (often mentioning it in passing when discussing "business models" – see O'Sullivan and Mitchell 2013 for examples), is telling. Berger (2013), for example, identifies the value derived from uniqueness but attributes this solely to product or process innovations despite the fact that it is branding that creates uniqueness in the mind of the customer (if in doubt simply compare any no-name MP3 player with Apple's iPod). Even those focusing on the knowledge capabilities underpinning modern manufacturing success leave out any mention of branding (Ridgway et al. 2013).

Mike Wright (2014, p. 13) calls for policy-makers to view manufacturing through the lens of business investment decisions, but at no point in his comprehensive report does he mention branding despite the fact that investors such as Warren Buffet place such a premium on a firm's reputation. This is particularly important because a common complaint in the sector is a lack of "patient capital" or long-term investors who will fund high-risk innovation (Foresight 2013). Attracting

investment is also a problem for large established manufacturers as well as the innovative start-ups that play an important role in manufacturing ecosystems (Livesey 2013). Again, branding plays a significant role in overcoming these challenges.

Those identifying the complex nature of modern manufacturing often stress the impossibility of separating out the individual contributions to manufacturing success of research and development, design and production (Berger 2013; O'Sullivan and Mitchell 2013; Pisano 2009; Sissons 2011a). Others often consider branding something that is done at the end of the innovation process (Pike et al. 2013), when the real value has been created through commercializing scientific or technological breakthroughs. Models of production-based industrial value chains, for example, often start with research and development and end with marketing-related activities including (rarely) branding (Sissons 2011b), which ignores the fact that the type of innovation engaged in must be driven by brand position (Beverland et al. 2010).

This view was reinforced in a conversation between Michael Beverland and a representative from industry who was part of a government taskforce to evaluate new approaches to defining value added when they identified the difficulties arising from the different prices of branded and non-branded goods. Although they understood that the value creation behind a Burberry T-shirt and an unbranded commodity were clearly different, they recounted how those seeking to measure value added disagreed vehemently on this issue. What was telling in this conversation was that even the person expressing frustration with how measures of value added failed to understand the differences in branded and non-branded goods still thought of branding as nothing more than a logo.

Furthermore, while some authors identify the need for more business-savvy STEM graduates (or those with joint STEM-business degrees) to help manufacturers compete in the future, rarely do they mention skills in marketing or branding (O'Sullivan and Mitchell 2013; Sissons 2011b), and we struggled to identify any report calling for a greater integration between manufacturers and business schools (even those examining ecosystems). Studies on the skill levels of UK manufacturing management also fail to include branding knowledge despite claims that they are examining the soft value-creation skills necessary to manage in the future or identifying capabilities for high value as a key policy target (McLaughlin 2013). This is despite calls for greater understanding and appreciation of "soft" or "non-technological innovation" (Pike et al. 2013).

An emphasis on branding knowledge becomes all the more urgent when one considers that 15 per cent of intangible investment across

all UK industries is in brand equity, whereas investment in branding barely registers in manufacturing (Sissons 2011b). The exception to this would appear to be the few "export superstars" (those who export ten or more products to ten or more destinations) who account for the majority of export sales and value added (Foresight 2013, p. 27). For example, Kneller (2013) identifies that 80 per cent of UK manufacturing exports are driven by just 14 per cent of firms. The vast majority of UK firms exporting are exporting little value – 59 per cent account for 4 per cent of value, whereas 14 per cent account for 89 per cent. In fact just 1 per cent of firms accounted for over 70 per cent of export value, while the top 5 per cent accounted for 90 per cent.

Although these "export superstars" are obviously critical to the future of UK manufacturing it is not clear who they are, what they require and importantly how we develop more of them. Apart from what we have stated already, for a number of reasons we believe these superstars are strongly brand driven. Reinforcing this, just consider that despite a lack of focus by UK manufacturers on East Asia, buyers in those markets nevertheless seek out and pay more for UK manufactured goods. Tragically, however, they get them from other markets rather than ordering direct (Kneller 2013).

Authors also fail to consider how investments in innovation, services, green technology and other capabilities are both driven by brand decisions but also add to brand equity. For example, consider how J. Hudson & Co Ltd of Birmingham maintains high margins in a low-tech, highly competitive category that is subject to commoditization. Although the name of the company may not be recognizable, their brand ACME is the leader in manufacturing whistles for sporting events in the world. ACME draws on its many historical associations (use in previous sporting events, use on the *Titanic*, its appearance in the *Roadrunner* cartoon), its craft and innovation tradition and country of origin ("Made in England") to capture margin and ensure local manufacturing can continue. Although innovation is a key pillar of the factory of the future debate (see Pisano and Shih 2012), no attention is paid to the fact that being an innovative or challenger brand is often the strongest market position one can have. Likewise, radical brand-driven innovation is essential to protecting one's competitive position because it often creates new market categories that close out competitors (Aaker 2012).

The shift to servitization or manu-services also misses the link between services and brand equity despite the fact that firms like IBM (consistently in the top ten most valuable brands as measured by Interbrand

and Millward Brown) brand themselves as solutions providers (under the tagline "A Smarter Planet"). An emphasis on experiential value where manufacturers seek to understand how to add value through improving the customer experience across all aspects of their journey reinforces the potential for branding in the sector (Sissons 2011b). Stressing the importance of environmental concerns including green technologies, recycling, reusing and other cradle-to-grave production initiatives (Foresight 2013) clearly also offers much in terms of brand identity and therefore value adding, if communicated in the right way to the right audience.

Chapter 5 will examine how manufacturers build value through brands and cover off some common misconceptions about branding. Brands earn higher margins, drive customer loyalty and enhance the success rates of new products. Firms with strong brands also attract more investor interest and better employees, all of which are vital to the future of UK manufacturing.

Innovation pathways

Innovation is indeed important for economic success and protecting against lower-cost competition from abroad. Innovation also accounts for the success of many UK manufacturers, be it product, process or policy (innovation in marketing and other business tactics) innovation (Nielsen and McGrath 2012). That said, characterizing innovation as primarily a STEM-driven challenge is not just a serious error, but also misses the multiple ways in which UK manufacturers do innovate. As many writers on the factory of the future identify, modern manufacturing is infinitely more complex than it was in the past, and in particular this means that value-creation activities are multifaceted and integrated (Livesey 2006; McKinsey and Company 2012; Pike et al. 2013). Those examining the actual practices of manufacturers in advanced economies back this up, identifying the need for manufacturers to develop capabilities in customer understanding, commercialization, design, research and development, service support and sustainability (Berger 2013; Chick et al. 2014; Foresight 2013; Pisano and Shih 2009).

One outcome of focusing solely on STEM is to assume that investments in research and development are essential for competitiveness. There are several problems with this view. First, firms such as Apple, who compete on the basis of innovative products, actually under-invest in research and development relative to their main competitors (Beverland 2009). Second, focusing on research and development often results in products that fill no market need. This of course assumes the results

of such investments can be commercialized, something the UK is not that good at. Innovation requires not just capabilities focused on exploration but also on exploitation or market development (Bryson et al. 2013). Finally, the relationship between research and development and economic growth or sector performance is at best complex.

Based on our analysis of successful manufacturing firms we identify a variety of paths to innovation, some decidedly high tech, some very much low tech, some driven by espoused customer needs, with others driven by science and technology breakthroughs. UK manufacturers deploy a range of approaches to innovation including technology push (STEM), design driven, craft based, customer led, process based and marketing driven. Typically, manufacturing success is a product of a mix of any or all of these pathways.

Much of the research and policy discussion has focused on technology push and process based innovations. We don't deny that either is important for manufacturing competitiveness nor that they don't play a role, often a central one, in the success of many firms. However, there is a tendency to place too much importance on these drivers. In relation to technological push, we have already highlighted the dangers of too much reliance on STEM and the limitations of the investment in research and development – economic growth relationship. Often too much of the success in this area is driven by large internal buyers such as the National Health Service (NHS) (pharmaceuticals) and Ministry of Defence (aerospace), which although critical often do not result in export growth. Also, the UK has a weak track record in commercializing much of their STEM-driven research and development often because market needs play little role in early-stage research programmes.

While process innovation is important, there are also limits to what can be achieved. Manufacturers also note that process innovation requires much more substantial firm-wide change than product innovation (Ridgway et al. 2013) and thus such gains are often achieved through outsourcing or off shoring (Pisano and Shih 2009). Likewise, others have noted that such innovations often do not lead to profitable results (Parry and Graves 2008). Also, as some operations specialists have started to realize, pursuing process-driven innovations and efficiencies can result in a very lean customer experience (Oliver et al. 2007). For example, efficiencies resulting from modular production did little to improve customers' perceptions of GM's many brands, and instead resulted in cannibalization and margin dilution because all of the firm's brands started to look alike (with the exception of each brand's distinctive badge and grill).

Consumers are not stupid – they will not pay more for a badge in the absence of any performance difference (as with GM). However, consumers will also suspend disbelief and go along with a manufacturer if the story helps reinforce their identity goals (Beverland and Farrelly 2010). As a result, although many firms adopt process innovations, they benefit from playing down these practices. Although such innovations may result in customer benefits they may not conform to the consumer's view of the brand. The Morgan Motor Company is a classic example of this – they adopt Kanban systems as a means of decreasing cost and build time, and improving quality but do not make a big deal about such investments simply because consumers connect to the brand through its continued craft traditions (Beverland 2009).

While others have focused on the value of design, typically these studies and policy reports focus on increasing the perceived value of the design function rather than feeding directly into the manufacturing futures debate (Micheli 2013; an exception to this is Nielsen and McGrath 2012). Design-driven innovation is behind many UK manufacturing success stories. As Chapter 6 will illustrate, design-driven innovation focuses on balancing market, firm, technological, and increasingly societal and environmental needs to develop breakthrough products. Eschewing the voice-of-the-customer approach to product development used by marketers, designers focus on meeting latent needs in a way that often creates new market categories (Beverland and Farrelly 2007).

In their interviews with leading manufacturers, Ridgway et al. (2013, p. 20) identified the need for design-led factories, design enablers and design methodology to generate new to the world products. As well, interviewees also noted that designers were excellent at balancing competing inputs and needs, often developing products that were not only technically innovative, but also designed for ease of manufacture and for ease of use. This can be seen in the requirements for the James Dyson Award. This award challenges wannabe designers and engineers to redesign an everyday product that frustrates them but, in so doing, give consideration to functional performance, styling and user-considerations, ease of manufacturing, sustainability and marketability. The message here is clear: value is created through unique designs that address a wide range of needs rather than just pure invention per se (Beverland 2012).

Customer-driven innovation is also critical, especially when one considers that servitization requires a much more market-driven approach to innovation (Sissons 2011a, 2011b). This is particularly the case for business-to-business manufacturers as many of the products made for these customers require ongoing services and updates

as well as on-site training. And much value can be added via services underpinned by a deep appreciation for the customers' business challenges including adaptability, problem solving and solutions provision (Beverland, Napoli and Lindgreen 2007). Customer-driven innovation is also critical to develop the incremental brand innovations necessary to maintain brand value and to maximize the returns on investments in the original breakthrough product. For example, the cost of developing a new generation of automobiles is significant and may require a mix of STEM-, design- and customer-driven insights. However, since the initial product will not cover the upfront costs, line and range extensions with incremental improvements are used to extend the life of each generation of vehicles. Typically these innovations require capabilities in customer understanding and time-to-market.

Craft-based skills are essential to the UK's often low-tech, but high-value luxury sector (Ridgway et al. 2013). Despite this, there is a tendency to ignore these skills, resulting in acute shortages in key areas, often driving many firms to produce offshore. Michael Beverland knows this all too well. Working on the re-launch of venerable eyewear brand C.W. Dixey & Son Ltd, it quickly became clear that to meet market expectations for luxury eyewear, the use of local producers was a problem. This brand, founded in 1777, and with a long list of clientele including Queen Victoria, Napoleon Bonaparte, Ian Fleming and of course Sir Winston Churchill could not overtly capitalize on its English heritage precisely because it could not honestly state it was "Made in England". Instead, accessing the necessary craft expertise involved outsourcing production to France. Worse still, in the pursuit of high-technology futures, many authors call for the active deskilling of these seemingly low-tech skills at the very time that consumers and manufacturers are seeking to benefit from such traditions.

The contribution of innovative marketing to manufacturing success often gets overlooked. Although manufacturing analysts recognize that marketing plays a role in commercializing innovation and even identify the need for such skills in debates on the factory of the future, the ability of innovative marketing to trigger manufacturing resurgence is missed by many, including many marketers. Much of this has to do with the belief that marketers do not really add value, but simply communicate product benefits to an audience once the "hard innovation" stage has been completed. Marketers also rarely innovate largely because theirs too is a "fit focused" business logic, largely aimed at meeting existing market needs (Beverland and Farrelly 2011).

Craft-beer brewer Brewdog provides an example of this form of innovation. Recognizing that traditional ales had cornered the market for

authentic, high-quality, craft beer in the UK, Brewdog sought to reinvigorate the lager category (a significantly larger part of the market) in the belief that there was a latent desire for such a product. Although the company makes award-winning products, it is the careful social media campaigns, customer share ownership schemes, championing of the category (including competitors), development of their own channels (branded pubs) and small batch innovations that have shifted perceptions about lager and driven sales, maintained margins, and resulted in increased manufacture.

In summary, UK manufacturers rely on innovation to sustain local production and margins, but the ways they innovate are much more diverse than those championed by the advocates of STEM. The failure to appreciate this has a number of implications including the continued poor reputation of manufacturing alongside an increased interest in making (including design and craft), the denigration of branding and advertising by some of the most passionate advocates for reindustrialisation, a narrow view of skill requirements and ecosystem partners, and competition for policy attention by separate groups who should be working together (such as manufacturers, services, craft councils and designers).

Ecosystems: industrial and symbolic commons

One of the most important developments in our understanding of manufacturing's competitiveness has been the focus on ecosystems, or the benefits gained by firms of being close to centres of research, linked in with other firms including suppliers of goods and services and talent and also surprisingly competitors. The UK sector is not exempt from this. Studies identify how many of the sector's success stories are tightly clustered in specific geographic areas. For example, the automotive industry has had a long history in the West Midlands and Northern England, optical, electronics and computing is located primarily in the South-East, chemicals in the Tees valley and Durham, aerospace localized in Lancashire, as well as Derbyshire, East Wales and Bristol, and pharmaceuticals (which is more spread out than any other sector) in Bedford and Hertfordshire, Cheshire, Merseyside, and East Yorkshire (Bryson et al. 2013).

The relationship between these sectors and their regions is mutually beneficial – strong firm clusters contribute to regional economies, which then in turn, often in partnership with national governments, are able to further invest in the infrastructure necessary to retain and attract additional businesses (Broadberry and Leunig 2013). Although the link between research organizations such as universities and the health of

manufacturing clusters is complex (old rust-belt regions with university expertise but without dynamic start-ups find it difficult to capitalize on their remaining industrial commons), these organizations often do gear up to provide a skilled workforce to the sector and also benefit from industry input in a number of ways.

Furthermore, evidence suggests clusters of design, research and development, business services and production are critical to the competitiveness of the manufacturing sector because the resulting innovation tends to be more client centred (Bryson and Rusten 2011). Co-location can also impact on cost competitiveness because it may have a positive impact on total (rather than labour) costs, enable one to react more quickly to market changes and business opportunities, and reduce delivery times (Bryson et al. 2013). Finally, it is clear that with the move to servitization, many firms are already benefiting from being close to such service providers and are starting to work more closely with educational providers to ensure their STEM graduates gain these skills (Sissons 2011a).

For example, the Niche Vehicle Network is an independent association of over 100 niche vehicle manufacturers, specialist technology and automotive supply-chain companies promoting the application of new technology by bringing together independent vehicle manufacturers and system suppliers with higher education to collaborate on the application of innovative technologies and is supported by the Technology Strategy Board, Innovate UK, the Office for Low Emission Vehicle and the Department for Business, Innovation and Skills. Speaking to the *Birmingham Post* on 3 March 2011, at the launch of the Morgan three-wheeler in the Geneva Auto Show, Dr Viv Stephens, representing the Niche Vehicle Network, said:

> We organised a supplier event at Morgan, when the project was at its initial feasibility stage, attended by 26 specialist automotive companies from the West Midlands region, who convinced Morgan that they could add value to the processes of design, development and manufacturing. … As a result, 12 of these companies have become partners or suppliers to the project, which will be a great benefit to the region in terms of jobs throughout the supply chain and also at Morgan.

Steve Morris, then manufacturing operations director at Morgan, acknowledged the support and grant funding received and its importance in ensuring the project's timely completion and the launch of the three-wheeler, in 2014 accounting for around half of Morgan Cars' output by volume. Since its inception in 2008, the programme has been a catalyst

for over 104 different business collaborations and has assisted the development of 11 prototype vehicles and three process improvement projects. Exhibit 4.1 provides two further examples of industrial commons.

The relationship between large and small firms is also important, but often misunderstood. While most understand that large firms benefit small firms through the ability to invest in research and development and small firms are often able to commercialize research emerging from the university sector (Broadberry and Leunig 2013; Bryson et al. 2013), there is a further benefit. From a brand point of view, large firms have the resources to build high levels of brand awareness both for their own products but also for the sector as a whole, while small firms, particularly those focused on very high quality, often garner the majority of specialist press attention that provides a significant halo effect from the mass-market products of larger firms. For example, wine regions such as the Barossa Valley in South Australia benefit from this relationship – the large brands such as Jacob's Creek and Penfolds build awareness for value and quality, while smaller brands such as Turkey Flat, Charles Melton and Rockford gain the majority of the press coverage and wine accolades. The former makes consumers aware of the region and provide valuable marketing investment, while the latter provide the regional cluster with symbolic value, thus resulting in higher margins for everyone.

Exhibit 4.1 Case examples of the industrial commons

Hub of All Things

Hub of All Things (HAT) is a £1.2 million multi-disciplinary project, funded by the Research Council's UK Digital Economy Programme, involving a team of 16 researchers from economics, business, computing and the arts across six UK universities of Cambridge, Edinburgh, Exeter, Nottingham, Warwick and the West of England.

HAT has been launched to create the first ever multi-sided market technology platform for the home, allowing individuals to trade their personal data for personalized products and services in the future.

The platform involves the collection and analysis of data generated by a group of volunteers through the use of sensors on objects in their homes (Internet-of-Things) and integrating it with other personal data, to uncover insights of unprecedented depth and breadth into how we live our lives in relation to the experience of things and people around us. The richness of this data will allow the research team to explore dependencies between industries such as medicine, energy and food in terms of home contexts and interactions.

The team will then develop an intelligent layer of algorithms linking disparate variables into meanings-based parameters that new applications can build

on to serve the home, facilitating the creation of almost limitless products, services and business models within the home, personalized by individual data. More importantly, the data collected by the HAT is owned by the individual, making the HAT the first ever digital vault of personal data available as a digital asset to trade for future personalized products. Warwick Manufacturing Group has created an application, the Knowledge Transfer Box, to help parties to this end, drawing on the Stafford Beers viable systems model.

Industry partners include Dyson, Osram, GlaxoSmithKline, Dropletpay, Sprue Aegis, Strand Hardware, RDM Telematics, 1248 Ltd, Mydex and DCS Europe, recognizing the huge commercial potential of the HAT project in bringing together the manufacturing and the Internet sector.

Smartphone start-up: Zone V

Zone V is a start-up, conceived by founder Abhi Naha, who has an inspiring vision to bring to market a reasonably priced smartphone, aimed at amplifying sight, sound and touch, for ageing consumers and those with impaired sight and hearing, whilst making it pleasurable and engaging.

Abhi Naha spent seven years working in Silicon Valley on touch-screen developments and is unable to forget the palpable energy generated by so many enthusiasts, all supported and backed to get to market and "have a go". He says: "They have an incredible attitude over there. It's all about trying things out, experimenting and the speed and pace they move at is amazing. It's accepted that some ideas will fail, but if you get enough into the pipeline some will come through and you don't need many winners to get the returns ratio working.

"Having spent time in Cambridge I notice big differences between Cambridge and Birmingham. There is so much pressure amongst venture capitalists to take a turn on their investments, rather than sticking with them … the 'patient capital' that people refer to. Cambridge itself, whilst a tight and eminent circle encompassing some world class expertise and technologies, is very focused around some core capabilities with the university culture and ethos firmly at its heart. Birmingham has a chance to carve out space for itself, not only as the UK's enterprise hot-spot, but with the capacity to bring together multi-sided partnerships with great flexibility and rapidity, thanks to some really well networked parties in the city. If this can be accompanied by investor pace and enthusiasm, measuring speed-to-market for start-ups, providing post-start-up personal support and mentorship, rather than academic mentoring, this could be very positive for the city.

"If Birmingham is serious about being the best place for business start-ups in Britain it needs to monitor not only the number of business start-ups but where they get to, how much support they have as they start and continue their growth journey to ensure that chances for success amongst these businesses are maximized. Starting up new businesses is not the most difficult bit; it's the growth journey that is so difficult as you can be overwhelmed by the regulation, accounting, legal and HR minefields hitting you in the early stages – not to mention the money, cash flow, sales and customer acquisition, new product launch, brand platform and marketing – it is so much and usually handled by a very tight team.

> "Universities like Birmingham City and the other universities in Birmingham have the opportunity to play a very important role in value creation in the city, kick-starting things, getting them going, perhaps a bit more under the radar at first. If they fail, they fail, but if they do get going the dividends for the city can be huge."

Although the benefits of this type of industrial ecosystem or industrial commons (Berger 2013; Pisano and Shih 2009) are well established and, as Chapter 8 identifies, used extensively by the UK's leading manufacturers, we believe that this debate misses one important aspect of this commons. If one accepts the argument that branding has much to offer manufacturers, then commonly available expertise or knowledge goes much further than just technical skill and covers symbolic assets as well. We call this the "symbolic commons" or the collectively accessible associations that can add value to a firm's brand or brands. These can include other branded organizations or actors, heritage assets that exist within a region or sector, and stories that provide functional, emotional and experiential associations that provide the raw materials for brand image.

Whilst the industrial commons can be run-down, thus limiting the ability nations to restart lost sectors or engage in the manufacture of some new technologies (Pisano and Shih 2009), the symbolic commons is more robust. For example, the recent re-emergence of classic American clothing should not have occurred according to the advocates of the industrial commons. With the shift of much manufacturing to low-cost countries, much of the manufacturing base, knowledge and expertise for making classic American work-wear including denim, leather and shoes had moved offshore, particularly to Japan. When American entrepreneurs desired to respond to the demand for locally made "vintage" styles of clothes, they had to visit Japan to learn how to actually make such styles. The Japanese had brought up much of the machinery and learnt much of the techniques used by long-gone American clothing brands because they so loved the look of these clothes. However, the symbolic commons still existed – for example, Ebbets Field were able to reintroduce traditional styles of sportswear by combining their newly acquired skills and manufacturing plant with connections to long-defunct sports brands such as the Pacific Coast and Negro baseball leagues. Thus they, along with several others, have played a role in revitalizing high-quality clothing production in the United States.

Although the above example suggests the symbolic commons is more powerful than the industrial commons, when combined they offer firms

leadership positions that often create significant amounts of value. For example, in the 1990s New Zealand Merino wool farmers decided to go it alone and set up their own marketing body in order to capture the unique value intrinsic to their product. Up until this time, one state-empowered board that blended different wools in order to create a product that could serve multiple needs had marketed wool of all varieties. Although this process was useful for making low-margin carpets and other industrial uses it offered those looking for high-quality natural fibres little value. As a result, farmers developed a new ingredient brand called Merino New Zealand, with the express purpose of increasing margin and building brand recognition and awareness among leading cloth manufacturers (such as Loro Piana) and fashion houses.

In so doing, however, they combined investments in an industrial commons with existing symbolic assets. In order to address the problem of quality variation, the Merino team developed a scientific process for accurately grading wool quality and tensile strength (previously it had been graded largely by feel). This system required changes in manufacturing practice, including bagging and tagging each individual fleece and building traceability back to each individual farm and animal. Suddenly, what had been a commodity was now a series of unique products that existed under the Merino New Zealand brand umbrella. Buyers could now specify not only which farmer they wanted wool from, but even which sheep! This resulted in buyers wanting to learn more about where their ingredient came from, and Merino New Zealand developed a visitor programme enabling buyers to visit many of the country's historic high-country South Island sheep stations (several of which had been held in the same family for over a hundred years). These symbolic assets thus became part of the Merino New Zealand brand.

Such symbolic assets also enabled manufacturers to use this ingredient brand to add even more value to their products. One of the most desirable brands of high-performance Merino wool outdoor wear is Icebreaker. Icebreaker is a design-led business from New Zealand founded by Jeremy Moon and an export success story. Although New Zealand's clothing manufacturing industry collapsed after the removal of tariff barriers in the mid-1980s the firm was able to combine its design expertise with the symbolic commons and overcome the perceived anonymity that arose from being produced in China by developing a programme that provided consumers with their product's back-story.

Drawing on the industrial commons established by Merino New Zealand, Icebreaker garments came with an individual Baa-code (pun intended). Each consumer could enter their code into the brand's website and immediately find out which sheep their product has come

from, their story and the farm it came from, and so on. By providing this powerful back-story Icebreaker was able to maintain its leadership position and expand sales in ways that competitor firms from other high-quality wool-producing nations could not (simply because they lacked access to the industrial commons that enabled them to leverage their symbolic capital). Being able to connect into a symbolic common is important for high-cost nations because it provides a sense of authenticity to consumers enabling them to connect their products to time, place and culture (Beverland 2009). And this symbolic commons is difficult for overseas producers to imitate.

Although C.W. Dixey & Son Ltd could not produce their frames in the UK, they could draw on significant symbolic assets to launch their brand. Although many of these assets related to the firm's back-story (and were therefore not commonly owned), the owner Simon Palmer drew on many common symbols to successfully launch his brand's first collection in 50 years including global perceptions of English style and class, the initial leadership position enjoyed by UK optical manufacturers and the understated nature of English high-quality crafts. Likewise, London-based cycle manufacturer 14Bike Co was able to draw on the UK's symbolic heritage of cycling design leadership, manufacturing dominance (although any mass industrial commons has been depleted) and Shoreditch East London cool when positioning their brand of custom-design fixed-gear bikes on the global stage. Exhibit 4.2 contains further examples.

Exhibit 4.2 Examples of the symbolic commons

Hille Chairs

Hille enjoys a distinguished history having been founded in 1906 by Russian emigrant, Salamon Hille, who employed skilled craftsmen to renovate and reproduce eighteenth-century furniture, building up a strong reputation for quality at home and as an export business. He was succeeded by his daughter, Ray Hille, who was, in turn, joined by members of her family including her son-in-law, Leslie Julius. In 1949, Leslie made contact with young designer Robin Day, who had been recognized as an award winner at an international competition organized by the New York Museum of Modern Art that year. Julius supported Day working with him for the next 20 years. By drawing on its heritage of working with a series of distinguished British designers over many years the business has been able to launch premium products into the very competitive market for educational chairs, charging a premium to gain market share and develop customer loyalty.

Plastics have been used in chair design since the 1960s by designers such as Charles Eames and Day. The "Polychair", Day's first polypropylene chair (also the world's very first polypropylene chair), was produced by Hille and became such a design icon it was subsequently commemorated on a postage stamp. Fred

Scott, a graduate of the Royal College of Art, also worked for Hille. In 1979 he produced "the Supporto" office-chair system, which in turn formed a source of inspiration for "the Meridio" created in 1990 by Michael Dye – designed in the anglepoise and rather anglophile tradition of engineered knobs and junctures, rather than the more international approach where joints are hidden away.

Professor Richard Snell of Birmingham City University worked with Hille to create a new school chair, known as "the SE Chair", with fellow designer David Rowe, with Birmingham City University and Hille funding their two-year research and development programme. Professor Snell said: "We've been taking another look at materials in light of the need for a more sustainable approach. Polypropylene can be recycled easily, it's low cost, has great strength, it's suitable for injection moulding and due to its natural integrity it does not need any fillers to gain strength, making it much easier to recycle. In addition, theories around seating posture have developed significantly."

"One year on from its launch the SE Chair continues to perform really well," says Nigel Punshon, Sales Director at Hille. "It's given us a product that we didn't have already and it's been brilliant for new schools. We are very pleased to continue to sell around 20k units a year as there are chairs available at around half the price of the SE so it is a more specialist product. We're also adding lots of additions to the range. We've already launched the SE stool, and we're in the process of launching a wooden seat option, writing tablet and concourse seat. … Our order books have been very strong this year."

The company, based in South Wales, targeted £3.7 million sales this year, but is already looking at finishing the year on about £4.2 million.

Emerging designer James Plant graduated from Buckinghamshire Chilterns University with First Class Honours in Contemporary Furniture and Product Design and was awarded the prestigious 100% Design New Designer of the Year Award that year. He was selected by Thorsten Van Elten for the New Designers One Year On programme and came second in the Channel 4 Top New Designers Award 2009. He has gone on to develop a reputation for original British design with personality, receiving recognition for his work with his iconic Clamp Lamp being described as a "future classic". Punshon met Plant at a Birmingham Made Me Design Expo where they were both exhibiting. They started talking about doing a new product with Punshon being impressed by Plant's fresh perspective and ideas involving a focus around reducing time in production, improving "green" or sustainable credentials and filling a gap in the Hille range, in particular looking at market offers made by competitors not currently produced by Hille. This new product will be launched in 2015.

Speaking about the British reputation for design, Plant said: "Branding and marketing is something that we do well here to enhance products at all ends of the value spectrum. British brands stand for something – like Pashley, Morgan, JLR – they all have heritage and are highly regarded so people want to associate with them and have a relationship with them. Building relationships with people through brands does not have to only relate to premium brands. I sell our Plant & Moss products in China because that market's view of British products is one of quality and aspiration. They are happy to pay for the shipping because they want to impress their friends with their taste and ability to buy British products."

AGA Rangemaster plc

AGA Rangemaster plc is an example of symbolic and industrial commons built up over a period of 300 years providing a mutually reinforcing framework for a family of brands. AGA Rangemaster, an international leader in range cooking, is renowned for its portfolio of brands, "loved around the world". The AGA Rangemaster family group represents an impressive range of assembled brands. Known for their pedigree, it includes names with some longevity – AGA, La Cornue, Rangemaster, Rayburn, Stanley and Redfyre – with Fired Earth, Falcon, Mercury, Grange, AGA Marvel and Divertimenti all part of the portfolio. This brand family inspires by building on their exceptional heritage and authenticity to connect to new customers. Continued success is put down to a pipeline of innovations, developed through a shared industrial and symbolic commons, enabling the range cooker to adapt to modern living.

William McGrath, Chief Executive of AGA Rangemaster Group, explains: "AGA Rangemaster has factories in Coalbrookdale, Telford, Leamington Spa and Nottingham. We have research and development centres in Telford and Leamington Spa.

"We have 1800 employees in the Midlands and as a Midlands-led producer of range cookers we believe we add range cookers and cookware to the Midlands' portfolio of products of excellence. We have spent over £21 million on product development over the past four or five years, with a unique manufacturing capability to support our growth plans.

"AGA researched the process leading to the development of the AGA cooker as an icon working with a team from Birmingham City University. It turns out that between the First and Second World Wars affluent people no longer had a cook, and following that they no longer had a maid, at which point the housewife went into the kitchen – and where she went the children followed – so the kitchen needed to be larger than it had been previously. The nature of the home was moving from the Germanic scullery to become the heart of the home and the AGA Rangemaster Group continues to sell this idea, in particular within Fired Earth at present.

"There was a group of people in this instance that had both the vision and the infrastructure to drive this process. They were, we discovered, major figures of the twentieth century, involved in bringing about this home re-design. They showed the world the importance of great design, perfectly cooked food, economy and ergonomics – all within the kind of modern kitchen setting that had never been seen before. In fact, from 1935, in developing and launching the New Standard AGA cooker, they shaped the future and changed the way people lived. It was their influence that made the kitchen the most important room in the house and made good food cooking a new national interest.

"Today all our brands are benefitting from digital platforms, enabling us to share more information about our family of brands with all our customers. Connectivity has meant that it has become easier to communicate how the brands work together with Pinterest, for example, enabling people to see the brands in situ and how they can bring them together to create something personal to their taste, customised to meet their own lifestyle and aspirations."

In summary, while manufacturers stand to gain much from the industrial commons or industrial ecosystems, we believe UK manufacturers also stand to gain even more by leveraging the symbolic commons that may exist within their firms, their industry sector, their region, the UK, other heritage assets including stories associated with founding, founders, and key actors including staff and customers. Furthermore, the generally positive perception that making or manufacturing enjoys among the UK populace also represents an asset for those focused on local sales.

Shaping markets

The previous chapter suggested that the logic of fit underpinned many of the arguments on manufacturing's future. To quickly recap, moving up the value chain through high tech was driven by the need to move away from perceived low-cost providers and imitators through knowledge-intensive processes. Innovation through STEM followed from this position, as did ecosystems defined by relationships to research and development expertise. The business model discussions were driven by a logic that worked back from predicted futures to identify necessary skills, capabilities and strategies that would enable UK firms to best adapt to these likely scenarios. In contrast, in this chapter we argue that although many aspects of fit are necessary, UK manufacturers are more likely to capture value through strategies that seek to shape demand.

In particular, the focus on branding represents one important way in which firms seek to influence consumers or business customers. Although branding involves considerations of consumer needs, it is primarily an inside-out strategy whereby firms essentially define for the consumer what is important and then make appeals as to why their brand is the best option. Chapter 5 will provide more detail about branding does this, but the key aspect is that firms seek to use their identities to compete in unique ways that are valuable to the purchaser. Brands have become the most important intangible assets to firms and therefore the management of them is of utmost concern among managers – all of which makes their absence in recent surveys on manufacturing best practice the more surprising (see McLaughlin 2013).

UK manufacturers shape their markets in other ways. One way in which they do this is to develop innovative products and offers (including services) that address genuine gaps in the marketplace, espoused user needs, or more often latent user desires. They do this not through embracing one best way to innovate but through multiple pathways,

many of which have hitherto been ignored in much of the policy discussions around innovation and manufacturing. In particular, design is very much a shape-driven strategy, whereby designers seek to balance multiple trade-offs through methods that draw heavily from the arts and humanities and social sciences rather than the physical sciences. In so doing they often develop breakthrough products such as the Cyclone vacuum cleaner that redefines existing categories, rendering existing competitors largely irrelevant.

Likewise, the continuance of craft traditions in combination with market insight and marketing expertise often means that many firms continue to succeed when much economic and business logic says they should have disappeared long ago. While many have suggested the need to de-skill these practices, even operations researchers are starting to realize that seemingly inefficient traditions offer a much richer consumer experience and generate higher margins than the lean and mean experience generated by the continuous search for efficiency. Marketing-driven innovations also seek to reconfigure existing market arrangements and generate new sources of value for consumers, often in ways that redefine existing preconceptions about product categories. Finally, firms draw on industrial and symbolic commons to shape their environment and generate new sources of value.

Conclusion

Just as the previous chapter identified the gestalt-like nature of the existing debate, so too we believe our four drivers are logically consistent and reinforce one another. In seeking to shape their markets or environments, many sectors' so-called export superstars do so by deploying their identities in the marketplace, investing in multiple pathways that enable them to define and own categories, and leverage their industrial and symbolic commons in ways that reinforce their brands as well as enhance their innovative capabilities. Critically, these firms have strong brands – an observation that has been largely ignored or that has been viewed as so obvious that it deserves no further thought. However, when one truly embraces a branding logic, there are significant implications for where and how one innovates, the business practices one engages in and the ways in which ecosystems are leveraged – all of which are for the basis for the next four chapters.

5
Branded Businesses

Introduction

The previous chapter identified that the central means whereby UK manufacturers created value was through branding. On the face of it this seems obvious but also bold. The so-called average person in the street's view of branding is that branding is nothing more than a pointless add-on, usually by marketing, intended to make us pay more than we would for often poor products. Such a view is echoed by no less than Sir James Dyson – the UK needs to move away from services such as marketing, branding and advertising, and return to making things. Unfortunately for Sir James, one cannot escape reputation or branding and his anti-branded strategy is one of the most powerful of all.

Although marketers largely have themselves to blame for the dominance of the brand as symbol view, nothing could actually be farther from the truth. Brands are organizational assets that, if managed carefully, result in higher margins, shape consumer or customer demand, attract and retain talented staff and long-term "patient" investors, and assist with the introduction of new products or offers (an area where the UK manufacturing sector underperforms; Hay et al. 2013). Brands are also more than just add-ons at the end of the value-creation process. Firms such as AGA, Airbus, Apple, Dyson, Jaguar Land Rover, the Morgan Motor Company and Rolls-Royce are brand-driven businesses. That is, the brand drives innovation strategy, the decision to invest in services, the choice of external partners, and many aspects of the business model including pricing, distribution channels, marketing communications, and so on.

Not for nothing does Sir James Dyson stress his focus on "what matters" in the detailed marketing stories that adorn his beautiful

high-performance products – this is the heart and soul of his brand, and that commitment drives everything else. This chapter outlines the basis of a brand-driven strategy, identifies the basis of brand-building logic (those readers interested in the technical aspects of brand building should read a specialist text) and address some common myths about branding.

The value of brands

A brand is defined as

> an organization's promise to a customer to deliver what the brand stands for not only in terms of functional benefits but also emotional, self-expressive, and social benefits. A brand is more than delivering on a promise. It is also a journey, an evolving relationship based on the perceptions and experiences that a customer has every time he or she connects to the brand. (Aaker 2014, p. 1)

As consumers we are probably all aware that we pay more for a branded item than a commodity. But how much more and why?

Estimates vary, but brands do represent a significant portion of a firm's balance sheet and, subject to market conditions, result in high margins. As we identified in the previous chapter, intangibles account for over 70 per cent of a firm's market capitalization, up from just 20 per cent in the 1950s. Brand equity increases have an impact on stock price. Aaker (2014), for example, identifies how return on investment and stock price are strongly related – if one goes up, so too does the other. His study found that increases in brand equity (the differential effect of the brand on consumer behaviour, or financial valuation) had almost as great an effect – 70 per cent as much (in contrast advertising had no effect except for that amount captured in brand equity). This study's results were replicated in high-technology markets.

In 2014 Interbrand estimated that the Apple brand alone was worth close to £80 billion, Microsoft £37 billion and GE £28 billion (as examples of manufacturing brands). Interbrand's top 10 global brand ranking shows brands are worth 33 per cent of market capitalization while those in the top 100 have 27 per cent. These are all companies that to varying degrees use their brand to drive their business. By way of contrast, firms that largely use technology to drive their brand have far less value – the brand Nokia is worth just £2.54 billion. The UK does not fare well on this list, with just three entries in the top 100, including HSBC, Burberry

and Johnnie Walker (the last two can be considered manufacturing although hardly high tech).

Furthermore, brands strengthen other key metrics. Table 5.1 identifies the results from a study on estimating brand values for publicly listed firms. Gregory and McNaughton (2004) estimated the value of brands and their impact using a number of different metrics. These are:

1. Brand power: brand power is a function of customer loyalty to the brand.
2. P/E ratio: a high price/earnings ratio generates expectations of greater earning growth in the future (it is often called "the multiple").
3. Market cap/book value: market capitalization is the total value of the shares or the premium; i.e. the strongest brands are worth 4.7 their book value.
4. Financial strength is simply an assessment of the health of the company's financial position.

A more recent study sought to identify further the financial power of brands. Madden et al. (2006, p. 230) analysed the Interbrand database (consisting of 2,000 brands) and found that an investment of $US1,000 in the strongest brand companies would quadruple to $US4,525 in six years while an investment in the overall stock market over the same period yielded US$3,195, a realized gain of US$1,330. These figures have been adjusted for risk and market share, and suggest brand equity has a positive effect on shareholder value. Although estimating brand value

Table 5.1 Effects of brands on financial ratios

All Brands	Quintile	Brand power	P/E ratio	Financial strength	Market cap/book value	Brand equity as % of market cap
Most powerful brands	1	58.8	19.5	6.3	4.7	15.6
	2	34.0	16.8	5.6	2.1	9.0
	3	20.9	16.0	5.4	1.9	4.7
	4	13.6	15.6	5.2	1.7	2.2
Least powerful brands	5	8.5	17.9	5.0	1.6	0.6

Source: Gregory and McNaughton (2004) "Brand Logic: A Business Case for Communication", *Journal of Advertising Research,* September, p. 235.

is difficult given that the only true valuation comes from sale (which is also reflected in the variance between different values attached to brand equity – the variance is partly explained by the ways in which each organization assesses brand power). Nevertheless, brand-driven firms are valued higher than those that are not, and much of this value can be attributed directly to activities that drive brand equity.

Much of the reason for the strong financial performance of brands is that they command a premium. Early experiments that attempted to estimate how much of a premium identified a brand premium of between 27 and 33 per cent over a commodity counterpart. However, such measures are based a consumer self-reports in hypothetical scenarios so do not always translate exactly into the real world (Ailawadi et al. 2003). The actual amount varies substantially. Intel's "Intel Inside" campaign ensured the brand earned a 10 per cent premium over its competitors. Apple by way of contrast earned a 25 per cent premium on their iPod (Sissons 2011b). On the face of it Intel may have performed relatively poorly, but for a small investment in building awareness of the value of what is an ingredient (albeit a vital one, it still represents a tiny amount percentage of the final product), Intel were able to earn a premium in a market subject to regularly commoditization.

Why does all this matter for manufacturing? Consider several of the challenges facing the sector. The sector has a poor reputation among potential future employees. The sector struggles to attract capital, and in particular more "patient" capital willing to invest for the long-term in breakthrough ideas. The sector struggles with a poor image more generally. And the sector's attempts at building competitive barriers through fit-driven strategies will not ensure sustained survival or margins in the long term precisely because these strategies are relatively easy to copy and subject to technological "leap-frogging". In exports, Kneller (2013) argues that UK exports are struggling (when compared with US, French and German) to attract new customers in old markets or retain existing sales with current customers, both of which are challenges solved by branding.

By way of contrast, financial markets, institutional investors and employees (future and current) all understand the value of brands. And branding provides a very real point of difference that is difficult to copy. Brands also help generate sales and retain customers. Thus, branding is critical to debates about manufacturing's future as they represent a key resource with which to solve many of the sector's immediate and longer-term challenges.

Financial markets for example understand the value of strong brands and brand-driven investment (they may not understand the science or art of branding but they understand the value-adding potential). Brands have many benefits that are often forgotten by marketers – brands reduce risk and thereby assist with new product introduction, market expansion and line extensions; therefore they offer a more efficient way to grow sales. Brands make it easier for salespeople to gain access to key channels, such as retail buyers, or gain distribution listings. Thus, they reduce the cost of sales. Because branded businesses aim for consistency, they dramatically simplify purchasing, resulting in cost savings from reductions in the number of items one needs to carry as well as improved buying power resulting from placing larger orders for fewer inputs. Brands create "pull" whereby end-users ask retailers or distributors for brands, thus reducing acquisition costs. Brands generate loyalty, which also reduces customer acquisition costs. Finally, quality suppliers of goods and services (including financial services) want to work with strong brands and thereby may reduce their rates or provide better deals in other ways. Brands have many benefits, the vast majority of which often have little to do with the end consumer.

Brands are also attractive to employees. Design and business graduates at the University of Bath all target the same cluster of companies. Design and engineering graduates all dream of working at Airbus, BAE Systems, Dyson, Jaguar Land Rover, McClaren and Rolls-Royce. Business students identify many of the top financial services brands as ideal stepping stones, while future marketers swamp P&G, Unilever, L'Oreal, Nike, Google and the luxury firms with applications. They do this because of the positive associations they attribute to these firms, the ability to work with great clients, or on great projects, and with great people. More importantly, having a strong brand on your CV adds value to your personal brand. For existing staff, brands provide security, a source of identity and pride, and offer many opportunities.

As a result, human resource managers at strongly branded firms are often in an enviable position. First, their acquisition costs are lower because people apply to them rather than human resources having to spend money on attracting talent. Second, they are more likely to attract the right type of person – someone who will fit the brand of the firm. Third, not only do they receive more applications, they also receive higher quality ones. Fourth, although branded firms do not always pay less than non-branded ones, they can do simply because employees understand the future value of the brand on their CV. Fifth, the financial benefits of the brand means they can often provide more

innovative reward packages including share options. Finally, human resource managers can use the brand to train staff, and measure and reward performance.

Customers also love brands. Despite a much-hyped consumer backlash against brands, many anthropologists have identified how complicit consumers are in buying wholesale into branding (McCracken 2012). Consumers gain many benefits from brands. First, they simplify, allowing consumers to make quick decisions against a backdrop of too much choice and competing product claims. Since brands provide an information short cut, consumers trust a well-known brand over a new product or unbranded commodity. Second, brands allow consumers to achieve their identity goals. Contrary to economists, consumers are not utility maximizers; they satisfice. Nor are they isolated individuals – many of their goals are socially constructed and identity driven. Owning a pair of C.W. Dixey & Son eye glasses signals to others an identity, or desired identity, a certain social status, or taste. So powerful are brands that consumers have even had logos tattooed permanently on them to signal tribal membership or identity. Finally, brands are even believed to improve product performance. For example, consumers have been known to apply an Apple sticker to a non-Apple product and believe it is cooler, better designed, more valuable and better performing than it was without (Beverland 2009).

So, firms gain many benefits from branding, and the evidence on their effect is certainly implied in some studies on UK manufacturing. For example, Sissons (2011b) has identified that many UK firms invest heavily in intangibles although his figures would suggest manufacturers under-invest in this area quite heavily compared with their non-manufacturing counterparts (although it is not clear what expenditure on branding may include as it could easily cover marketing spend). Oliver et al. (2007) identify how organizations that have not embraced many of the tenets of lean production remain preferred in their category precisely because of their brand. Sissons (2011a, 2011b) identifies branding as a core driver in the shift towards manu-services.

Kneller identifies that although manufacturing does not meet its export potential, many overseas buyers seek out branded UK manufacturers from third parties because they view them positively. France is viewed as having a more "developed export brand" thus enjoying higher margins, faster growth in export sales and faster adoption of new products. And his research also shows that the vast majority of exports are accounted for a by a few "export superstars", which figures would suggest are likely to be those organizations that feature regularly as case studies of

manufacturing excellence (i.e. brands). Bryson et al. (2013) identify the phoenix like nature of firms such as Jaguar Land Rover without realizing that it was the latent equity in these brands that attracted investors, or in the case of MINI, a new owner. Brands are critical to the ecosystems underpinning many manufacturing sub-sectors, as strong brands attract resources into the region.

Apart from that, branding is largely left out of the manufacturing debate and even those that cover it make the mistake of viewing it as simply an external communication tool. Debates on the factory of the future leave out branding altogether, instead focusing on skill, technologies, and processes. Discussions of servitization identify the strength of a brand to shape demand but then go on to identify close relationships as the real driver of value (Sissons 2011a, 2011b), thereby ignoring that close relationships result from and reinforce supplier reputation (Beverland et al. 2007). The New Automotive Industry Group has also identified the existence of premium brands as a strength of the industry but says little more about how to exploit this asset (NAIGT 2009). Thus brand equity seems to be recognized as important, but the means to achieve it, rarely discussed. We believe this paradox reflects a misunderstanding of how brands are built and how brand-driven business operate, points we address next.

Eleven common myths about brands

Branding is just a logo

This is one of the most common and persistent views of branding. The equation of branding with an output of the branding process (a logo) is understandable – after all it is those logos we all see, attribute meaning to and, if we're in the right target audience, desire. However, firms make an enormous mistake when they adopt this so-called man or woman in the street view of branding. A logo, name, symbol or sign (as well as a sound, smell, taste and feel) are all outputs of the branding process, and in many ways are the least important aspects of what is a critical strategic management approach. The process of branding and building value through brands involves much more fundamental choices that fonts, colour and shapes.

Branding is a strategy aimed at shaping demand and also differentiating one's goods or services from other sellers, in ways that are compelling to a target audience. Before deciding on how the brand feels, sounds and even smells, decisions are made to orient the company towards the market (see Chapter 8), segment that market into distinct needs, target

one (or sometimes more) of those needs, position the brand and then go to market. Thus, a branding strategy ensures that all aspects of the business (with the exception of the core strategic goals set by the top management team) are subservient (including innovation, design, processes, tactics, lobbying activity, corporate social responsibility and so on). Branding is therefore a strategy by which the firm competes in the marketplace, while brands are assets requiring careful management and attention.

Why does the brand as logo myth persist? First, branding is a victim of its own success – the dominance of logos and people's attraction to them leads people to believe that's all there is. Second, those who have played a role in creating brands benefit from maintaining the view that building brands is a mysterious, dark art requiring specialist advice and insight only a few can bring. Third, as one experienced marketing professional (who was behind some of the world's most successful brand re-launches) states, many people may have the word "marketing" in their title, but they don't deserve to. Marketers themselves are often more comfortable with a short-term focus on results or sales, and (partly due to lack of exposure) have little understanding of what lies behind powerful brands. Fourth, the wave of privatizations in the 1980s was coupled with changes in corporate communications systems, leading to cynicism towards branding, especially when such programmes follow a crisis and/or cost a seemingly large amount of money (which is the more galling when no substantive change has occurred). Finally, the backgrounds of many manufacturing executives are often not in marketing and thus knowledge of branding is limited.

Branding is too restrictive

Those of us who teach post-experience students (usually in MBA programmes) hear this a lot. For example, at the University of Bath MSc Marketing students are given a local brand to work with. The exercise usually involves a new, small or tired brand that requires help with its positioning. The most recent client was one half of a new craft coffee/brewery business in Bath, Colonna Hunter. After articulating the strategy behind his already wildly successful specialist coffee business (Colonna and Smalls – think of it as the Heston Blumenthal of coffee) co-owner Maxwell Colonna-Dashwood was asked by one student, "But aren't you missing the big opportunity represented by tea drinkers?" Uncharacteristically, Maxwell was stumped for words before replying, "They can go to a tea shop". The substance of this comment, and we hear it a lot, is that brands are too elitist. Because they target one group

of needs they exclude others and this means you are missing out on sales and market share.

Brands are indeed elitist – at least the best ones are. By elite we don't mean expensive. Ryanair is very much an elitist brand – if you want extras, business class, lounges, food, drink and so on, they won't provide it to you, unless of course you pay. They make it very clear who they're after and everything they do reminds you of that. By way of contrast, British Airways attempts to appeal to everyone – low-budget holiday-makers and business travellers – and they fail at both ends. The package deal travel companies and low-cost carriers carve up the bottom end of the market while the Gulf State and South East Asian airlines take the top end. The Morgan Motor Company is equally elitist – they ignore the whole under-40s market simply because they know this consumer is unlikely to have the disposable income necessary to afford one of their cars. Finally, Apple's elitism pays off – with just 9 per cent of the global smartphone market they earn 75 per cent of the profits.

The mistake many students and a lot of executives make is that they equate larger share with larger profits. As a result, appealing to more consumers or more segments is smarter than appealing to a smaller target. The long-run result is always the same – brands that attempt to be all things to all people are like vanilla ice cream – no one hates it, but no loves it either. Brands are built around addressing tightly defined needs. Although in the past it was possible to target two segments with one brand (usually through offering different product lines) increasingly this is very difficult in markets characterized by a plethora of consumer needs, lean and mean low-cost competitors, and many niche luxury providers. Getting caught in the middle is dangerous as Research in Motion (makers of BlackBerry) found out (and Acer, Nokia, Samsung and Sony are yet to realize) when it decided to chase the consumer market rather than focus solely on owning the high-margin, brand-loyal business market.

If you want share, either cut price or, preferably, build more brands. If you're worried about elitism, stay in commodities.

Branding costs a lot of money and its effects can't be measured

Branding can cost a lot of money, but the level of investment depends on the likelihood and size of the return, and on the scale and scope of your operations. As we've mentioned in the previous section, the effects certainly can be measured. It's not surprising that branding is associated with cost – our everyday experience of brands reinforces this, especially when we see the billboards, social media campaigns, advertisements,

sponsorship investments, themed retail stores, trade show booths and even the architecture of head offices. These cost serious money. But, these are only one way in which brand-driven businesses can build awareness and create value. Large-scale, global consumer goods brands typically spend a significant portion on branding activities, but this is always justified by the returns it generates.

Small firms, many of which are covered here can develop sophisticated branding programmes without a huge marketing spend. The Morgan Motor Company runs very few advertisements and instead invests in owners' clubs, trade shows, public relations and racing (although even here the budgets are much smaller than you imagine). C.W Dixey & Son and 14Bike Co spend even less, focusing on public relations, trade advertisements and web-based activities such as 14Bike's "My 14" owners' wall that contains stories from consumers about their custom-designed and built bicycles. Business-to-business firms would make very different investments, focusing most of their activity of corporate communications and trade shows, with a limited amount of advertising. Finally, a carefully defined target market and brand position will improve the efficiency and effectiveness of any investment.

Another reason why executives see branding as costly is because so often it is pitched as a cost. Marketers are often reluctant to commit to target returns, partly because the financial impact of branding took researchers time to identify, and partly because making these commitments is risky. It's far easier to hide behind soft data such as awareness or customer satisfaction or trot out tired lines such as "brands take time to build", "it's difficult to identify the exact benefits of branding, but we need one because competitors have them or consumers desire them" and so on. Branding therefore becomes perceived as a cost, and arguments usually ensue over how much should be spent. The outcome of this is that when sales start to fall, the branding budget is among the first to be cut, which is often the worst thing one can do. Focus on how brands can enhance firm value, share price and price/earnings ratios, and lead to price premiums (as well as generate some of the cost efficiencies identified above) and budgetary discussions will be framed in terms of return and investment.

There are other ways to measure the effect of branding activity. First, buyers should be aware of your brand. Your target customer should be able to (unaided) recall that your brand is part of a particular category, and has certain associations that are valuable. Second, if your branding is working and you are using it to drive your business, they should be able to identify unique associations that provide you with a point of

leadership over other competitors. Third, brands don't drive market share (they can increase share but that is not their primary goal), they build loyalty. Retention is therefore something that can be tracked. Fourth, you can always ask buyers a price proxy question – "How much more would they pay for your brand over a commodity counterpart?" Fifth, you can ask buyers whether they would recommend your brand to others. This is called a net promoter score and it is a key driver of income growth. Finally, you should be tracking your brand against a key set of competitors to identify points of leadership.

Brands are assets. They should be seen as investments. If your marketers do not accept or understand this, it might be time for a change. Since they are assets their value can be measured against a range of traditional financial measures as well as standard measures such as awareness, associations, tracking and net promoter scores (all of which are critical indicators of your brand's health). Finally, if you have the budget and a global focus there are any number of agencies that can estimate your brand value including Brand Asset Valuator, Interbrand's Global 100, and Millward Brown's Brandz.

Branding is a luxury only large firms can afford

This claim mistakes advertising for branding. Advertising, especially mass advertising, is expensive. However, this form of marketing communications is only one means of communicating your value proposition and is not always necessary for building a brand. Social media options also reduce the cost, as do targeted communication strategies to key influencers (such as public relations activities), trade show customers and lead users. Many of the firms we studied built global brand awareness amongst their target market on small budgets. If anything, given the inherent weakness of being a small player, branding is even more important as smaller firms must focus on higher value added. The brands of smaller firms are also important because often they command the vast majority of press attention, thus providing a halo effect for other, larger UK manufacturers.

Branding is fine if you're a business-to-consumer (B2C) firm but offers no value to business-to-business (B2B) firms

This is a common observation among many students of branding. The myth consists of two elements: (1) B2B buyers are rational whereas consumers are not; and (2) the principles of branding in consumer markets do not apply in business markets. Both are wrong. Any quick glance at Interbrand's top 100 global brands will identify a number of

B2B brands including GE (top 10), Caterpillar and Accenture (top 50), not to mention "relics" from the industrial age including oil companies such as Shell. Table 5.2 provides financial performance data on the effect of branding on B2B firms (others such as Interbrand also provide measures of brand equity for B2B firms). The data certainly shows that the value of branding to B2B firms is less than for B2C (a view reinforced in other studies) but this does not lead to the conclusion that branding has no value (far from it). In fact, the figures illustrate the benefits from branding as well as the lack of maturity in branding adoption in the sector.

Michael Beverland has spent a significant amount of his academic career working with and studying B2B brands. Although many industrial firms often had identities and even reputations, the strategic use of these were limited. However, as competition increased reputation became the key basis for selecting suppliers and providers of business services and inputs (Beverland, Napoli and Lindgreen 2007). As a result, interest in B2B branding has grown over the last decade and will continue to do so. Many B2B firms have spent time talking to their most loyal customers (customers relationships in B2B are much longer than in B2C) to identify the unique associations that keep them coming back over the years. Rather than just relying on a positive reputation (which is provided to the firm by customers), B2B firms are now leveraging those points of difference to grow markets, drive sales, increase retention, and assist with the introduction of new products and programmes including servitization.

Table 5.2 Effects of brands on business-to-business financial ratios

All Brands	Quintile	Brand power	P/E ratio	Financial strength	Market cap/book value	Brand equity as % of market cap
Most powerful brands	1	48.8	15.8	5.4	2.5	13.3
	2	27.1	16.0	5.4	2.1	6.9
	3	16.3	14.9	5.4	1.2	3.3
	4	12.4	14.7	4.5	1.5	2.0
Least powerful brands	5	8.0	17.2	4.5	0.5	0.6

Source: Gregory and McNaughton (2004) "Brand Logic: A Business Case for Communication", *Journal of Advertising Research*, September, p. 235)

As to the substance of this critique, the idea that business buyers are more rational is a long-held myth – business buyers may be achieving different goals in their purchases than consumers, but many of these goals are not particularly rational in the sense of utility maximization. For example, there's an old saying among purchasing managers – "No one ever got fired by buying IBM". This is not about utility maximisation for the firm; rather it is about risk reduction. Decades of research on business purchasing has identified that purchasing managers are as susceptible to brand claims as consumers and are just as likely to make selection decisions that reinforce their expertise (i.e. identity), status, minimize risk and provide a sense of comfort, as well as functional performance claims (Beverland 2012; Beverland, Napoli, and Lindgreen 2007; Ford and Associates 2002). Organizations may put in place processes that try and minimize buyer irrationality, but this only means buyers tend towards rationality rather than are strictly rational in the economic sense.

Since the claim that B2C brand building processes are not transferable to the B2B context is based on assumptions about buyers, this claim tends to fall along with the claims about buyer rationality. Brand building is about driving awareness through one's brand identity (the category the brand belongs and what it stands for) and brand image (through a mix of functional, symbolic and experiential associations). This doesn't change in B2B. What does change is how one executes branding programmes. Given that segments are sometimes smaller in B2B markets and that purchases can be highly customized (though not always), the ways in which brands are communicated are different.

Rather than relying heavily on advertising, B2B brand managers invest more in their sales force and trade shows than their B2C counterparts. They also provide much more technical information in their communications than would be the norm for B2C. Advertising is used primarily to raise buyers' awareness about the brand, which then assists salespeople to gain introductions with purchasing managers. Advertising is also used to launch new products and remind loyal buyers of the value of the brand. That is, the tactics change, but the strategic process remains the same. B2B firms stand to gain much from branding.

Branding doesn't work for ingredients or for original equipment manufacturers

On the face of it this seems a fair claim, until one thinks about Intel Inside, Bosch, Dolby, Merino NZ, Goretex, Nylon, Zeiss, Pantone and Reynolds Steel and so on. It is certainly true that ingredient brands do not generate

the same returns as the brands of end products or services but that is to be expected – they often only make up a small portion of the final value of the product (albeit sometimes a critical portion). As mentioned above Intel Inside delivered a 10 premium for Intel over almost two decades, which in itself is significant. The Merino NZ programme delivered significant value to wool-growers in New Zealand at a time when commodity prices crashed. Admirers of Michael Beverland's two customized bikes comment approvingly on the Reynolds steel frame (often knowing far more about the different numeric variations than he does), Royce hubs, not to mention the branded brakes, saddle, chain and wheels. And who really knows what Dolby is for? We just know it's good.

In the context of UK manufacturing this criticism is also less important than others. UK manufacturing is particularly driven by final demand, much more so than that of other nations (Hay et al. 2013). What this means is that UK manufacturers of ingredients are closer to the consumer than they may think. Thus, a carefully planned ingredient brand programme that taps into unique processes, locations, heritage factors and so on can add value to the end user, and as a result pull the product through the channel (adding significant value to the manufacturer's immediate buyer). Only less traded manufactures (food and drink, primary industries and minerals) have long demand chain linkages and even here there is more scope for branding than one thinks – after all De Beers used branding to generate value for diamonds while many retailers capture the value in food manufacturing by identifying the farm and farmer fresh produce came from.

Branded ingredients can add much value for those further up the chain, but to do so the brand programmes must be compelling to end users and go beyond simple claims of origin (food) or quality. And, they must be treated as assets rather than given away to all and sundry (as was the case with Woolmark – a brand with high awareness but little value). To do so involves taking responsibility for your ingredient from production through to end use and possibly disposal or re-use. To add value in this way, ingredient manufacturers must understand the nature of their customers and the type of business pressures they face. Investing heavily in relationship management and programmes that bring networks together can generate insights into potential value creation as well as underpinning the delivery of brand promises.

The one advantage ingredient manufacturers have over others in branding is that they stand to gain much from a first-mover advantage because brands provide a barrier to exit and typically many buyers are 100 per cent loyal to one supplier of key ingredients (i.e. where

consumers may choose room a set of brands in each category, business buyers only need one provider of computer chips, wool, Dolby sound technology, steel tubing and so on).

Great products are what people buy, not brands

In a way this is very true – a brand is only as a good as the products, services, systems and people underpinning its claims. But this also misses the point. If this was strictly true, Samsung would be worth more than Apple and capture higher margins, not just greater market share. Sony's brand would not be rated as "junk" by agencies. Morgan would have long ago gone faded into history, as would Ferrari or even Porsche. There are many great products available to consumers and business buyers in every category (with some exceptions to providers of unique minerals or inputs such as grapes from particular appellations), but people don't buy a "product" – they buy the services it provides including the identity benefits it brings, and this is where branding comes in. And, given the vast array of choice we face, brands cut through all of this, making our lives much easier.

Finally, let's say you make a great product, what happens when that becomes obsolete? You need to start again. Whereas with a brand, consumers can ask for the next version of Brand X. Consider what happens with many commodity ingredients. Michael Beverland spent ten years in the wine industry and spent much time observing wine makers buying grapes. Each year grape growers are judged on the quality of their products, as measured by water and sugar content among other things. No matter how long they've been in the business, they're only as good as this year's harvest. A great product is the start of a great brand – the excitement captured by that breakthrough product can be leveraged into a brand story to pave the wave for the next product introduction (not to mention all the other benefits of branding identified above). And brands also protect you when those products don't perform as well as hoped – Apple, Dyson, Toyota and many others can attest to this.

My industry is subject to commodity cycles – brands won't change that

Let's think about this for a second. The most valuable commodity export from the Colony of Virginia (when it was ruled by the British) was what? Tobacco. Unbranded? Tell that to Marlboro, a brand that has remained a constant part of the top ten in Interbrand's global top 100 brands – it's been there longer than Apple, Google and Samsung, and has arguably faced a much more hostile environment than any of those

aforementioned brands. Let's think about some other so-called commodities for a second. How about tea? Branded. Diamonds? Branded. Oil? Branded. Wine? Wine was traded as a commodity for much longer than it has been bottled and branded by estates, but we'd hardly classify it as a commodity today. Salt? Branded. Olive oil? Branded. The list goes on. There is simply no such thing as an intrinsic commodity. There are simply potential brands that are misunderstood or underappreciated by their owners or manufacturers.

If you doubt this claim, consider the sad state of many primary producers today. At a time when demand for food is outstripping supply, when concerns about food safety, animal welfare, traceability and methods of production are at an all-time high, and when city folk (who make up the vast majority of the population in developed economies) romanticize farming, farmers are suffering. Not that they've sat on their hands for the past few decades – farmers have innovated, become more efficient, improved quality, worked harder, reinvested profits into their businesses, gained more knowledge, switched to more in-demand products, responded to consumer concerns and even worked more closely with key buyers, all to little avail. It's the retailer that still gains the most margin.

You may think this is an injustice (and in one sense it is), but it is the retailer that adds the most value – they brand these items (with their own guarantee – retailer brands are not to be sneezed at in terms of equity), provide the valuable shelf space for these products, market them and assume some of the cost of spoilage. What's more tragic about this situation is that farmers only have themselves to blame (or maybe the organizations that supposedly "market" their produce do). With retailers desperate to encourage consumers of one brand to switch (i.e. Tesco wants to gain customers from Sainsbury) it is destination categories (categories that cause consumers to switch retail brands – a critical category since the majority of consumers are close to 100 per cent loyal to a retail brand) such as fresh produce that provide the cheapest means to do so. However, sellers of produce fall over themselves to sell their wonderful products, often highly differentiated due to processes, location and back-story to all retailers, thereby undermining their own strategic importance. And, despite all the emphasis on origin in labelling, it's the retailer that hijacks this to their own advantage, reinforcing their image of quality and local contributors.

Over history what were once commodities became brands. If you want to stay in commodities you are consigning yourself to the low value end of the market, and this is a form of manufacturing that is unsustainable in developed economies.

Branding is fine for a new company but we've been around for a hundred years – we know what our customers want

Do you? How? For many firms, particularly business-to-business ones, having loyal customers in spite of formal branding programmes is not unusual. However, this represents an opportunity for further value creation not a rejection of branding per se. Loyal customers buy from you because (assuming you are not a monopoly) something that you do is unique and valued. However, relying on reputation (which is provided to the firm by its customers) obscures what this point of difference is and means you miss out the benefits of branding that unique selling point in order to appeal to more customers, driven channel pull, ease new product introductions, export to new markets, and the other benefits identified earlier.

The Morgan Motor Company was one such manufacturer that studied its reputation and used that to build a branded asset. For a long time, the cult status of Morgan was taken for granted. The firm, through consistent innovation, restrictive supply, and the actions of many of its staff and owners built up a reputation as an iconoclastic, old-world throwback that appealed to a niche market of highly loyal customers and/or fans. In the early 2000s, Charles Morgan commissioned a brand study to identify exactly what set Morgan apart from other marques. The study of owners and wannabe owners identified the strong emotional attachment customers had to the brand and mapped this love onto the care the owners and staff also demonstrated. The result was the realization that in an era dominated by faceless large corporate firms, Morgan stood out for some people. Morgan also realized that this group was growing. Thus, after almost 100 years of trading it formalized its branding under the strap-line "Driven at heart" and used this to drive innovation, communicate benefits, appeal to new customers and drive all other aspects of their business model, to continued success.

If you have been around for a long time and been successful, surely you deserve to capitalize on that.

Branding is risky – we just need sales!

Then reduce price! The easiest way to generate sales is to cut prices. Or you can invest in a sales force to drive sales, but this is very expensive. Brands cut the cost of sales while also allowing you to earn premiums. Since much of the manufacturing debate is focused on higher value added, a focus solely on sales or share is short sighted. And the transactional logic underpinning a sales focus leads to too much emphasis on attracting new customers rather than also on retaining existing ones

(which is much cheaper). The latter is critical because they offer the potential for value added through servitization, will recommend you to others, will more likely trial a new innovation and be prepared to pay a premium for the reassurance that a brand offers.

The best example of the dangers of a sales- or share-driven agenda is General Motors (GM). Prior to its government bailout GM spent much energy trying to live up to its claim of being the world's largest automotive company. So much so that it literally gave vehicles away. Despite a 22 per cent jump in sales (their second best annual performance) in 2006–2007, GM lost US$146 per car (an improvement over a US$1,271 loss per car in the previous year). While GM's strategy ensured Toyota remained number two, Toyota earned US$1,977 per vehicle over the same period. Price discounts kill brands – because of a track record of discounting, consumers expected GM-branded cars to be sold for less than full sticker value (Ritson 2007). In contrast, Toyota was able to earn US$2,692 more per vehicle on average. A branded strategy focuses on profits, not sales.

Brands kill innovation

There is some truth to this claim. Sir James Dyson is in one sense right to bemoan the lack of risk inherent in marketing and branding. Brands build value through being consistent and as many have noted, reinforcing the brand over time often results in a conservatism that drives a preference for incremental innovation. However, that is only half of the story. Brands require strength or forward momentum and it is innovation that provides that. In brand-management parlance the latter drives brand relevance. The toughest challenge faced by many brand managers is getting the tricky balance between consistency and relevance right. Relevance is critical but cannot come at the cost of diluting the brand. However, so powerful is the logic of consistency that many brand managers fall back on reinforcing brand preference among existing loyalists in the hope this will preserve existing levels of equity. A focus on relevance often only occurs when brand equity starts to decline and the brand gets into trouble (at which point it can be too late).

Consider the case of Research in Motion (RIM) and the BlackBerry. BlackBerry became the must-have item for the powerful or wannabes around the world. As such, amongst movers and shakers, it was the necessary item. BlackBerry owned the high-margin business market. Apple in contrast owned the more artsy, creative end of the market. This left Android, Nokia, Motorola and Samsung among others to fight over the low-value, functional part of the market. Unfortunately for RIM,

they got greedy, and decided to extend their brand into the consumer market with their Pearl range of messaging devices and Playbook tablets. In taking their eye off the main game, the brand suffered a critical crisis when their security was hacked. Worse still, their consumer products were not very good. As the company sought to recover from the security crisis and shore up their consumer products, they had less to invest in their all-important business products. At the same time, sensing an opportunity, Apple started to offer more comprehensive business packages. The rest is history.

This story is a cautionary tale of failing to balance innovation and consistency, and it also is used to shore up the preference among brand managers for consistency.

Conclusion

In the previous chapter we claimed that UK manufacturers created value not primarily through high tech but through branding. In this chapter we expanded on this, identifying how brands build value and addressing many of the criticisms raised about branding by manufacturers and others. Brands also provide the mechanism to address many of the resource challenges confronting the sector including the need for higher margins, skilled staff, greater investment, export growth and policy support. However, these gains are not achieved by simply creating a great logo, tagline and advertising campaign. A branding strategy requires a different business model. The best UK manufacturers do not just have strong brands; they are brand-driven business, which means the brand becomes the first input into innovation rather than an add-on at the end.

6
Innovation Pathways

Introduction

The previous chapter identified how manufacturers use brands to drive their business models. A brand-driven business model has implications for how firms innovate. Writers on innovation (and the vast majority of those on manufacturing policy) rarely give much consideration to branding other than to identify it as something that is "added on" at the end of the innovation process. Nothing could be further from the truth – the type of innovation (primarily breakthrough or primarily incremental) and, critically, the means by which one goes about innovating are all contingent on one's brand position. Far from being a last-minute add-on, branding considerations take centre stage in innovation strategy. This chapter explores the relationship between branding and the six innovation pathways identified in Chapter 4.

At the time of writing, Apple is the world's most valuable brand. Part of Apple's turnaround story that gets overlooked is how branding considerations drove the firm to focus on no more than ten core products (down from a reported 800 plus) including the iPod, iPhone, iPad, iTunes and Apple TV. When Steve Jobs returned as Chief Executive Officer (CEO) he reviewed all of the ailing firm's projects and focused on only those that would bring to life the brand's position of "Think Different". This focused strategy allowed Apple to create and define new markets, move from a brand many thought near death to the world's most valuable, and become the darling of the share market. Its competitors, many of whom make fine products, have largely been following ever since, primarily because they adopt a model whereby innovations are aimed at somehow creating a positive reputation for the firm, which then spills over onto the brand. The difference in approach explains

why technological leaders such as Samsung, Acer and at one time Sony do not enjoy the same market prestige or valuation as Apple and other brand-driven businesses.

Brand-driven innovation

Figure 6.1 identifies how writers on manufacturing think about the appropriate place of branding considerations in the innovation process. Branding and other commercial considerations are usually seen as last-minute add-ons, applied towards the end of the process largely to make the product more marketable or acceptable to consumers or users. In this model, branding is lumped in with other marketing activities including advertising; this not only fails to appreciate the hierarchy of such activities (branding drives all tactical marketing activities rather than representing just one marketing input), but suggests branding is little more than styling or the addition of a logo and some packaging. Such a model means that the brand must somehow be made to fit the innovation. Critically, it means that any brand benefits from previous activities are difficult to capture.

Such a model is representative of how many South East Asian technology firms such as Acer, Samsung and Sony operate (excluding perhaps the focus on end-of-life). These firms have built a reputation for providing a very wide range of good-value, quality products. In some cases their products contain many advanced features, including some that are truly ground-breaking. And these firms typically operate a corporate branding or branded house strategy. These approaches to branding mean that the firm has just one brand that its products and

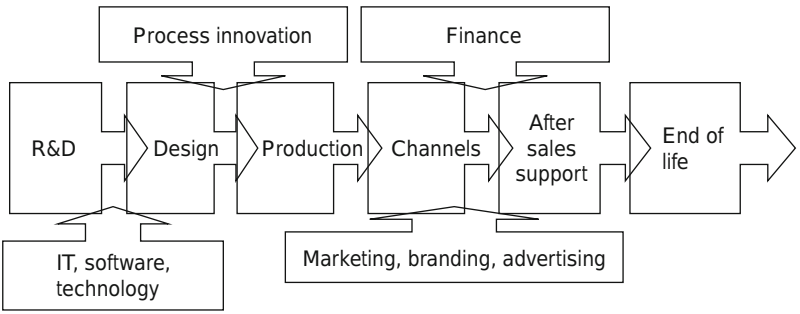

Figure 6.1 Classic innovation model

Source: Sissons (2011a, p. 14)

services represent. Thus, while a firm such as Proctor and Gamble has many brands, all of which are aimed at building value for the group and have distinct innovation strategies (that may draw on group-level resources and capabilities), Sony, for example, has many products, all of which are branded Sony. If you ignore Pixar and Beats, Apple operates a similar branding strategy although they tend to also build strong sub-brands around technological platforms that are then endorsed by the Apple brand.

Although you may be tempted to follow the strategies of brands such as Sony and Samsung it's worth pointing out that these firms' brand valuations or market capitalization are not as high as brand-driven firms such as Apple. The brand value of Sony was recently rated as "junk" and although Samsung has made significant gains in market share, Apple still accounts for the vast majority of profits in categories in which it sets the agenda. South East Asian technology brands have built their reputation around engineering prowess. Their strategy is focused on capturing as much of your technology spend as possible, thereby starving other brands of oxygen. In terms of branding, their strategies are similar to the old automotive sector model whereby each new product release provides a reputation spill-over for the brand. In these models, technological investments drive the brand. However, this model is not without significant limitations.

First, the reputation and therefore value of the brand is only as good as the next product release. Just as a great product may provide a positive spill-over for the corporate brand, mediocre or incremental releases may reduce reputation.

Second, the model requires expertise and investment across a large number of product categories. In contrast firms such as Apple can concentrate their resources in a few.

Third, this model tends to result in incremental innovations rather than more radical breakthrough ones that define whole new categories. This is because technological advances shorten product life cycles, resulting in the need for regular releases that maintain competitive parity.

Fourth, the model relies on sustained performance advantages only. As we identified in the previous chapter, this results in competition through functional creep that is difficult to sustain and ignores the fact the consumers and business customers use brands to enhance their identities.

Fifth, the model rarely builds layers of brand associations. Ask people what they associate with many of these technology brands and typically

their answers include "wide range", "good quality", "good value" and other functional associations. Rarely do they feel strongly about these brands (they are, as we identified in the last chapter, "vanilla brands" – neither loved nor hated). Missing, for example, is any emotional response. This is a shame because the back-stories of many of these firms are extremely human and emotional, often more so than firms such as Apple. On the other hand, take a brand such as the Morgan Motor Company – the associations that the brand has includes famous users, the production process, the members of the Morgan family, various models, wins at Le Mans, romantic associations of a bygone age, links to the symbolic commons including notions of "Britishness", "British style", "Biggles", and the list goes on. All of these enhance the value of the brand, thereby strengthening the relationship between it and the consumer, and also generating price premiums.

Sixth, any symbolism attached to particular products is often ignored in favour of the corporate brand. Prior to the emergence of the iPod, consumers used Walkmans. They didn't always use a Sony Walkman, but nevertheless Sony defined the category. Rather than leveraging this leadership position and all the associations with pop culture that has been built up over almost two decades, Sony dropped the name in favour of the Discman (which had no associations) before moving on to the next technological platform. In contrast, brand-driven firms would have realized the Walkman transcended the technological category and brought out a line of strongly branded MP3 players (probably before Apple) supported by an online music store (they do after all have an entertainment division).

Seventh, apart from a reputation for value and quality, this strategy neither contributes to nor benefits from a symbolic commons.

Finally, as we noted in the previous chapter, there is a strong chance innovations may fail simply because they do not fit the consumers' image of the brand. BlackBerry suffered this fate with its "Playbook" – for a brand targeting the high powered (or wannabes), a line of consumer-focused innovations framed in terms of "play" simply identified that the brand had gone off track (their aforementioned security crisis only reinforced this).

In contrast, brand-driven firms use the brand's position to drive innovation decisions, both in terms of product and process. The brand's position also determines which markets the firm competes in and how they do so. Finally, as identified in the previous chapter, value or equity (as represented by measures such as loyalty, margins and shareholder return) results from delivering on one's brand position consistently over

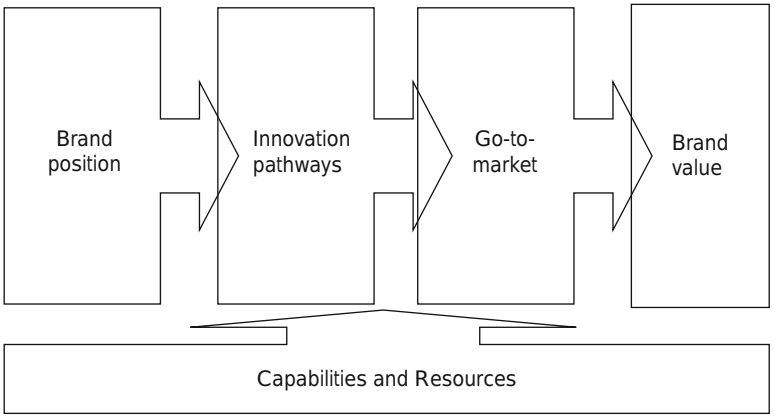

Figure 6.2 Brand-driven innovation model

time. Figure 6.2 reflects this process in a highly simplified way. In this model, an emphasis on incremental or breakthrough innovation, the type of innovation pathway, and the form of and emphasis on process innovation follows are all driven by the brand's position. Thus, while a firm such as the Morgan Motor Company may gain significantly from process innovations such as Kanban, these are viewed as a point-of-parity. Instead, the firm emphasizes the link between past and present, stressing the combination of its craft heritage with design-driven innovation in concepts such as the environmentally friendly LifeCar. Other firms, such as Dyson, emphasize different things, but what unites them is a brand-driven focus.

This model trades the vanilla-type appeal of those who chase market share at all costs, for a passionate customer base who see something of their desired self in the product being offered. The brand-driven model also overcomes the limitations attributed to the brand-as-add-on model discussed above.

1. Brands can sustain abuse and even missteps – for example, despite Dyson's failure in washing machines, the brand is still viewed as an innovator, making consumers more likely to consider the next product offering from the firm.
2. Firms such as Dyson concentrate their resources in a few capabilities rather than across a wide range of product lines, thus enabling breakthrough innovations and follow-up incremental innovations that extend product life cycles.

3. Although brand-driven firms may focus on performance, this is not the only option they have. After all, are Morgan cars or AGA cookers really performance leaders (at their price point)? Probably not, but they capture margin and build loyalty anyway.
4. These brands build meaning in through multiple associations including functional, emotional, symbolic and experiential associations. Many of these are impossible to replicate and therefore make the brand unique.
5. These brands contribute to and benefit from the symbolic commons. Likewise, symbolism attached to the brand by individual consumers or the subcultures of which brands are part all enhance the brand's meaning over time. Thus, Harley Davidson not only reinforces notions of American power, freedom and manhood, but also gains from being featured in movies, novels, songs and other forms of pop culture, as well as encouraging a diverse array of owners' clubs, all of whom add to the brand's uniqueness and value.
6. Brand-driven innovation ensures new products reinforce consumers' expectations about the brand, thus ensuring a higher likelihood of commercial success. As well, they often reinforce the image of the brand among retailers, channels, the press and other stakeholders, all of whom play a role in ensuring the success of each product launch.

So, how do brand-driven firms innovate in practice? In Chapter 4 we identified a range of different innovation pathways that reflected the strategies of many of the UK's manufacturing success stories. The next section explores these in more detail with reference to exemplar cases. Critically, it is unlikely that success will emerge from just adopting one pathway alone; instead firms often combine several approaches even if they choose to emphasize only one in their official communications (Exhibit 6.1 provides an example of this).

Exhibit 6.1 The Morgan Motor Company and innovation

"Of course Morgan sells heritage", says Charles Morgan. "Our factory has around 20,000 visitors a year who come to see and learn about Morgan and visit our Heritage Motor Centre in Malvern Link, Worcestershire. What are they all coming to see? Complexity and heritage. Handmade cars that are fast, fun to drive, lightweight, responsive. The craft and care involved in the making, combined with cutting-edge technologies. Our craftsmen are very skilled. Cartier, when speaking about craft and the past, said, 'You can never reflect the past, but you can always be inspired by it'."

In the past Morgan was renowned for its 3 Wheeler with the company continuously producing three-wheelers between 1909 and 1953. In 2011 they brought this classic back to life in the form of a homologated 3 wheeler motor tricycle. There are far less stringent road tests and standards for these than for cars. Whilst the three-wheeler is a modern take on what is probably the most iconic Morgan of all time, the new vehicle embraces modern manufacturing technology and is the most environmentally friendly product in the Morgan line-up. The 3 wheeler was the start of the business when it was launched by company founder, H.F.S. Morgan. It still holds many speed records and is considered by Charles to be the personification of Morgan's brand values, subsequently leading to a doubling in orders.

The design process starts with hand-drawn sketches and mood boards. Working on an iPad is very much part of this activity. Once a concept has been drawn up then it is put onto a CAD (computer-aided design) platform. Following this their design team start milling the prototypes with this being done increasingly using rapid prototyping techniques. The car design is then submitted to a "critical audience". For example, they might take one out to a show at Pebble Beach, California, exposing it to demanding customers and exhibiting it alongside the most respected world brands in front of car designers.

"The basic reference files on CAD have to be brought together, aided by Autodesk," says Charles Morgan. "The Alias Graphics kit has been very flexible in producing graphics for our cars. We produce the catalogue for new cars before we have done any tooling. We invest in ergonomics testing and go to a wind tunnel. Once we have sold the form we are able to go into detail on the componentry and fit out, but because of the complexity of these components we are unable to hand model these."

Pedigree is important. For example, the original three-wheeler was a strong influence on the design of the new three-wheeler. "We created a tubular chassis with an S&S engine from Wisconsin, USA. It is, in our view, slightly better than the Harley engine. We have matched up the gearbox to Honda. A Quaife carbon fibre belt is used to drive to rear wheel. We wanted the three-wheeler to have a very different interior design and feel. At the centre of the console we have positioned the starter button. We want each 12 cylinder engine to be respected. The ignition sounds rather like a bomb going off and the ignition switch is modelled on the bomb-release mechanism on the Euro fighter.

"To complete the design process we had to review 200 orders before we signed off the model. At the Geneva Show the car was partly tooled and partly hand built. We took 400–500 orders after that show alone and since then the popularity of the re-launch has continued to grow phenomenally."

Morgan developed the first AIV (aluminium-intensive vehicle) and designed a chassis that meets world safety standards but is 20 per cent lighter than comparable steel-production monocoques, having been funded by the Technology Strategy Board to develop lightweight applications for the composite, magalloy. The business collaborated with Superform in Worcester to develop the big wing curves on the Morgan Aeromax as the first automotive manufacturer to assimilate this technology from the aircraft industry and worked with Birmingham supplier Radshape to develop adhesive bonding

capable of doubling the resilience or stiffness in the Aeromax chassis structural integrity.

Company results posted for 2013 showed turnover remaining broadly in line with the previous year, nudging up from £34.9 million to £35.1 million. Output remained steady at around 1000 cars, with the Morgan three-wheeler accounting for half of volumes sold. Morgan employ around 180 people, with showrooms in Beijing and Shanghai in China, having launched its latest three-wheeled model in 2011, almost 60 years after the first one was built, helping its sales to move ahead and output to increase by a third. Whilst income from the UK dropped from £12.2 million to £11.7 million, and fell in Europe from £16.4 million to £15.3 million, sales to the rest of the world made up for the shortfall, climbing from £6.3 million in 2012 to £8.2 million.

Pathway one: technology push (the STEM model)

The first innovation pathway is the one that has received the most attention in policy debates on the future of manufacturing. Although we have argued that manufacturing's future requires more than this narrow focus, nonetheless what we call a technology-push approach has much to offer the sector, particularly in combination with some of the other pathways identified herein. The essence of the technology-push argument is that high value added requires the deployment of specialist knowledge – in the UK's case, areas of established world leadership. As we've discussed in Chapter 3, this typically involves drawing on research expertise in the UK's leading universities and research institutes, particularly in STEM-based subjects. This pathway draws heavily on existing ecosystems and is the reason behind the UK's success in aerospace, automotive, particular computing technologies and pharmaceuticals among many others.

In this model, innovation is typically driven by a pure science or basic research agenda. That is, the focus is on genuine new-to-the-world solutions to existing problems. This would include new drugs to combat diseases as well as new technologies to address environmental concerns. And such innovations are often driven by the national interest including the provision of pharmaceuticals for the NHS or cutting edge defence technology for the armed services (Broadberry and Leunig 2013). Although the nature of such research makes success difficult to predict, researchers have focused on tightening relationships between research institutions, established firms, government initiatives such as Catapult Centres and start-ups that are able to commercialize much of the research coming out of universities.

The following example of Continental Engineering Services UK Ltd reinforces the value of STEM-led innovation. Lichfield-based

Zytek Automotive, diversified into hybrid electric vehicles in the mid-1960s as concerns about fuel supply and air quality were beginning to emerge. Since then they have developed a global reputation as a technology leader in producing automotive systems for electric vehicles and hybrid electric vehicles. They have, for example, says Neil Cheeseman, their Engineering Programme Manager, been producing smart cars since 1996 and were commissioned by Daimler in 2009 to engineer smart cars for two for EU and USA to use as an unlimited field trial.

In 2009 they were awarded UK government funding to support, design and manufacture a brand new drive train for a small city electric vehicle comprising motor, inverter (with integrated DCDC power converter, charger and power distribution unit), gearbox and battery. Following their 18 month development programme they produced a total electric power-train weighing 700 kg, or under half that developed for use in previous vehicle programmes. The business, through a collaboration with Honda Racing, has produced a hybrid electric racing car, the CRZ GT300, regularly placed in top three race positions, with this experience leading to further collaboration on Kinetic Energy Recovery Systems with Honda.

More recently the business has been collaborating with Jaguar Land Rover on a £16.3 million Technology Strategy Board-funded programme, involving 12 industry and university partners to develop a mild hybrid, plug-in hybrid and full battery-powered electric powertrain capability, compatible with the existing Range Rover Evoque production model, known as the Evoque_e. Jaguar Land Rover have predicted that this will lead to new technologies with the potential for high-volume production and capable of delivering benchmark performance in terms of cost, weight and sustainable materials.

In summary, STEM-driven innovation remains a critical river of innovation in the economy. Consistent with previous reviews on manufacturing, we support further calls for STEM development although are cautious about over-investing in this area or viewing it as the sole pathway to value added. Critically, commercialization remains a challenge, suggesting ecosystems mixing small agile firms, large established firms and universities are most likely to result in more value creation than simply hoping investments in basic research alone will be sufficient. The change in the way university research is assessed may assist with this shift, as it requires university departments to demonstrate real world impact. However, technology-driven innovation is likely to be

more successful when combined with other pathways including design, marketing and process.

Pathway two: design-driven

Manufacturers in the UK invest heavily in design – design accounts for 24 per cent of all manufacturing intangible investment compared with 14 per cent for all industries (Sissons 2011a). The design-driven model of innovation on the surface shares much with the technology-push approach. First, designers typically focus on breakthrough innovations rather than incremental shifts or mere styling (often the marketing view of design whereby designers make a product prototype consumer -friendly). Second, designers draw heavily on changes in technology and STEM-driven trends to identify new product concepts or categories. Third, they seem to focus on developing products that fulfil perceived needs or gaps. Finally, they draw heavily on ecosystems, often partnering with firms to provide raw material advances, engineering advantages and even manufacturing expertise. However, while all this is true, there are some significant differences.

First, although designers often appear to ignore customers when developing concepts, in reality they often downplay the value of marketing data focused on espoused customer needs in favour of focusing on latent or unmet needs. Second, technological or scientific knowledge is one of several inputs designers use to develop innovative product platforms. Typically, designers balance technological, customer, business and environmental needs when developing products (Brown 2008). They also focus not just on developing the object, but give very real consideration to commercializing it, a focus that extends beyond invention through to manufacture, sales, and even disposal and reuse. Third, although they draw on ecosystems, they often also create or reorder existing commons as part of the design process in order to create a more robust innovation (think of Apple's category dominance through its system of products, software updates and iTunes as an exemplar). Finally, they obviously also view aesthetics and emotional functionality as a crucial means to reinforce the brand and add value.

Dyson provides one example of this approach (although we recognize this firm's success involves overlapping pathways). James Dyson's design philosophy involved making everyday items more effective and doing so in ways that also provided consumers with emotional benefits (think of the ball on his wheel barrel or the colourful design of his vacuum cleaner). Dyson's research on the vacuum category revealed that

consumers remained frustrated that existing products did not deliver on their promises – despite much effort, floors did not feel or seem clean, resulting in anger and also undermining the user's identity of being a good home keeper. Drawing on his engineering background, Dyson realized that the dominant firms lacked innovation and were failing to embrace new materials, new engine technology or move beyond the original design specifications of the very first vacuum cleaners.

His subsequent success resulted in the formalization of a design process whereby designers and engineers seek to capture markets by addressing user frustrations with existing technologies. Since this approach lies at the heart of his brand, Dyson's design innovations not only set the standard for functional performance, but must also provide users with an all-round positive experience (including ergonomics and aesthetics), address environmental concerns, be easy to manufacture and of course be marketable. This approach has evolved over time, often as a result of painful experience. For example, although the firm's washing machine (the Contrarotator) was based on ethnographic insights gleaned from watching women washing clothes by hand, the subsequent product launch failed to champion the very real benefits of the machine including the shorter wash times, lower chemical use and improved performance, instead focusing on the seeming benefits resulting from an extra drum.

Design-driven innovation is characterized by an emphasis on what innovation writers call the fuzzy front end of the innovation process. In layperson's terms this refers to the initial concept development stage. While stage-gate models of innovation (see below) try and reduce the time spent in this stage in the search for efficiencies, design-driven firms often spend a long time seeking to understand the exact nature of the solution desired by customers. In so doing, they spend significant amounts of time immersed in their respective markets, often engaging in participant observation in order to gain deep insight into what consumers are feeling, what needs they are trying to meet and what frustrations they are experiencing. For example, Oxo Grips were developed after the designer made themselves up as a retiree and began to experience how society's expectations that their productive lives were over flowed into everyday designs that hindered their ability to achieve important goals. Simple redesigns of basic cooking utensils and household objects resulted in the development and ownership of a new market category.

The emphasis on these techniques reflects beliefs about the ability of customers to articulate their needs. While marketers believe consumers or users are the source of innovation inputs, designers believe that

such an approach primarily leads to incremental or me-too innovations because customers can only talk about what they know, rather than identify what could be. Too much reliance on voice-of-the-customer analysis results in products that provide little point of difference to the competition and that are unable to provide much in the way of value-add or shape markets. Effective design-driven innovation may involve good designers, but it should not be mistaken for an egocentric view of innovation. Instead, designers innovate in ways that result in aesthetically pleasing, breakthrough products that meet real needs and thus meet genuine business targets including a point of difference, high margins and sales.

Birmingham-based WB the Creative Jewellery Group reinforces the value of design-driven innovation. Chairman Patrick Fuller joined the business in 1979, having previously worked in companies marketing food and interiors. The business, established by his father-in-law in 1947, was producing volume components for the jewellery industry, through a lost wax-casting production process. They sell to around 4,500 jewellery clients in the UK, recently extending their B2B brand offering to include two new ranges, "Rosabella" and "Sienna", moving from rings alone into earrings, necklaces and bracelets, often sold as sets. "Our retailers had previously assured us that there was limited market appeal, but in 2012 alone we sold 3,500 diamond necklaces at price points of between £15 and 16k."

As one of the largest jewellery manufacturers in Europe, the business produced over 400,000 pieces in 2013 and set over 100,000 diamonds. New product introduction accounts for between 20 and 25 per cent of turnover a year, with the business producing about six new ranges annually, with 5 per cent of their workforce involved in design, 60 per cent in manufacturing and 35 per cent in sales.

Fuller sees great value in designers from different businesses visiting each other to learn more from different departments and disciplines:

> There is a prevailing view that the creative industry as a sector largely excludes manufacturing. But it's really important we think of all manufacturing as creative and include this with our cultural activities aligning them with each other to enable more cross promotion. We have a wealth of designs to showcase. Ballet and opera have a similar cachet to jewellery and other high-value-added brands produced in the Midlands such as Morgan, AGA and Jaguar Land Rover. There's an opportunity to get to a wider audience through collaborations of this sort – not only through the potential to promote and sell but also

> by getting more people interested in designing and making things. By bringing together a serious group of people we can facilitate these activities.

Fuller's approach to innovation resembles the focused intuition that underpins design-driven insights. In particularly he emphasizes immersion in markets in order to get underneath the skin of customers. This approach focuses not on espoused needs, which Fuller believes are less important for breakthrough innovations. Instead he focuses on learning about each particular industry he is focused on in order to identify latent needs, or pockets of value that offer great potential that no one is yet target. For example:

> Developing a feel for new market opportunities is something that requires an intuitive feel for products and sectors. Sometimes this comes with experience. At times marketing people can be too focused on immediate market research on what consumers want now. You really have to move beyond that. Marketing seems to have become a buzz thing, but a lot of it is learnt by going out and seeing things. Marketing is not simply a technical discipline. You need to love the product and like the market.

In summary, the value of design-led innovation is all too often discussed apart from the manufacturing debate. As we've already noted, this divide reinforces the poor reputation of manufacturing. However, design is critical to brand value – not just in designing the aesthetics of the brand (its logo and so on) but in bringing the brand to life and ensuring it remains highly regarded. The process of design also adds value symbolically as well as competitively through its focus on appealing to unmet latent market needs. However, good design requires more than just STEM expertise. Good design also draws on skills from arts and humanities as well as many of the traditions associated with social science including psychology and anthropology (Kelley and Littman 2005) – skills (and dare we say mind-sets) that to date have been largely ignored in debates about the future of manufacturing.

Pathway three: craft

At first glance the idea of craft-innovation seems counter-intuitive. Typically crafts are viewed as old-world techniques passed down unchanged through the generations. Skills and expertise are built up

over time through repetition of time-proven practices. Not to mention their branding practices typically stress adherence to time-honoured skills, supposedly "slow" ways, the continuance of the traditional, and a rejection of low pursuits such as commerce and trends (Beverland 2009). There is certainly some truth to this, but the reality is more nuanced. Certainly expertise is developed through practice – Saville Row menswear brand Gieves and Hawkes says it takes around ten years for their cutters to acquire the expertise necessary to meet their exacting standards. However, study craft firms in detail and you'll often be surprised at how innovative they are.

Craft firms are paradoxical – they often continue to define industry standards while seemingly never embracing new technologies or trends. For example, the world's finest winemakers often combine traditions with cutting edge technology to ensure the continual evolution of product standards (Beverland 2005). And, they can be surprisingly innovative, just as the Morgan Motor Company was when it developed its high-performance, environmentally friendly LifeCar that drew on its century-long use of wood as well as design expertise in its ecosystems to produce a high-performance, recyclable and light concept sports car at a time when many thought such an outcome was impossible with existing technology.

Craft-driven innovation is valuable in the context of this book because it is the least likely to be subject to price competition, the most knowledge intensive and therefore difficult to copy, and the least likely form of manufacturing to be relocated offshore. Why is this? As Pisano and Shih (2009) identified, this low-tech form of innovation cannot be disconnected from the process of making. In contrast, the high-tech outcomes of technology push and even design-driven innovation can be decidedly low tech to manufacture and thus are most likely to be sent offshore to ensure greater efficiencies and cost savings. For example, Apple and Dyson retain design workshops in California and Malmesbury respectively but offshore production to China and Malaysia. In contrast, so much of the value of the UK's luxury and craft sector (including high-end food and drink manufactures) is tied up in the continuance of local craft traditions that to locate production offshore or even in another geographical region would be commercial suicide.

Founded by John Boultbee Brooks in 1866, Brooks England's reputation is built on quality, authenticity and a heritage cherished by owners around the world. Aged 16 the young John left his home in Hinckley, so the story goes, to make his fortune in Birmingham, in his case by

making leather saddles for the horse trade. Steve Green, Manager of Brooks England, says:

> It was only in 1878 after John Boultbee Brooks's horse died and he wasn't able to afford a new one that a friend lent him a bike. The bicycle saddles at the time were made of carved wood and horribly uncomfortable, so he decided to try making one from leather. It was all about finding more comfortable alternatives for the rider and this is still very much at heart our ethos. Even today all our bicycle saddles are hand-finished. They're still being made now as they have been for the best part of 150 years.

Of their total turnover Brooks estimate that perhaps as much as 50 per cent is generated by products designed in the 1800s, with their B17 Standard, the oldest saddle in the current range, having featured in the 1890s catalogue, and one of their most successful models to date. Products designed in the 1900s generate roughly 30 per cent of turnover, with those designed in the 2000s responsible for around 20 per cent of turnover. J.B. Brooks also had the foresight to patent his designs, with his first patent gained in 1882, a process he pursued with vigour, registering many subsequent designs.

Brooks was acquired in 2002 by the Italian business Selle Royal. Company turnover is in the region of £10 million annually and they employ around 40 staff. Revenues have more than have doubled in the 12 years since the Italians took on the business and it has grown by over 40 per cent in the last five years. Brooks have been focused on telling their story. As Green states:

> They've drawn on our unique heritage, creating striking advertising campaigns and new point of sale materials and most recently opening a new shop in Covent Garden, all focused around emphasising our authenticity. It's been interesting to see how they have looked at the business, finding value in much that could have easily been taken for granted. Many of our employees have been with the business for 20, 30 or more years. We have a very loyal team here. We realize that our saddles depend on craftsmanship, attention to detail and authenticity – all delivered by staff, who know our processes, each of our traditional machines and their characters, and who also know each other.

Not all craft business are defined by low technology and slow innovation. For example, Samuel Heath reinforces the value of craft-led

> innovation. The business, founded in 1820, generates £10 million turnover, employing 130 people with a focus on preserving the craftsmanship innate within its manufacturing of quality taps, showers, bathroom accessories and architectural hardware, whilst combining this with the latest design technologies. David Pick, Managing Director, states: "From designing to machining, polishing, plating and assembly, we have complete control over the whole production process, so that we can oversee the quality of each product at every stage and remain faithful to our design principles."

At the height of Victorian industrialization the company moved into manufacturing locks, gas and electrical fittings, and later as the automotive industry's growth gathered momentum the business started making headlamps for motor cars. In 1958 they acquired Perkins & Powell, producing high-quality architectural hardware. In 1970 Sam Heath became their Chairman and with the acquisition of Holt Siron and W. Adams they moved into the design and production of luxury bathroom accessories such as taps and showers. Having been established as a traditional brass founder, the business has refined its knowledge of plating technologies as applied to the European brass used exclusively in their products today. Pick says:

> We believe, as a British manufacturer, that we're able to attract new customers through our focus on quality, our constant product innovation and by remaining true to our integrity and provenance. With the growing interest in customized pieces we are even able to produce bespoke products, thanks to the vertically integrated nature of our production. We would never have this flexibility if we had outsourced.

He explains how each product is hand polished and plated in up to 34 individual processes to create a flawless finish:

> We have developed a layering process that is unique to us. The careful polishing and preparation of the surface and the thickness of each layer is very important in giving a lustrous finish, what we call a "mirror finish". It's what gives the products a true reflection, without any distortion.

This plating expertise has enabled the business to produce a vast range of finishes to their brass products including bronze, antique brass,

polished nickel, polished and satin chrome, matt black, lacquered brass and non-lacquered brass. It is clear to Pick that knowledge of the craft of making is at the heart of their competitive positioning. This has seen them embrace new technologies in order to improve on speed-to-market and quality. For example:

> Recent developments in design and manufacturing technology are enabling us to speed up times to market. CAD software means that we can undertake much of our design process on screen building virtual products in three dimensions – shaping and testing for weight, volume and performance before they leave the screen. Rapid prototyping enables us to "print" three-dimensional models of our products using layers of powdered resin providing a means of producing quick, easy and cost-effective prototypes in-house in our tool room. CNC (computerised numerical controlled) machines have also enabled us to test complex design ideas that might never have made it past the drawing board in the past – for example modelling and testing the internal workings of products to test intricate design ideas. These processes are reducing lead times in terms of new product introductions. However, for new taps and showers it can still take up to two years to bring a complete collection to market. These developments have also been reducing the need for continual new product testing leading to more sustainable processes reducing material wastage.

In summary, craft-driven innovation combines deep knowledge of making with an appreciation for quality leadership. The strongest craft brands typically manage what Beverland (2009) calls the "paradox of authenticity" whereby they remain true to their brand position while also managing to remain the perceived standard setter in their product category or class. They achieve this through employing staff deeply committed to their particular craft and who are interested in pushing the boundaries of their traditions in ways previously unheard of. This dedication is then captured in marketing messages that suggest timeless dedication to quality without a care for the concerns of the modern world (including fashions, commerce and technological change). However, in manufacturing debates, these skills are often classified as low tech and therefore low value added, and as a result areas requiring active deskilling. Ironically, at the same time industry often complains about a shortage of mid-level skilled workers (exacerbated by the decline of high-quality apprenticeships for young people; Wright 2014), many of whom embody the craft skills so beloved by consumers today.

Pathway four: customer-led

The customer-led model is the model favoured by many writers in innovation as reflected in the dominant stage-gate model of innovation. In this model, innovative concepts are filtered through various customer tests or "gates" before moving on to the next stage. Since each stage involves more investment from the firm, each gate provides the basis to filter ideas less acceptable to customers and lead users in order to enhance the chance of launch success and improve efficiency. Thus, the multitude of rough ideas at the fuzzy front end are quickly reduced and honed until just one or two ideas are developed into prototypes and then launched. Unlike a design-driven model, innovation in this approach relies on customers being able to articulate their needs and provide accurate assessments on emerging concepts. Although this model has received a lot of empirical support it has also been associated with producing incremental innovations.

Although voice-of-the-customer analysis is unlikely to generate breakthrough innovations, nonetheless a customer-driven approach is useful in three ways: offering small insights that may result in design improvements that assist with launch success; identifying and improving the incremental innovations that extend the life of breakthrough product concepts; and, crucially, drive the service innovation so important to many of the UK's manu-services providers. Such an approach is also often integral to large-scale business-to-business innovations as such projects are often jointly developed between organizations. In brand-driven customer-led innovation, ideas are typically vetted early on to ensure they fit with the brand's existing position. Again, although such an approach is unlikely to lead to the development of new categories that often add significantly to brand value, it is important for enhancing existing brand associations and therefore maintaining or defending the brand's equity (Aaker 2012).

So what skills are required for this form of innovation? The research is clear that this type of innovation requires strong multi-functional teams who are able to apply their particular expertise to solving the innovation challenge while also being able to work with others who have different but complementary inputs (Beverland and Farrelly 2011). Given the customer-centricity of the model, firms also require skills in uncovering and acting upon customer insights and doing so in ways that ensure a point of difference with existing offerings. Enhancing a firm's ability to relate to customers is also critical. Since the customer-led innovation model focuses on value-in-use, enhancing one's abilities to appreciate the types of goals consumers and other users are trying to achieve

becomes critical (Vargo and Lusch 2004). This is particularly important when seeking to develop bespoke products and services and more innovative methods of innovation including crowdsourcing and co-creation (Sissons 2011b). Relationships become critical for those seeking to shift to manu-services because the cost of such services can only be recovered over the life of relatively long business relationships (Sissons 2011a).

Brintons Carpets founded the modern carpet industry in Kidderminster, Worcestershire, in 1783. With annual revenues in excess of £50 million and 1500 employees worldwide, the business employs over 80 regional field designers out of design offices in London, Los Angeles, Pune in India, Melbourne and Sydney in Australia, and most recently in Dubai. Residential sales account for 20 per cent of sales with 30–35 per cent of these products being new designs. Their commercial market makes up 80 per cent of sales with 85 per cent of these representing one-off designs created to fit customer specifications. In total, one-off designs account for around 65 per cent of turnover.

The technologies sitting behind this are key to success with Brintons the only sizeable business working on Axminster looms capable of producing woven patterned carpets similar to the hand-knotted carpets of earlier times. Andrew Wilcock, Group Marketing Manager of Brintons, says:

> The majority of looms work on 12-colour patterns which take six people to change and the best part of a shift. We are just rolling out our newly developed technologies giving us greater flexibility in colour range and able to weave 32 colour carpets which is unique in the industry. We have looms of different widths and they have to be threaded ready for weaving. With a 12 foot loom, for example, there are 7 tufts per inch which means 1008 locations in total. If we weave a 12-colour pattern, then we have to prepare 12,096 feeds of yarn before we can start. However, our newly patented 32-colour process enables sequential tufts which takes yarn from a limited number of feeds and threads the loom as the work progresses – this is a revolutionary technology and will enable a far greater colour palette in the future with faster changeovers and much lower waste.

Brintons Archive Collections have been brought together with painstaking care over the past 20 years representing a unique resource. With three rooms of archive material and over 30,000 hand-painted paper designs, Yvonne Smith, company archivist, recently discovered a collection of over 1,000 Japanese stencils dating to circa 1890 previously

unknown to the business, turning out to be one of the largest private collections outside the V&A and leading to the launch of their Katagami collection. This resource is just one of many that Brintons draw on to meet customer specifications. Field designers send in details of client specifications – the preferred look, design idea and feel. Through Yvonne Smith's work the firm's design team is able to refer back to their archives for inspiration, re-interpreting them in light of today's trends and their clients' aspirations and advising them on project management, planning and estimating, which can save thousands of pounds. For example:

> We send out about 500–600 designs each week, constantly updating our collections through new partnerships with well-known designers, including Timorous Beasties, Vivienne Westwood and Manolo Blahnik, leading to some high-profile advertising campaigns. It's this approach, coupled with constant innovations in processes and production technologies that is helping to keep us ahead.

Founded in 1926, Pashley Cycles is Britain's longest established cycle manufacturer, designing and hand-building traditional bicycles and tricycles. Generating £5 million annual turnover and about 8 per cent net margin, the group, encompassing the Pashley and Moulton bicycle brands, employs around 70 people in total. Over the last five–six years, their export turnover has grown from 15 to 45 per cent, with USA and Japan being their most important export markets. There are about 160 products in the range, taking into account variations in frame size and colour. Women's bikes account for half their sales and 75–80 per cent sales are of traditional consumer bicycles, with carrier cycles contributing a further 20 per cent of turnover. All Pashley cycles are manufactured out of the company's head office and factory in Stratford-upon-Avon.

Pashley has recently introduced a new accessories range, being sold B2C directly via website channels. This covers bicycle accessories as well as ladies and men's clothing collections, targeting the smarter rural and urban cyclist who is looking to combine work or leisure with a spot of cycling and prefers not to sport Lycra in pursuit of this. The range includes practical but stylish ladies' and gents' trousers, jackets, shirts and T-shirts, as well as prop stands, tyres, bells and pump. Company owner and Chief Executive Adrian Williams states:

> We're finding that by providing this range direct to our customer we're getting quite an insight into their needs which we'd not had in the past through our dealers. Customers are going into bike shops

> and asking for certain parts which they cannot buy there and now they can come straight to us. We're aware that dealers and distributors are keen to have our product, but we're still checking to ensure our supply chain can keep up with us and won't let us down if and when sales really take off. It's got us into the digital marketing side too, something quite new to us, as we now have our own Facebook page and have even started tweeting.

When focused on identifying and develop service innovations to enhance product offerings, specialist expertise is also needed. Service innovation requires input from ergonomics specialists, marketers, human resource staff and designers (Pike et al. 2013). In their review of Europe's Industrial Excellence Award winners, Chick et al. (2014) identified that manu-service firms focused on using data to work closely with suppliers, focused on optimizing value creation across the whole chain (from supply through to demand), build customer-focused processes and use their technical capabilities to develop customized solutions. Sissons (2011a) identified the need to expand our understanding of ecosystems to include non-technological innovators in order to enhance manu-service capabilities. This would include linking up with universities and other training providers, albeit to parts of these institutions that have largely been ignored in policy debates.

All of this suggests a need to continue to invest heavily in intangible assets including human capital, software and technical support (particularly important in an era of big data and data mining), and in organizational systems that help create customer value. Furthermore, firms need to adopt a market-oriented model which involves investing in customer- and competitor-oriented capabilities and systems as well as enhancing inter-functional co-ordination to ensure different parts of the organization work in together to deliver customer value. This is important because a recent survey identified that although UK manufacturers developed new product projects more quickly than their American and Japanese competitors they experienced a higher incidence of post-launch problems, suggesting that too many manufacturers lack a customer-oriented approach to innovation (McLaughlin 2013).

In summary, customer-driven innovation offers firms a pathway to manu-services and for developing the incremental innovations that extend the life of existing products or ensure the brand remains on a par with existing competitors. Such innovations involve the input of customers and lead users during different stages of a fairly linear process. As such, success here involves considerations and processes that are very

different to those involved in basic and applied research and development, science and engineering (STEM). Such an approach therefore requires team-working and project-management skills in order to ensure outcomes that provide compelling points of difference and meet real needs. And, with the shift to manu-services, capturing value added will require policies that link firms into business schools and providers of specialist services such as design and human resources.

Pathway five: process innovation

All of the pathways to innovation are in effect processes. However, process innovation typically refers to changes in firm-level processes that result in value-added. Manu-services, for example, represents one such process innovation since it involves innovation in the offer and how it is delivered rather than in products and technology (Sissons 2011a). This type of innovation includes everything from supply chain management, quality improvements, flexibility and adaptation, productivity improvements via technology, use of information technology, through to reducing new product development cycle times (Bryson et al. 2013; McLaughlin 2013). As process innovation has received a vast amount of attention in manufacturing policy including in imaginings of future factories, we will only skim over this material.

The following example of Amtico reinforces the value of process-led innovation. Amtico, brand leaders in the "luxury vinyl tile" market, has 20 per cent global market share and sales of over £120 million. Chief Executive Jonathan Duck says:

> We came out of Courtaulds in 1995, as a management buyout, having built this whole market segment in the sixties, seventies and eighties. In 2012 we became part of Mannington Mills, a much larger US-based flooring company, with great long-term vision and the ability to fully invest behind Amtico. As a result, we've recently doubled our manufacturing capacity through a £6 million investment in a new production line, so now we're Coventry's largest company actually making things in the city, employing 300 people in the UK and 600 worldwide. This latest investment shows both our commitment to UK manufacturing and the strength and confidence we have in our product.

The fully vertically integrated production process is finely tuned, drawing on 50 years' experience, an intimate knowledge of materials, customized

machinery and production lines, all ensuring that the end product is something very distinctive and set apart from the competition. The tiles are made up of five layers, a very hard-wearing PVC sandwich, generally with a photographic film of very high fidelity included. "We're particularly good at long runs of high fidelity woods and stones, with constant shades and low levels of pattern repeat", says Duck. "Our new calendar line enables us to create unique visual effects in-house, giving us a technological edge against competitors."

Around ten years ago he realized they needed to compete full square with the Chinese.

> We worked hard to increase output per person by four-fold over ten years. We studied Chinese manufacturing, learning a lot from them, which we brought back to our factories in UK and US. On the design front we created a new line, Spacia, sitting at a price point below our Amtico Signature range. We worked hard not to cannabilize Signature with Spacia, operating along the lines of a good, better, best series of offers. For example we can customize our offer for Amtico Signature, but not for Spacia, and we cut patterns as part of Signature, but not for Spacia. Taking this approach helped us to grow right through the recession. Pulling production back to the UK, or reshoring, is now very fashionable, but it wasn't five years ago when politicians, journalists and even banks were always suggesting that if you made things it was better to produce in the Far East and concentrate only on downstream sales and service.

Being able to compete with lower-cost operators was driven by connecting design to the process of manufacturing. For example:

> We have really got three businesses – design, manufacturing, sales and marketing. We rigorously chase down our sales opportunities. And we innovate heavily. Fifty per cent of our products are new every two years. Clearly this is a high rate of product churn, but the company needs this to stay ahead. There are a lot of competitors copying what we do. We stay ahead through product renewal, ensuring our designs are appropriate to market needs and trends, while creating a better quality product that outperforms our competition.
>
> We have nearly 20 designers who have a global perspective on interiors and textile trends, interpreting these into our products to ensure we produce and sell the latest trends timed to hit the market – not too early and not too late. We have consciously brought innovation into

> design. We are seeing increasingly abstract trends at present and for us some of these patterns are not based on photographs. Amtico has always marketed itself not as a flooring business, but as a brand with a unique view on selling flooring product.

There are lots of mimics for their products, Duck says, but on the design side it is a case of making sure what they are producing is both relevant to meet market needs and "designed for manufacture".

Pathway six: marketing driven

The final pathway to innovation is one that is marketing led. Although often driven by customer insight, this type of innovation sits at odds with most writing on marketing. Marketers typically focus on market-driven innovation that focuses on working back from espoused needs or identified gaps and then responding accordingly. Driving the market is an alternative but complementary viewpoint that has received less attention primarily because marketers are reluctant to acknowledge they create as well as respond to needs. Market-driving strategies create new categories and/or reshape existing ones through clever deployment of the classic marketing mix (as well as combinations of innovation pathways). In this approach, marketing often creates a niche and helps expand it, paving the way for further innovators and innovations.

The most obvious manufacturing example of this type of innovation is craft beer, in particular lager. Brewdog, for example, identified an opportunity to create a high-quality and high-value market in lager (as opposed to ale). Although they had to make a top-notch product, the skills involved in this are decidedly low tech and the knowledge is readily available. However, given that the beer market is full of large, efficient brands and small dreamers, a good product was never going to be enough, certainly not to attract brand-loyal consumers away from their preferred drop and product category.

Brewdog's success lies primarily in developing a strong brand campaign aimed at cutting through much of the puffery of modern beer advertising. Positioning their brand with punk attitude, social media campaigns were used to build brand awareness and create the perceived need for a revolution in the lager market. Clever social media campaigns focused around the founders' distaste for bad beer (which involved using well-known, customer-supplied unopened beer bottles as bowling pins), while tiny small batch production (often no more than ten bottles) of innovative beers (including those with very high alcohol levels) were aimed at changing

perceptions of what the lager category could be (the outrage from newspapers didn't hurt either). Controlling the customer's experience through a chain of branded bars focused on craft (not just Brewdog) beer education encouraged trial and built the basis for brand loyalty. Finally, a customer share ownership scheme offering discounts and providing beer dividends tightened consumer attachment to the brand.

As a result of these innovations, local demand soared. Further innovations including a US television series championing the process of craft brewing helped drive export sales. Although we do not want to suggest that clever marketing can cover up product deficiencies (consumers are not silly), innovative marketing aimed at challenging existing perceptions of categories, product performance or product use can underpin manufacturing growth, particularly in areas where the UK has significant symbolic capital (in the case of Brewdog, craft beer tradition and punk attitude). Clever marketing also helps overcome the problem of low marketing budgets faced by many small firms. To drive the success of C.W. Dixey & Son's Chartwell collection (inspired by Sir Winston Churchill), an actor was dressed up as Sir Winston when an original pair of his glasses came up for auction at Christie's. The public relations campaign told the story of the brand and its heritage, under the playful tagline of Sir Winston wanting to get his glasses back. Although the actor did not achieve his aim, the brand was successfully re-launched on the back of a simple brand-driven opportunistic marketing campaign.

However, the skills required to innovate in marketing are rare. Most marketing programs are focused primarily on tactical excellence mainly through managing the famous four p's of price, promotion, placement and product. Critically, business students and marketing students are rarely exposed to making activities or even experience exposure to product innovation, design and entrepreneurship. The dominant marketing model is also one driven by fit – thus students are exposed (often without their or their instructors awareness) to a fit-driven logic. For example, standard marketing planning techniques force students to innovate in ways that reinforce existing customer perceptions of products and categories, be consistent in execution and pay attention to voice of the customer analysis rather primarily through techniques that ignore outliers or opportunities for innovation. Even brand courses often stress consistency at the expense of relevance, meaning all too often that brand-driven innovation becomes predictable and incremental.

In summary, entrepreneurial marketing strategies can provide the basis for manufacturing innovation, often through the reinvention of

existing categories, leveraging industrial and symbolic commons to create competitive barriers (as in the case of Icebreaker and their Baacode strategy), and re-launching long-dead brands (re-launching long-dead luxury brands has gathered pace over the past few years as many of these brands still have symbolic capital and can draw on a symbolic commons). Although we have identified the need for STEM investments to be broadened to include other forms of knowledge, business students also need exposure to more creative, inquisitive subject matter if they are to challenge existing market conventions as basis for value added.

Conclusion

The above review identifies several pathways for innovation. Although STEM-based skills and capabilities offer one source of innovation, with innovation involving the need for identification, the integration of multiple streams of knowledge and careful launch and after-sales service, we believe that UK manufacturers can benefit from combining multiple pathways. The combination depends partly on the new product development problem faced by each firm. Firms should also leverage the back-story of their innovation success to build, enhance and defend brand value. However, firms also need to be mindful of those parts of their innovation capabilities and practices that enhance the brand. Manufacturers may benefit greatly from process innovations; however, these may offer little value to the brand, and in some cases may even undermine it. Finally, the pathways identified here and the importance of being brand-driven suggests that innovation debates need to move beyond notions of low or high tech and an over-emphasis on STEM as the main source of future competitive advantage.

7
Manufacturing's Business Model

Introduction

In Chapter 6 we highlighted how industry analysts framed manufacturing's business model in terms of how to best fit the current and emerging environment. Much work has been done on examining how to increase productivity, improve quality, leverage global supply chains, commercialise technological breakthroughs, improve cycle times and add value through services. Others have begun to highlight the benefits to be gained from increasing exports, investing in design and/or focusing on sustainability both in terms of products, process and recycling or re-use at the end of the product's life.

All of this work is excellent stuff, but as we have noted, it all focuses on how best to fit with existing environmental conditions or emerging trends rather than trying to shape one's environment to one's advantage (McLaughlin 2013). The previous chapters have suggested manufacturers use different strategies, investing in brand-driven business models, multiple innovation pathways, and building and leveraging ecosystems. In this chapter we build on these, identifying the need to invest in capabilities that allow firms to build and reinforce their brands, identify and exploit opportunities, and draw on their ecosystems. Building on calls for manufacturers to place capabilities at the heart of their strategy, we identify the need to develop dynamic capabilities including those focused on constant innovation, balancing brand relevance with consistency, and renewing business relationships with key buyers (in the case of business-to-business manufacturers). Finally, we highlight the need for parity-building capabilities, which includes issues such as productivity, cycle time and servitization.

Capabilities as basis of manufacturing strategy

Authors examining the future of American manufacturing have identified the importance of *strong differentiating capabilities* (Berger 2013; Pisano and Shih 2009). A focus on capabilities is particularly important since they tend to be either ignored, or at best implied, by many local analysts focusing on the requirements for a resilient manufacturing sector (Ridgway et al. 2013), or lost in discussions about emerging technologies (O'Sullivan and Mitchell 2013). Others have identified a shift in UK manufacturing investment from physical capital such as plant and machinery to intangibles including human capital, research and development and organizational systems (Sissons 2011a). A focus on resources is based on a widely accepted strategic approach called the resource-based view of the firm. In this model, firms are in effect bundles of tangible and intangible resources and compete by deploying (which is where capabilities come in) them in unique and relevant ways (Stadler 2011).

In this model, there is no "one best way" to compete; rather one's market position or, in our case, brand identity, determines resource investments and deployment. Development in this model is often path dependent, which means future actions are shaped by previous choices including resource investments. For example, ACME blends cost control, unique brand associations (including heritage, country of origin, relationship to sport), craft and design-driven innovation to ensure it remains relevant in its key markets and thus accesses the financial resources necessary to survive and grow (Bryson et al. 2013). The Morgan Motor Company does something very similar even though the particularities of the resources including the symbolic brand associations, heritage factors and innovation pathways deployed differ. However, the capabilities underpinning both brands success, we would argue, are fairly similar – both innovate in ways that balance brand heritage and present-day relevance, both build relationships with customers, both invest in and draw from their industrial and symbolic commons, and so on.

Researchers have moved away from focusing on resources to focusing on capabilities. Capabilities are different from resources. Resources are tangible and intangible assets that are largely static. A firm can have a rich array of resources but still struggle to create value or maintain a competitive advantage. Although manufacturers account for the vast amount of research and development investment in the UK, this is all for nothing if the sector is unable to capitalize on such results (particularly critical since the majority of such investment is in basic research; Wright

2014). Hay et al. (2013), for example, note that the UK has the basis to be an innovation leader but underperforms other European nations when it comes to taking new products to market and introducing product and process innovations.

Many have noted for example the lack of a link between investments in research and development and economic growth, or the existence of research institutions and local manufacturing sector resilience (Bryson et al. 2013; Moffat 2013; Sissons 2011b). In these cases, research and development is of little use if the outcomes of such investments cannot be successfully commercialized, while in the case of ecosystems, the breakthroughs achieved in research laboratories is of little use if regions lack the type of firms able to take up and develop such innovations. Likewise, having brands on a balance sheet is fine, but if firms cannot leverage these assets through the development of new categories or extensions, or renew them in order to ensure they have forward momentum then the value of their brands will quickly dissipate (Aaker 2012; Gerzema and Lebar 2008).

The ability to leverage resource investments partly explains the success of the German manufacturing sector. Innovation in this sector relies on transfers of knowledge between industry and universities, groups of workers within firms harnessing technologies to create breakthrough and incremental innovations, and networked firms working together create further innovations (Hancké and Coulter 2013). The ability to harness different capabilities also underpins the resilience of the US manufacturing sector. For example, Berger (2013) identifies how the transfer of knowledge between universities, corporate research laboratories, small start-ups and large firms creates a strong industrial commons that provides the base for new products and ensures that basic research is quickly commercialized. In each case, it is not so much the investment that matters but rather the underlying capabilities to make use of such resources that contributes to sector resilience.

To create, renew and leverage resources, firms require capabilities or knowledge-based resources that are largely dynamic in nature. Since markets and other factors (such as technology and customer needs) constantly shift, firms cannot rest on their laurels, but instead must renew their resources, and to do so requires capabilities that achieve this, including those focused on identifying new sources of value, ensuring ongoing customer loyalty, the development of a stream of innovative products and services, and ensuring the maintenance of brand equity (among many others). Dynamic capabilities are particularly important given the emphasis placed on agility by many industry analysts when

discussing drivers of future manufacturing success (Sissons 2011a). Furthermore, the stress placed on knowledge investments or being "smart" when discussing the competitive advantage of the UK manufacturing sector also leads one to start thinking about how best to leverage such assets (as well as how to renew them).

Apart from the need for constant innovation (see Chapter 6) one way of highlighting this is to think about the proposed shift to manu-services. Sissons (2011a, p. 31) suggests services might include co-ordination of design and compatibility of components to improve quality, support with installation, repairs and maintenance, and risk management, support with the adoption of new systems and project management including co-ordination across global supply chains or innovation teams. Although it is tempting to think one can develop expertise to achieve these tasks, underpinning the actual doing of these services is a series of capabilities that ensure firms can continually renew their service offer including identifying and understanding customer needs, shaping customer expectations, creating a positive experience, identifying and creating new technological platforms to co-ordinate various actors in global networks, keeping ahead of competitors, and important impression management capabilities that indicate commitment to the client's long-term success (Beverland et al. 2007; Chick et al. 2014).

The next sections identify some of these capabilities based on our case observations and the existing literature on manufacturing strategy.

Market orientation

In the late 1980s marketing academics began to move away from a sole focus on tactics to understanding how firms needed to organize in sustainable ways. The result of this research was a model called market orientation whereby long-term financial performance was proposed to result from developing an organization-wide culture focusing on creating customer value (Kohli and Jaworski 1990; Narver and Slater 1990). This culture was reflected in investments in three behaviours: customer orientation, competitor orientation and inter-functional co-ordination (this will be discussed below under synthesizing capabilities). Although not technically a capability, market orientation underpins competitive success and is critical to manufacturing's future given the emphasis on being closer and more responsive to customers and more adaptive to market changes by the government's Foresight Project. Market orientation is also essential given the need to increase the number of export

stars in the UK sector including an increase in the scale and scope of exporting activity (Kneller 2013).

Customer orientation is particularly important for firms focusing on servitization because of the need to for a customized solution including a focus on adding value through experiences (Sissons 2011a, 2011b). Voss (2005), for example, has identified the importance of understanding customer touch-points throughout the entire encounter with their supplier. Touch-points refer to those points of contact between the customer and supplier. These encounters all shape customer perceptions of the supplier's brand, the authenticity of their promise, and the likelihood of doing business with them in the future. One way of identifying touch-points involves mystery-shopping techniques that map the customer's journey with the supplier, from start through to finish. Typically, these audits result in the identification of seemingly innocuous sources of contention (for example in how invoices are set out, website design, call-centre service and so on) that have an inordinate effect on how customers perceive their suppliers. Attention to improving the customer experience throughout their entire journey can often make the difference between low levels of customer dissatisfaction and highly loyal customers (as reflected in simple but critical measures such as net promoter scores).

Many mistake customer orientation as being a largely adaptive or reactive response to espoused customer needs or requests for value change (Flint et al. 2002). Although focusing on customers' needs certainly means one has to be respectful of their requests, sole reliance on their espoused views is not only at odds with much of the previous chapters, but is also insufficient to ensure the ongoing loyalty of said customers (Beverland et al. 2007). As many designers note, customers are often not particularly good at articulating their true needs, and thus fall back on requests for incremental improvements or worse, demands for price reductions and increased service levels. Business marketing researchers also understand this, identifying the need for supplier capabilities that help identify their customers' real problems and then follow through with customized solutions that ensure they are viewed as a strategic partner worthy of retention (Beverland and Lindgreen 2007; Beverland and Lockshin 2003; Chick et al. 2014).

Thus, customer orientation requires capabilities in market sensing (see also discovery below), relating (see also renewal below) and innovating. These capabilities are related. For example, Chick et al. (2014) identified that sharing information, investing in market data-gathering techniques and fast adaptation underpinned the ability to provide the customized

solutions that drove European manufacturers' leadership positions. Thus, investing in sensing activities, be it big data and/or soft ethnographic insights, is useful only in so far as manufacturers can apply such insights to benefit their customers. This requires knowledge of the firms' business and the strategic problems that they face, which necessitates strong relationships (relating). In combining these customer-related capabilities manufacturers can protect themselves against lower-cost competitors who lack the knowledge of their customers' business to develop the type of solutions that ensure their ongoing success (Beverland et al. 2007).

Market orientation also involves sensing capabilities focused on monitoring competitors (or a competitor orientation). This should not only include what competitors are doing but whom your customers view as potential competitors (see the discussion on points-of-parity below). In this case, sensing involves tracking how your competitors are doing on criteria essential to your offer. This will tell you if once compelling points of difference have now been adopted by competitors and thus new forms of value must be offered. In tracking the action of potential competitors for your target customers' needs, you are attempting to identify the emergence of new technologies, business models or players that may supersede your own (for example Apple's investment in smartphone technology or Dyson's cyclone technology displacing entrenched providers of vacuum cleaners).

Finally, market orientation should not be seen as a firm driven by the marketing department. That said, marketing plays a key role in not only collecting information but also in disseminating it across the organization (Gebhardt et al. 2006). Research has identified the need for greater understanding and appreciation of customers' needs across the organization because different functional groups impact on the customer experience. However, for this to occur, marketers must also ensure they transform the insights gleaned from research into a form that other disciplines could understand and use (Cayla and Arnould 2013). This empathetic ability is critical to not only a strong customer focus but also the development of compelling innovations (Beverland et al. 2014). Market-oriented capabilities thus require some appreciation for the market – both customers and competitors – across the organization.

Discovery capabilities

Market orientation should not only be equated with being market-driven (which would be akin to a fit approach). Instead, firms need

capabilities to ensure they adapt to market changes while also driving the market through shaping activities (Jaworski et al. 2000). Since driving the market is likely to stem from various forms of innovation (see the previous chapter), capabilities in exploration (as opposed to exploitation) are required. Exploration involves capabilities that identify new sources of value, and often come easier to disciplines such as entrepreneurship, design, science, art and technology than they do to business disciplines which are often more comfortable with exploiting existing sources of value (Beverland and Farrelly 2007).

Design-driven innovation, for example, often requires unique approaches to identifying needs or market opportunities. For example, Hans Beck, the designer behind Playmobil's successful line of children's toys, spent much time with children and their parents trying to identify new market opportunities for plastics. In talking to parents he identified that their fundamental concern was in letting children be children and not allowing them to grow up too fast. In watching children he eventually came to learn that kids could not wait to enter the adult world. Drawing on both sets of insights he realized that there was a market gap for toys that allowed children to place themselves in everyday adult situations, but only those contexts devoid of life's negatives such as war, crime, sex and so on. Thus, he created a range of sets focused around the day-to-day world of adult work, home and play. Spending time playing with children Beck identified that kids viewed reality in highly stylized ways, insights that eventually flowed through into the unique design of his famous figurines (big eyes, smiling mouth, no nose, exaggerated bodies, skinning legs). The result was a successful business and, at the time of his death, over five billion figures sold.

Exploration capabilities underpin the re-emergence of luxury eyewear brand C.W. Dixey & Son. Although owner Simon Palmer inherited the optician business from his father, he was keen to explore the potential to re-launch the brand in the luxury eyewear market. His initial research focused on understanding both his target end-user as well as the channels that would sell the glasses. In each case, he identified a gap in the market for something understated, handcrafted, independently owned and distinctly British. Although his up-market clientele were targeted by many leading luxury brands, the very ubiquity of labels such as Gucci, Tom Ford, Burberry and so on undermined their potential value. Simply put, these glasses were not unique enough. And, they were conspicuously branded, whereas the target customer wanted something much less overt because they were comfortable with their social status. Although independent chains carried many brands three large licensees produce

all these brands (primarily in China). Thus each individual store had little by way of point of difference to attract customers with. This dual realization led Simon to realize that classic understated British-styled glasses backed up by heritage, service and independent family ownership could overcome limited resources and marketing budget.

Exploration also underpins strategies focused on shaping consumer demand and expectation. For example, one firm studied by the first author identified how understanding why consumers viewed categories in a certain way helped them shift perceptions of that category to their advantage. The firm was an innovative manufacturer of bedroom furniture. They focused on renewable materials (primarily wood) and had a distinctly modernist design philosophy. However, their retailers and salespeople constantly asked their designers for more traditional styles. Based on consumer research they quickly realized that the classic or traditional styles desired would conflict with the brand's design philosophy or language.

However, rather than ignore this request or develop a second line of products, the design team developed an extensive study on the meaning of classic furniture. They quickly realized that consumer perceptions of tradition had been shaped by their experience of historical styles, often viewed in museums or heritage sites. Realizing that these styles represented just a limited range of heritage pieces (the furniture of working people rarely made it into museums), they focused on why consumers valued heritage and tradition. The resulted in the realization that it was not the look of the furniture that mattered by rather than craft tradition and expertise that went into their making. Since the manufacturer combined design expertise with carpentry skills they were able to emphasize this type of tradition in their marketing materials that supported the new line of furniture, thereby meeting demand and challenging shaping consumers' perceptions of the category.

Capabilities in exploring underpin firms that shape their markets. They drive products that create, define or redefine product categories, that shut out competitors (in the way Dyson has done in so many product categories), and that challenge existing market and marketing conventions. These capabilities are essential for expanding the value of a manufacturer's brand and are underpinned by cultural beliefs that the market environment is more malleable and subject to firm influence than much of the debate around the factory of the future. Expanding these capabilities is particularly important given the centrality of innovation in debates about manufacturing's future and the fact that the

UK is an innovation follower according to the European Commission's Innovation Scorecard (Hay et al. 2013).

Renewal capabilities

Although dynamic capabilities imply a need for and capacity to renew, manufacturers that shape their environments are able to renew themselves in multiple ways. The most obvious one involves the innovation pathways covered in Chapter 6. Another way involves investing in the types of capabilities identified herein, as well as contributing to the ecosystem and symbolic commons. And renewing sources of value has already been identified as essential for ensuring ongoing customer loyalty, especially in the context of supplier relationships. As well as these investments, successful manufacturers need to renew their brands. Given the importance we attach to brands as a source of high value added, keeping one's brand fresh is a critical renewal capability.

Keeping brands fresh may on the face of it seem easy. After all manufacturers can simply innovate, enter new markets, adapt to new trends and so on. However, this not only underestimates the challenge, but constantly changing one's brand will quickly lead to the dilution of your position, thereby ensuring declining equity or value. The Morgan Motor Company's launch of the closed-top fibreglass Plus 4 Plus (+4+) in the 1960s proved a flop precisely because it did not fit with existing brand meaning. Brand managers are faced with two dual and often conflicting tasks: reinforcement and relevance. Reinforcement involves staying on message and remaining consistent. Relevance means just that: keeping the brand meaningful in the eyes of the target market. In both cases, renewal is involved, but the means to achieve each is different. Although reinforcement requires consistency, it does not mean simply remaining the same. Renewal in this sense requires brand managers to constantly refresh the communication of their brand position without undermining the brand's essence. Relevance is a more innovative strategy that takes the brand into new territories, adding layers of meaning to the brand and thereby adding new sources of value – in contrast, reinforcement focuses on preserving existing meanings and value (Keller 1999).

For example, the Morgan Motor Company renews its brands through reinforcement and relevance by deploying very different capabilities. Reinforcement involves exploiting existing sources of brand equity. Morgan do this in a number of ways including constant quality improvements, supporting owners clubs with specific events, competing in Le Mans, limited advertising, incremental year-on-year model development

whereby they add features, improve handling, and so on. The capabilities here primarily involve appealing to existing loyalists (current, potential and even lapsed users) and subtly freshening up their brand. One way they do this is to encourage their employees to engage in vintage racing events. These events require participants to extract performance from old technology and very low budgets. Through participating in these events Morgan employees increase their chance of picking up small improvements (based on contextually relevant insights) that enable them to reinforce their brand.

Relevance is different. Relevance requires innovation often through the adoption of new technologies, or the development of new categories or extensions of existing ones. Although Morgan appears to be stuck in the past, many of its innovations have over the years ensured the brand has remained relevant. These include their investments in meeting US and EU emission and safety standards, which have ensured the firm's products can be exported (when other niche British marques have lost these markets and thereby become far less viable). The firm has also engaged in line extensions, going up and down the price curve with new models to appeal to new users, and engage in some limited category extensions to expand sales without diluting the brand. For example, the development of the three-wheel Morgan appeals to existing users, often encouraging them to purchase a new car to complement their existing one, while also providing a radical point of difference with other sports vehicles. More up market versions such as the Aeromax and Supersports have enabled the brand to leverage its craft heritage into high-value luxury markets. The LifeCar prototype has identified the firm is serious about climate change. Finally, the development of more modern versions of their traditional cars ensures the brand appeals to those who have few mechanical skills.

These outcomes require capabilities in exploration rather than exploitation. In this case, Morgan draws on different capabilities. The development of new vehicle technology involved linking in with university partners, designers and material manufacturers to identify new developments in lightweight materials, engine technology, high-performance parts and developments in non-fossil-fuel-based engines. Aligning these with the brand involves exploring the brand's heritage to understand the essence of its meaning (contrary to popular opinion Morgan developed a clearly defined brand position (Driven at Heart) in the early 2000s). By exploring how owners related to the brand, the management team focused on clearly identifying what their brand meant and then using this to develop more new models of cars in the last ten years than they had in their previous ninety.

Balancing exploitation and exploration is critical for manufacturers in other areas too. First, although exploration is necessary for developing new-to-the-world products, recouping the up-front costs often requires exploiting existing product lines through brand and line extensions. Second, servitization involves both identifying customers' genuine needs and co-creating solutions through exploration combined with exploiting this knowledge to ensure ongoing service delivery to high standards. Third, new designs may involve exploration while improvements on the original model require exploitation. Craft-based models stress exploitation through the development of skill while exploration helps craftspeople transfers those skills to new product types or categories. Finally, while shaping markets more generally involves exploration, exploiting that position through incremental products, developing supportive ecosystems and drawing on the symbolic commons all involve more exploitation.

Synthesizing capabilities

Integrating resources into new products and successful business models has been identified as an essential theme for manufacturing in the future (Bryson et al. 2013). Synthesizing or integrating is also critical given the replacement of vertically integration with global supply chains and inter-organization relationships (Berger 2013; Sissons 2011b). Synthesizing capabilities are those that bring together different resources to create value. Business history is littered with stories of firms that failed despite having a strong resource base. In contrast, firms such as Apple have prospered not so much from inventing the technology underpinning their successful products but from being able to put innovations together into a package (including product, service and network) that delights consumers and sets the benchmark for competitors to aspire to. They then package up these products with retail and service offerings and a strong brand story, all of which enables them to consistently earn the highest margins in each of the respective categories they compete in. Far from being a cherry-picked example, academic research has identified the need for inter-functional co-ordination, strategic integration, and integrating devices to launch successful new products and to create lasting market value (Carlile, 2002; Dougherty 1992; Kohli and Jaworski 1990; Narver and Slater 1990).

The shift to servitization represents one way in which manufacturers are combining different resource investments and capabilities to create new sources of value for customers. Sissons (2011a) identifies

how successful manu-services strategies require not just great products and skilled service employees, but also the ability to work closely with customers over the long term to identify solutions that consist of products and services that address emerging customer needs. Many companies, including BAE systems and Rolls-Royce, have added value to their customers by repackaging their offers as "solutions" which usually involves a range of services including post-purchase support, specialist help, logistical expertise, design input, customization and emphasizing their customers' experience through user-centred designs. These firms either developed new capabilities to engage in these activities, or more often than not drew on their existing specialist expertise built up over many years (Pike et al. 2013).

Researchers from the Industrial Marketing & Purchase Group (IMP) were among the first to highlight the need for integrating resources. Focusing on how industrial or business-to-business firms built value they identified that their customers defined the value offering in ways different to the dominant model of the time (which typically consisted of trade-offs between price and quality). In this model, an offer consisted of a core product, supportive services, both of which were underpinned by adaptive and innovative capabilities (Ford and Associates 2002). A firm's reputation and its ability to ensure ongoing relationships with clients (many of which lasted for many years) resulted from developing solutions as opposed to providing stand-alone products or services (Beverland and Lindgreen 2007). Often these required a high degree of customization and required a strong degree of integration between the client and supplier as well as functional departments within the suppliers' firm.

Writers on design have also identified the ability to integrate as a key source of competitive advantage. Tim Brown, CEO of IDEO, has identified "design thinking" as an inherently integrative skill. Brown, along with many others, identified that tricky problems, such as those faced by many manufacturers in high-cost countries, required integrating multiple perspectives (business, customer, technology) into new strategic solutions (Brown 2008). Although these mental processes are typical of many creative people (as opposed to being uniquely held by designers) (Kimbell 2011), the main thrust of these arguments is that innovative products and solutions rely on rejecting traditional dualisms (e.g. sustainability versus price, customer needs versus brand position) and seeking ways to combine multiple inputs in new ways. For example, the Morgan Motor Company's LifeCar concept challenged convention

about high performance and sustainability. The firm's practice of using wood and aluminium in the construction of their cars meant they could produce high-performance sports cars that were strong but also light. As a result, they were able to produce a vehicle that was efficient, had extended range, and that could provide the customer with the performance of a classic sports car (Beverland 2011).

Writers on innovation and market orientation identify the importance of inter-functional co-ordination to value creation. One of the three pillars of market orientation is inter-functional co-ordination, or the practice of ensuring all functional groups within the organization work together to create customer value. Achieving this is no easy feat as firms also benefit heavily from functional specialization. Therefore, trying to make everyone a marketer or a designer or an engineer is self-defeating as it results in less not more innovation. That said, because every function approaches problems in different ways, conflict is likely to emerge unless they share some basic commitment to the customer and the firm's overall goal. Kelley and Littman (2005) identify ten separate faces or skill sets of innovation, all of which are necessary to create breakthrough products and business models. These include capabilities in discovery, integration, project management, delivery, execution, story-telling and post-sales support.

Graduates at firms such as Ted Baker, Rolls-Royce and Jaguar Land Rover, for example, are required to work in different parts of the firm regardless of their skill set. They are also required to lead projects that many firms would consider to be too big for graduates. The logic here is simple. First, graduates quickly get to understand different areas of the business and how each connects to the other. Second, they quickly realize they are out of their depth on their individual projects and must therefore ask for help, a skill critical to the development of successful new innovations in everything from retail concept stores in fashion precincts through to new vehicle technology, aircraft engines and nuclear power plants. In each case new graduates quickly learn that different functions approach problems in unique but valuable ways, use a different language and tool kit, and have different mental models but nonetheless are all trying to contribute to the project's success (Beverland 2012).

Points of parity

As leading brand researchers understand, points of difference are critical to sustained success, but points of parity should not be ignored (Keller et al. 2002). Although we have focused heavily on the capabilities

necessary to shape markets, it is worth emphasizing that being able to adapt and sometimes fit existing or emerging conditions is critical to preserving one's existing position. Thus firms must deploy many of the capabilities identified above (especially in the discussion of market orientation) to ensure they do not fall behind in key areas including cost, productivity, sustainability, and the adoption of new processes and technologies. Maintaining points of parity primarily involve capabilities in market sensing, broader environmental scanning and incremental innovation.

Critical to identifying the right points of parity is an understanding of customer needs. In our experience all too often manufacturers often define their business in relation to the product category in which they operate. This approach is extremely myopic and can result in firms missing the emergence of new technologies and practices that threaten their very survival (Levitt 1960). One example of this involves the displacement of high-street music retailers such as HMV (which only just staved off bankruptcy) with Internet providers such as Apple's iTunes platform. As late as 2012, HMV was still defining its business in terms of its category – an entertainment retailer on the high street (in fact the firm celebrated this, claiming they were the last remaining high-street music retailer) – despite the fact that customers had long ago migrated to online providers, streaming services or illegal downloads.

Since the strongest manufacturers are brand-driven businesses, they have a clear understanding of their existing and potential competitors because through their targeting decisions, they have defined the need they are serving (Aaker 2014). That is, since they are customer focused, they have defined needs and providers of those needs through the eyes of customers. As a result, they are more likely to develop capabilities that are relevant to meeting these needs, and are more likely to refresh those capabilities as a result (regardless of whether this means dropping cherished models, technology platforms, business models or practices). Customer sensing of this type typically involves tracking one's brand relative to competitors on key performance metrics (determined by the brand's position) and acting early on any declines, usually through qualitative research techniques with existing customers. Environmental scanning, including the use of powerful databases such as IBM's Cobra to search customer conversations about one's brand and product category, are also vital in identifying declining performance on points of parity as well as potential sources of innovation.

Parity capabilities always represent a moving target since competitors adopt what once were differentiating factors quickly. McLaughlin's

(2013) review identifies a number of capabilities or skills that help deliver parity. These would include focusing on those areas that once delivered advantages but are now simply required for doing business – for example, lean production, just-in-time systems, continuous improvement, total quality management, health and safety, six sigma and balanced score card systems, supply chain management, and so on. They would also extend to the other factors he identified as being essential to compete in the future including agility in supply chains, the adoption and use of new technologies, engaging with ecosystems, upskilling staff, knowledge management, advanced analytics (or "big data"), servitization, and sustainable practices and innovation. His research identifies significant deficits among UK managers of manufacturing firms, suggesting benchmarking and tracking is essential to closing this gap.

Conclusion

Underpinning the value creating and innovation strategies of successful UK manufacturers is a focus on shaping one's environment, be it through the development of new categories, technologies, business models or even reframing how customers view existing products. Just as assumptions driven by a focus on fitting existing or likely future market conditions led any analysts to focus on capabilities aimed at avoiding low-cost competitors, defending weak flanks, staying ahead of competitors through moving up the value chain or adding services to existing offers, developing high-tech innovations or simply improving productivity to maintain cost parity, beliefs about the need to shape one's environment leads to an emphasis on different capabilities. In this chapter we identify the importance of being market-oriented and in particular suggest that driving the market is critical for UK manufacturers. To achieve this outcome, manufacturers balance skills focused on maintaining parity with investments in discovery or exploration, refreshing and synthesizing.

Although many of these capabilities underpin STEM success, these fields do not hold a monopoly on them, nor do they possess the contextual expertise necessary to design new products, uncover customer insights, identify business problems, renew customer relationships, balance brand heritage with the need for relevance, shape customer expectations and so on. The capabilities discussed here are more likely to be found across a range of disciplines (Berger 2013) including traditional subjects such as social science, arts and humanities, as well as business, design, ergonomics and technology. This suggests that definitions of the

industrial commons or ecosystems are too narrow as is the focus of skills policy in the context of manufacturing's future needs. And it suggests we need to move away from identifying particular technical skills (e.g. numbers of apprentices or engineers) or worrying about skills gaps and focusing on the distinct capabilities that create value in the marketplace. These issues will be taken up in the next chapter.

8
Ecosystems: Supporting Manufacturing Success

Introduction

Ecosystems have been explained in simple terms as connecting partners to help things *work*. They are therefore focused on enhancing the conversion of *strategy* to *delivery*. In the case of this chapter the focus is on how this works for manufacturing and how it might work better. Rosabeth Moss Kanter described an ecosystem as conveying the idea that "all the pieces of an economy come together in particular places and that their strength and interactions determine prosperity and economic growth" (2012). The priority is on creating the ability to *link* – ideas to enterprise, small and large businesses to each other, education to jobs and entrepreneurship – along with encouraging cross-sectoral collaboration. It is about developing a real and virtual place-based infrastructure to support economic growth.

Preparation for this chapter has been derived from conversations between June and November 2014 with leaders from business, universities, and economic and skills development organizations to gain greater insights into what this means at city and regional level, and what in light of diminishing access to funds following the financial crisis can be done better. We spoke with 60 senior-level decision-makers over this period, including over 30 directors of businesses demonstrating an earnest desire to engage, contribute, shape the discussion and make a real difference. Their concerns ranged from too much short-termism, lack of policy stability ("we're far too good at reinventing things"), currency and interest rate stability, difficulty in accessing patient finance (a considerable challenge for the supply chains into key sectors such as automotive and aerospace), infrastructure investment in the widest sense, and planning which through lengthy procedures is far too

costly and included a lack of co-ordination amongst local government regarding site provision.

Ecosystems in context

To put this chapter in context, departments of government set policies establishing priorities for implementation. There are over a hundred ministers supported by civil servants in Whitehall working within 24 ministerial departments and 22 further non-ministerial departments including the Departments of Business Innovation and Skills, Communities and Local Government, Education, Transport, Health, Culture, Media & Sport, as a selection relevant to manufacturing, each with various arms of delivery – listed as numbering 300-plus agencies and bodies. The Local Government Act 1888 established county councils, in 1889 boroughs were established. Unitary and two-tier local authorities account for a mixed local government landscape including city, town, district and parish councils with accountability for issues including planning, education, environment and waste management, housing, social care, public safety and economic development split between them.

Within this the goal of economic development for Britain's estimated 4.9 million businesses employing 24.3 million people and rebalancing to develop a stronger manufacturing-based economy, employing 2.6 million directly, is largely the responsibility of the Department for Business, Innovation & Skills (BIS) and is not an overriding priority across government. In his 2013 report "No Stone Unturned", Lord Heseltine called for the establishment of a prime minister-led National Growth Council to ensure all parts of government support economic growth. However, this, as one of his 89 recommendations, has not been implemented.

In the ten years prior to the formation of the coalition government in 2010, economic development in the English regions was the responsibility of the Regional Development Agencies (RDAs). Following the financial crisis, and with the pressing requirement to cut budgets coupled with a different political emphasis, the RDAs were abolished, having been viewed by the newly elected government as bureaucratic and unwieldy. Thirty-nine Local Enterprise Partnerships (LEPs) were formed, although the majority of businesses believe it would have been far less disruptive to have set about reforming RDAs rather than embarking on a policy of building from the ground up – yet again.

The Manufacturing Advisory Service (MAS), established in 2002 and well regarded by the manufacturing sector for the quality of practical

advice and contacts it brings, was re-launched in January 2012 with £59.3 million funding over three years, January 2012 to March 2015, focused on providing support for manufacturing small and medium-sized enterprises (SMEs) to drive business growth through strategic and technical support to develop advanced manufacturing capabilities, and enabling business improvements for manufacturers operating in global supply chains and linking SMEs into the apprenticeship programme to deliver targeted engineering and manufacturing apprenticeships nationally.

The Technology Strategy Board (TSB), now known as Innovate UK and established in 2007 as a non-departmental body receiving around £500 million in 2013–2014 as a means of incentivizing and funding collaborative programmes for innovative businesses and manufacturing, is connecting these into sources of expertise through a mix of programmes, including Knowledge Transfer Partnerships, to accelerate sustainable economic growth. It has an important role in terms of near-market innovations and launched seven new "Catapult Centres", with a further two in energy systems and precision medicine due to open in 2015, receiving around £110 million annually when all sources are taken into account. These are modelled on the 66 German Fraunhofer employing 22,000 staff, the majority being qualified scientists and engineers. They receive an annual research budget of 1.9 billion euros, with 1.6 billion euros being generated from contract research for industry and publicly financed projects. This is good news as it suggests that UK funding has room for expansion if UK firms, both manufacturers and others, are to compete better on a level playing field, but also where market-oriented research and development activities are able to generate significant revenues.

The Catapults are intended to bridge the gap between primary, early-stage research and commercially ready propositions. Business and academic input into the Hauser review has recognized the need for the Catapults to be further "joined up" to each other, to business and increasingly to centres of research and applied excellence, as well as to additional sources of EU funding. Manufacturers have been enthusiastic about the opportunities they have provided with a focus on long-term funding and market readiness having been stressed by all partners.

Following the publication of the CBI report "Pulling Together", the need for greater support for near-to-market development (as opposed to research) has been stressed alongside connectivity between funds enabling joint bids with funds numbering AMSCI (Advanced Manufacturing Supply Chain Initiative with £125 million competitive

funding available in rounds 1 and 2, with £120 million further funding announced in autumn 2012), Regional Growth Funds (£3.2 billion available between 2011 and 2018 for competitive bids allocated through a number of rounds), Catapults and TSB funds in driving greater investment through manufacturing supply chains.

Rebalancing has brought a focus on productive wealth creation and manufacturing, which in turn has resulted, after some years of lobbying by the Confederation of British Industry (CBI) and the Trades Union Congress (TUC) in particular, in the development of a national industrial strategy with a sectoral focus, allied to cross-cutting themes around access to finance, skills, technology and procurement. As explained earlier in this book, much of the focus within this is STEM led, especially in light of the forecast of skill shortages estimated to amount to around 800,000 over the next ten years. The CBI has subsequently called for the industrial strategy to "join up" across government as a critical part of the supply-side response to sector development and in collaboration with the sectors themselves.

These challenges require enhanced connectivity through and across government as well as into the wealth-creating arm of the economy. Having developed from a laissez faire approach, where the cultural mind-set has been one of letting the markets deliver with minimal involvement of government, we now need to move towards greater collaboration in terms of creating value, enhancing opportunities for business and manufacturers to shape and create new markets and to place sustainable economic development and rebalancing at the heart of all departments was the view expressed.

With an emerging reassessment and a growing realization that our entire market economy is a "designed" entity, that we set the legal and regulatory framework within which markets function and respond, there is an appreciation that government is not simply standing aside whilst the business of economic development takes place. For example much of the automotive response to the need for low emission, hybrid and electric vehicles is focused around meeting low-carbon legislative requirements being set in Brussels, with industrial designers, engineers and researchers in the Midlands stating that, by and large, they welcome this, and have been working hand-in-hand with the regulators to design products that will meet these emerging requirements for a greener economy.

To deliver an approach that enables the connections to be made – at national and sub-national level – will require national, regional and local systems and systemic capacity, and a series of arteries running

through each connecting them up together and running back up to a central clearly defined objective, backed by a thought-out rationale binding it all together. What one department does must not offset what others are doing to stimulate business and growth but instead they should be working to reinforce each other. This requires the ability to pull together the many highly developed strategies within the departments of government, whether it is industrial, innovation (including research and development), education and skills (including our higher educational expertise and cultures), planning and infrastructure, and tilt them to one goal – seeking balanced economic growth, as Lord Heseltine has recommended.

The record so far

The goal of economic development requires a cross-party consensus and a long-term vision – as well as extremely expert and unbiased civil servants who are able to analyse and advise on the best policies to achieve the overall objective of sustained and well-balanced growth. In the UK we still seem to be miles away from having achieved that. At the regional level, for example, the cuts in public spending on infrastructure and other capital projects aimed at achieving fiscal consolidation have hit particular regions hard. The business investment drop that followed is only now being slowly reversed but capacity was hit badly in a number of areas and productivity across the economy and in many industry-intensive regions has suffered as a result. In addition other policy initiatives have not helped.

One such is the demise of the nine former English RDAs, as UK economic development strategy at sub-national level has become the responsibility of LEPs in collaboration between local business and local authorities. It is true there was a lot of variability between the RDAs in terms of their effectiveness. But the decision to abolish them appears to have upset the systems of collaboration sitting behind these structures (and behind those relationships and the trust that results in "things happening" and "delivery on the ground") that had been slowly developed through the years: systems of co-ordination between RDAs, local councils and all the arms of government in local places that affect economic development.

The new sub-regional economic development landscape has had some positive aspects welcomed by business, in particular where it has brought real business focus and leadership. But as fledgling structures the LEPs have been preoccupied with working out what they are here

for, what their governance arrangements are and should be, and how to access resources required to deliver anything beyond some strategic aims and ambitions. Enterprise Zones, where there are growth opportunities with benefits such as capital allowances and business rates retention schemes and City Deals, are providing greater focus – and in the case of Manchester the first "earn back" scheme in the country.

If the RDA record of delivery was considered patchy the LEP record from start-up to delivery in support of economic development has been patchier still, due to few initial resources, different aspirations, structures and teams leading to great variation in LEP performance and funding. The six LEPs of the West Midlands, for example, have prioritized between themselves over 30 growth and enabling sectors, some aligning with the industrial strategy and some not. The North East LEP straddles an economically significant area with a population of around 2.5 million, with a settlement hardly in line with its status; by contrast Tees Valley LEP, although a smaller area, has access to a comparatively greater share of resource from local partners. Local Growth Funds have recently been made available to LEPs – £12 billion in total between 2015 and 2020, with half allocated to projects within LEPs and half to competitive bids.

The way ahead?

The economic challenge for ecosystem development has been focused around the best size for accountable units able to empower local action alongside the need for some degree of scale in economic development to drive economic rebalancing. Amongst the figures demonstrating a South East economic bias, IPPR has highlighted that over 75 per cent of all infrastructure spend between now and 2020 is planned for London and the South East; economist David Smith has stated that London and the South East account for almost 40 per cent of UK GDP and McKinsey have stated that central government's share of decision-making on public spend accounts for 72 per cent in the UK, compared with 35 per cent in "centralised" France and 19 per cent in Germany. City regions want to have the flexibility to tailor solutions to meet their specific needs, rather than have a one-size fits all approach "foisted" on them, especially when it comes to priority issues such as skills.

The sub-national economic development landscape has become more confusing – for example, within skills development the processes and systems that sit behind whichever organization takes the lead between Sector Skills Councils, LEPs and local government needs resolving

through agreed protocols. Collaboration required to resolve strategic site development and delivery is a further challenge, as businesses grapple with administrative boundaries between district councils with planning responsibility and county or other councils. In light of this, Lord Heseltine's recommendation for unitary authorities across the country would be welcomed and not only by business – local authority leaders want change that will enable them to deliver too.

The move to Combined Authorities may help to resolve some of this fragmentation. Manchester, through the leadership of Sir Richard Leese, has recognized the importance of scale (and greater cohesion) by aligning boundaries to functional economic areas together with prioritizing economic development as opposed to the traditional local government focus on social provision, which Sir Richard has stated as being one of the reasons why cities were not performing as well as they might (*Prospect* 2014).

Manchester's Combined Authority, with Sir Richard in place as leader since 1996 and with Labour controlling 95 out of 96 council seats, will, from 2017 have its own elected mayor with £1 billion of devolved funds, setting that city apart and focusing attention on cities, including Birmingham which has just announced plans towards the formation of a Combined Authority with the Black Country, with the opportunity to engage with Coventry and Warwickshire. The West Midlands LEPs have responded by announcing the formation of a "region-wide" LEP to mirror the potential boundaries of any future Birmingham, Black Country or West Midlands Combined Authority. The potential prizes are large as illustrated. On welcoming the announcement Sir Richard Leese said:

> Greater Manchester has been in the vanguard of the national devolution debate. It was clear that an over-centralised national system was not delivering the best results for our people or our economy. We are extremely pleased that we can now demonstrate what a city region with greater freedoms can achieve and contribute further to the growth of the UK. Our ultimate ambition is for full devolution of all public spending in Greater Manchester, currently around £22 billion a year, so that we either influence or control the whole amount. We recognise that this cannot happen overnight and there needs to be a staged approach based on evidence that devolution delivers increased economic growth and better public services. But today's settlement is a huge move forwards and a road map for the future. (*Manchester Evening News*, 3 November 2014)

Devolution as an agenda has been pushing forward, especially in light of the Scottish referendum. Whilst business is broadly supportive of moves to Combined Authorities and of LEPs, where they are working well through business leadership, they remain cautious about devolution. Opportunities have been recognized, but concern remains over increased fragmentation, especially if cities were to start collecting taxes, whilst at the same time recognizing the opportunities for greater infrastructure investment. With devolution new forms of distributed leadership are being developed, with Mike Emmerich, Chief Executive of New Economy, Greater Manchester's strategic economic hub, explaining that for their Combined Authority it has been about ceding leadership and distributing power:

> We have a model of leadership in which the Chair of the Combined Authority is Lord Peter Smith of Wigan. Each authority leader has a portfolio and so do chief executives. If people think they're leaders, because they are exercising leadership, they will act as leaders.

The RSA City Growth Commission Report, "UniverCities the Knowledge to Power UK Metros", published in October 2014, as one of the reports feeding into the final recommendations made by the City Growth Commission in their report "Unleashing Metro Growth", chaired by economist Jim O'Neill, highlighted that jobs for graduates were forecast to grow from 43 per cent of the workforce at present to 54 per cent in the next decade, indicating the importance of the role played by higher education in our future competitiveness as a nation and within metropolitan areas.

Their primary recommendation was to "orient the content of teaching and research to meet the demands of metro economies" by providing them with the freedoms and flexibilities, and co-ordinating these through either Combined Authorities or LEPs, to establish Metro Investment Funds for Higher Education (MIFHE). Other recommendations included ReFreshers weeks, with universities working to retain graduates within metro areas and a centralized "graduate clearing" system pooling rejected graduate recruitment applications and recycling them to local firms with vacancies, along with golden handcuffs arrangements to reward commitments from graduates continuing to work locally.

Recommendations supporting entrepreneurship included the provision of incubation space, seed investment programmes and flexible course provision together with schemes enabling visa extensions

for overseas graduates. Implementing these proposals would require the development of considerable social and political capital, in turn requiring time and commitment.

In September 2014, Greater Manchester Universities combined to prepare proposals for European funding to support High Level Skills Delivery in Greater Manchester, noting that just 29 per cent of UK students undertake a form of internship during their final two years of study, compared with 66 per cent of German students and 79 per cent of French students with their bid aimed at widening participation, improving levels of graduate entrepreneurship and employability and postgraduate teaching and research.

A new industrial strategy

A paper for the think tank CentreForum (2012) called for all-encompassing industrial policy of which the state is a pivotal part – not by spending money necessarily but by acting as facilitator to ensure that the "ecosystem" that businesses believe is vital for propelling growth functions effectively. It stated:

> There is a now a growing realisation that the changed environment in which all players are operating is leading to the acceptance that it is no longer a question of whether the state plays a role in the reshaping of the economy, but how best it can play that role, whatever one's political persuasion.

The CBI state that the creation of an "attractive business environment" is at the heart of a successful and coherent UK industrial strategy and have developed a scorecard to measure progress taking into account eight criteria in gauging progress. These comprise education and skills, research and innovation, infrastructure, energy costs, tax competitiveness, regulatory burden, access to finance and investment, and trade. According to the CBI, when measured against international competitors including France, Germany, USA and Japan (as well as the world leader in each category), the UK performs poorly in five aspects of eight broader criteria including education and skills, R&D spend as percentage of GDP, infrastructure quality, regulatory burden and access to finance in terms of ease of access to loans. More concerning is the fact that the UK performs worst amongst the benchmark competitor nations in education and skills, R&D spend as a percentage of GDP and ease of access to loans. Only in two areas does the UK perform well – quality of science

and research institutions and headline corporation tax. In emphasizing the business environment the CBI have stated the need to focus increasingly on supply chains in developing manufacturing sectors.

The www.forEurope policy paper no. 13 promotes a vision of industrial policy around "high road competitiveness", or the ability of an economy to achieve "beyond-GDP goals". They refer to systemic industrial policy working in alignment with other policy strands and supporting social and environmental goals; affecting the structure of the whole not only the manufacturing sector. To deliver this as Will Hutton has stated in the past:

> We need to help business, beset by risk, to minimise these risk factors and to do this we need to map local innovation eco-systems. Where are the early adopters? How can we find innovative ways of employing people? We need to use open innovation to extend businesses' capacity and reach into value adding networks – even the big companies can't do a full array of consumer goods and services themselves. (Idea Burmingham 2011)

Mariana Mazzucato (2013) in her book *The Entrepreneurial State* focuses on symbiotic innovation ecosystems, which are not just about smart growth, but smart, inclusive and sustainable growth. This requires active government, a focus on the interface of industrial and innovation policies using procurement policy to actively promote innovation and not just in technological areas but in social and ecological fields. This is promoting an entrepreneurial state, creating and shaping markets, not just fixing them. Businesses surveyed agreed. They see a need for greater dynamism, speaking of a "smart industrial strategy" driving collaboration across sectors and using design to transfer ideas, best practice, cultures, working practices to greater dynamic effect. Architect Glenn Howells stated:

> A lack of collaboration between businesses is holding back innovation capacity – both between and across the private and public sectors, for example through partnerships with education. Public sector procurement practice needs to be revitalised and could generate tremendous opportunities for re-design and innovation.

This point is echoed in the 2012 CentreForum piece referred to earlier calling for a fourth-generation industrial strategy and arguing for a more coherent approach:

> characterised by a presumption against sector-specific policies and a greater emphasis on cross-cutting policies and underlying issues. In short, government should see its role as providing some of the necessary elements to business success, but it is for business to decide what to make from those elements.

In arguing for a revitalized industrial policy the CentreForum piece reminds us that:

> The problem is that at present the emphasis is understandably on how to get the economy moving again rather than thinking necessarily about the long term, The result has been a series of piecemeal type proposals that may or may not have some impact on economic growth in the short or long term, with differing views depending on what political spectrum people are coming from … However, a new industrial policy requires a much more holistic approach that addresses the root of the problem which is how to make markets work efficiently and provide what is needed for long term sustainability. For example, sufficient finance for investment, skills that are flexible enough to cope with rapidly changing circumstances, continuous investment in innovation that enables UK companies to compete, encouragement of entrepreneurship and creativity and an environment of free movement of goods and labour that keeps the economy competitive in the longer term. All of these should be within a competition and regulation framework that is fair and stable.

In summary, the UK government has been reassessing its role as a partner in business. The question of picking winners though remains. Indeed the Director-General of the CBI, while welcoming the publication of BIS's industrial strategy in 2012, still argued that "In addition to improving the underlying business environment, the government should adopt a more strategic approach to championing key sectors where the UK has competitive advantage and sees future opportunities for growth". He saw this as a "once in a generation opportunity" to get industrial strategy right with the need to continue to champion key sectors, refining targeted policy interventions to remove barriers to growth, as well as focusing on building stronger supply chains. That may be so. But picking winners is always difficult. Providing the right components that allow economic competitiveness to be sustained in a globalized environment is arguably a better way to proceed, especially when money is tight. As Mariana Mazzucato (2013) argues, risk-sharing

and supporting technologies have greater spill-overs and for many that is more effective. At the very least any sectoral approach needs to become more cross-cutting, with the strategy becoming integrated with other strategies and policies moving towards becoming a "smart" and symbiotic industrial strategy creating and stimulating greater links and more collaboration.

Survey results

For most of the manufacturers and other businesses we spoke to it was clear that they do not feel that systems are geared towards the achievement of value-adding aims and ultimately wealth creation through making. They spent too much time slashing through the canopy referred to by Lord Heseltine in "No Stone Unturned" and hacking through "thickets of complexity" referred to by Lord Witty (BIS 2013), as long-term "endurance entrepreneurs". The Chairman of the Black Country LEP, Stewart Towe, speaking in 2013 (Idea Burmingham 2013) about the impact of AMSCI, focused on competitiveness improvements in the supply chain which had received over 70 bids in rounds 1 and 2 projected to safeguard 18,700 jobs:

> Tier 2 and 3 businesses are suffering from funding deficits. We have secured £25m to make available as loans or grants to businesses. This initiative has involved Greater Birmingham & Solihull, Coventry & Warwickshire and Liverpool LEPs. It has been delivering some impressive results and is an example of what can be done by pulling together.

However, alongside the above, the overwhelming priority stressed by those interviewed was the skills required – to fill skills gaps and to power industrial and economic growth. Manufacturers were looking for creative and entrepreneurially focused people able to combine specialist skills with a broader perspective. Steve Norgrove, VP Operations GKN Land Systems, added:

> On skills there is a need for a broad perspective. We have lost a bit of balance. The balance is achieved around mixing our ability to use people's talents by combining academic and practical skills. The education system is more focused on grades and forces people at an early stage into a template that doesn't necessarily make the best use of their talents. To get vocational skills – technicians, maintenance, we

> used to be well served by the Vocational Colleges. We do need STEM, but a more rounded practical understanding is really required.

Ivanka Visnjic Kastalli Assistant Professor, ESADE Business School, who with Andy Neely, Cambridge Service Alliance, University of Cambridge, produced "Collaborate to Innovate", commented on the role of city (region) governance in incentivizing players to *link* together to create better conditions for businesses to do their jobs and grow, with the job of mayoral teams being to promote co-ordination between these players. It was important, for example, to connect start-ups and large companies, create events and special programmes for screening and match and connect these to aspiring entrepreneurs.

The priority is on creating the *ability to link* – ideas to enterprise, small and large businesses to each other, education to jobs and entrepreneurship along with encouraging cross-sectoral collaboration. It is about developing a real and virtual place-based infrastructure to support economic growth. Mike Wright, Executive Director, Jaguar Land Rover, noted the increasing importance of collaboration within the supply chain, stating: "In designing our products we create a process where we need all our suppliers to be talking with us and sharing challenges, innovating together, and getting product to market faster. Ray Edwards, Managing Director, AugustaWestland, has outlined the increased requirement for enhanced mutual capability:

> There is a relentless need for innovation in manufacturing. The supply chain is a bedrock for us. Helicopters are reliant on vendor products for quality, cost and performance and their engineers need to be part of our team. Seventy-five per cent of our parts are bought in and whilst new product introductions are accelerating, much of our innovation is in modifying existing aircraft, so we need to work closely with suppliers. Their ability to respond rapidly to improvements on anything from brackets, or pipework, or mission computers is vital and includes a focus on the critical nature of craftsmanship and people. We have 850 suppliers in the UK alone. They are working with us on composites, metals and electronics. Key to us is their flexible response. We can no longer work based on a linear process of design, procure, develop and sell; it is not enough for us now.

Manufacturers would like to see more measures put in place, such as through a developed version of the CBI scorecard, to assess and gauge progress, consistency in managing strategy from the national to the local

level and whatever layers of government sit in between. Their top competitive requirements are focused around skills, access to patient finance as well as to expertise, knowledge and research, increasing too the applied research as well as the "D" or "development" of R&D. Whilst current policy emphasis with regards to manufacturing is focused through sectors, the provision of STEM skills and linking into STEM-led institutions, business wants to see a broader emphasis on bringing together "thinking and doing" through multi-disciplinary activity, with the term STEAM skills emerging – the "A" for art representing design, creativity and entrepreneurship. Steve Norgrove, GKN, stated:

> This will require a lot of free thinking people … Free spirits of enterprise. They need to be very creative, producing products in a very different way. Our young design thinkers need to be more commercial and very entrepreneurial. There is a real need to get creative subjects linked into commercial markets because at some stage you have to link to reality if you want to change the world. You do have to be anchored in the world where people want to buy something.

However, where greater collaboration and planning is happening business applauds it, with Phil Swash, Chief Executive, GKN Land Systems, stating:

> In terms of aerospace initiatives things really do seem to be coming together to make impactful relationships between industry, government and our universities. It could be better, but in many ways our engagement mechanisms in aero and in auto are more effective than in Germany. I believe in many respects we have caught up. We are not ahead of them overall, but we have significantly closed the gap.

Steve Norgrove, GKN, commenting on the increasing role of connectivity which is impacting on the value chain as well as the combination of technology and user-driven skills required in bringing successful products to market, said:

> Products are becoming more and more customized in the way they fit into everyone's lifestyle – connectivity on the move, instant access to information and even remote access are becoming the norm … Many products are now bought on emotion as well as function and much of this is provided by the software interfaces that determine the look and feel of them in the eyes of the consumer. The UK needs to be moving towards this space in line with the way consumers are changing their behaviours and expectations.

The trends identified most consistently by manufacturers surveyed included the following identifying a strong lifestyle focus by producers across the manufacturing spectrum:

- Accelerating New Product Introductions: Around 50 per cent of AGA Rangemaster's revenue was generated from products that were not present in their range in 2011. Jaguar Land Rover sold 431 cars in China in 2003; by building on the success of the Range Rover Evoque this had risen to 77,075 cars in 2013, which was having a positive impact on company profit. Specialist educational chair manufacturer Hille outlined that highly targeted new product introductions made each year over the past six years had driven top line sales and profits and resulted in them taking on more people.
- Connectivity: There was a great recognition amongst manufacturers of the growing need for haptics, user focus and user interface.
- Customization – mass personalization: This was recognized as driving an even greater lifestyle focus with the need to develop capabilities in branding, design, reputation, social and cultural appropriateness.
- Urbanization and population growth was continuing to enhance the focus on lifestyle.
- Heritage and authenticity: around 50 per cent of Brooks England sales were from products designed in 1800s.
- Fragmentation of retail and routes to market: Emma Bridgewater were generating around 50 per cent of their sales over the Internet.
- Low-carbon and lightweight materials: EU legislation and standards were driving this agenda and along with it much innovation.
- Micro-specialization of product focus had become possible through the web which was enabling highly specialized companies to be established by targeting and gaining sales effectively and often gaining traction rapidly through internet channels.

The trends highlighted growing STEAM skills requirements. Connectivity and customization were leading to the alignment of heightened digital and emotional functionality, with software interfaces determining how devices "look and feel" and the degree of cultural appropriateness. Manufacturers both within supply chains and selling directly into consumer markets were looking for a new generation of "free spirits of enterprise" blending high-tech with high-design skills with a highly commercial and entrepreneurial mind-set drawing on innovation and design cultures embedded within the learning system from an early age.

This in turn was leading to the need for much greater engagement between education and business with young people gaining greater insights into real manufacturing and real job opportunities, with insights into the full range of skills required, working on live projects with commercial goals, gaining work experience and insights into how they might become a part of this future following their formal education.

Manufacturers were responding to this heightened need to develop partnerships and working together increasingly to find new collective solutions as demonstrated in the case studies. Academia was responding by co-developing courses with employers specifically tailored to meeting their needs and often co-located on their sites. They were forming Centres of Excellence to clearly signal what expertise could be accessed where, leading to a greater pooling of specialist knowledge across universities in order to leverage greater collective investment over longer periods.

The following case studies provide examples of how through links being established between universities, graduates and manufacturers the Midlands maker economy is continuing to grow and with it an emerging symbolic commons set to strengthen the Midlands reputation for a transformational innovation and design-led culture.

Connecting to emerging makers

Jack Row studied a BA in Jewellery and Silversmithing: Design for Industry Programme at the Birmingham School of Jewellery. While completing this he was introduced to Harrods who were visiting the university whilst reviewing graduate degree shows having been invited by Idea Birmingham. Harrods on spotting his work saw in it something unique representing British craftsmanship with a contemporary twist and prompted him to contact the buyer responsible for the Harrods Great Writing Room, who subsequently advised him on designing and producing his first collection. Speaking of this experience Jack said:

> He liked my name and recommended I used it. I was going to use a more generic name, but he felt it had a British artisanal ring to it which would work well amongst their target audience. I did not receive any advice on price-pointing, I was simply asked to produce a collection to be exclusive to Harrods for 12 months. Harrods were a great help in providing advice around brand recognition, awareness, credibility in this early stage as I was starting up and in entering the luxury market which is by and large run and controlled by a handful of companies including the Richemont Group, who own Cartier and Mont Blanc.

Jack spent the best part of the next two years working up his first pen collection for Harrods, the Architect Collection. The pens were inspired by the Lord (Norman) Foster building, known as the "Gherkin", and have been retailing for between £7,000 and £27,000 with his cufflinks selling for between £4,000 and £9,000. "I was really pleased as they ordered a whole range for their retail display and we sold a number of the top-end white gold and diamond set pens which went into the personal collection of a prominent Middle Eastern monarch."

Harrods were impressed with this performance, especially considering the space required and sales per square foot generated. From this promising start Jack has been able to keep growing his business with new collections – the Jaali introduced in November 2012, also performing well with the modestly priced cufflinks selling for around £700 and the City Collection launched subsequently, a more minimal collection which is sold direct and online.

Rebecca Struthers of **Struthers London** gained a National Diploma in Jewellery from 2003–2005, "learning so much about making jewellery, the qualities of the metals and materials and the practical side of making, including traditional hand-making skills". From this she moved on to attend the British Horological Institute completing a Higher National Diploma in horology at the Birmingham School of Jewellery from 2005 to 2008 where she met Craig Struthers, who was studying at the same time. It taught her to appreciate the finer qualities involved in designing and making. As she said:

> There is a real pleasure in owning something beautiful, at the very least just to admire the skills that went into making it. We were very lucky and had a wonderful set of tutors – Paul Thurlby, a very talented watchmaker, Malcolm Wadlow, who subsequently went to Manchester and Justin Jay Koullapis, Editor, the *Horological Journal*.

The network provided them with a good opportunity to make contacts which have proved invaluable.

> I was inspired to join watch making from jewellery because when I was designing jewellery I had always been interested in pieces that moved. I got spotted and asked if I had ever considered horology. As I love science and design this seemed like the ultimate combination.

The Struthers were awarded the Lonmin Award for Design Innovation in 2013 when Kelly Hart, then a designer at Dominos (part of WB the

Creative Jewellery Group) in the Jewellery Quarter, also a School of Jewellery graduate, recommended their work.

> At the same time we attended the Birmingham Made Me Design Expo last year, 2013, and had the chance to meet Charles Morgan, which led to a meeting with the Morgan designer, Jon Wells. We agreed a joint collaboration with Morgan in December 2013, with a brief to produce two watches for Morgan to preview the following March. We officially launched these watches in June 2014. They are now selling for over £16,000 each and we had our first delivery in Harrogate in August. Morgan lent us a car to drive up there. It has been really great working with them … Our revenues have grown dramatically since we launched our business in 2012. In our first year we were only doing restoration and we earned about £50,000. Last year we had increased our sales 100 per cent moving to £100,000 in revenues … and this year, well we'll see, but we are hoping to see another big jump forward well ahead of 2013.

Strengthening the industrial commons

MAN Group is an innovative alliance of 11 companies operating within numerous supply chains, including automotive, aerospace and renewables amongst others, who have joined together as suppliers to share best practice and create a stronger combined force when tendering for contracts. They each pay an annual subscription, which, when combined, amounts to over £100,000 a year contributing to a small admin capability, marketing and promotion. The companies involved promote their mutual services through their own sales teams and of course they have a web presence too. Business profile has increased enormously for member manufacturers from this arrangement and they have announced over £1 million additional business to group participants. One of the member businesses, Alucast, noted their success in gaining automotive accreditation TS16949 by working collectively within this group. Tony Hague, Chairman, MAN Group, and Chief Executive PP Electrical Systems, stated:

> MAN Group has been set up as a non-legal membership entity to promote, market and develop business for its members. All members have complementary skills bases so that no two businesses compete directly with any other. I do see some really some great opportunities here for businesses, especially in some areas, such as in wind

> turbines. However, I am just back from a three-day visit to "Meet the Mittelstand" in Germany. If we look at how their supply chains are so joined up and financed for the longer term there – there is simply no comparison between us. In the UK we tend to have lots of little initiatives, not joined up, that come and go, running out of money, energy and steam. It is all very disjointed. We really do need initiatives that will carry on regardless of the colour of the government. We need continuity and clarity. We would like to be "worked with" rather than "done unto". It's really about getting things done properly and in a business-like manner if we really want to change the picture and improve the chances for younger people coming through.

The West Midlands Collaborative Commerce Marketplace (WMCCM) at WMG has around 13,000 businesses registered as members of an innovative virtual business network leading to sales of around £6 billion, with over 50,000 tenders per year flow through the system, with over 20,000 users resulting from supplier collaborations and procurement tenders successfully won by companies making bids through this online network established in the early 2000s. Dr Bal explained:

> Our members are three to five times more likely to get enquiries from this site than they were prior to registering. This is because of four elements of the functionality that we've built into our system. The site generates new business enquiries and is ranked highly by google search engines. Tender feeds generate real business leads for members with each tender automatically analysed to identify the capabilities required to execute it. Competency profiles were constructed for member companies, "not just what you do today but what you are capable of doing". These were matched to tender requirements automatically by the system. The team recognized that tier 1 businesses don't build the whole product themselves and increasingly many smaller businesses need to collaborate to get a foothold in valuable tender generated business contracts. The system feeds tenders to companies it recognizes as having some of the capability and skills required for any tender being circulated. Member companies can assess if they want to cluster together and collaborate with other businesses to respond to the tender. The system will help match them with "compatible businesses".

Whilst not all businesses work in this way, those that have mastered this skill set have become wealthy on the back of it. Dr Bal claims that several millionaires have been created in the West Midlands as a result and that the site attracts visitors come from many countries worldwide, though they do not allow non-UK member companies. His team invested £250,000 building the system which is totally automated. Member business get appropriate business opportunities delivered to their inbox based on the capability they wish to utilize. The World Bank recognized WMCCM's capacity as a new business incubation system and have been using it as an exemplar virtual business incubator in their training material.

Rethinking manufacturing

The challenge of reassessing the contribution of manufacturing has been apparent to many involved in the sector. BIS, for example, has brought together an Expert Panel, led by Professor Sir Mike Gregory, Institute for Manufacturing, University of Cambridge, due to meet for the first time in November 2014. Speaking at a conference organized by BIS in October 2014, Mike Gregory stated that, due to changing industry structures, distributed knowledge and value chains, together with emerging industries, the full economic impact of manufacturing was not properly understood.

Gregory suggested that by focusing on particular stages of the value chain we could gain greater insights into the complexity of these as well as the key knowledge inputs required. He cited Plastic Logic as an example of an early stage R&D or STEM-led business; Apple by contrast had drawn on established technologies, packaging them together to provide greater aesthetics and functionality, with production being completely outsourced; GKN was a leader in engineering linked to advanced design, relying on close integration with customers and local production; Tesco commissioned design and orchestrated production, distributing and retailing whilst managing a complex supply chain network; Xerox had pioneered the service-based model, with service including sustainability and value capture offered to clients through re-manufacturing, enabling them, for example, to swap a part once it had worn out. In this way it was clear that business models existed along the value chain, with companies at different stages of development requiring different types of support and highlighting a need to focus on emerging transition points.

Gregory outlined how this required a broad approach to industrial systems to capture and appreciate their full breadth and context,

mapping the particular knowledge type required within the stages of the value chain. "Industrial emergence is", he claimed, "a neglected area, with the international evolution of industrial innovation and production ecosystems representing a major challenge," and requiring a "new breed of industrial systems architects and monitors".

Figure 8.1 provides a simplified means of visually indicating some of the multiple interfaces and exchanges of intangibles, knowledge assets and goods combining to produce an object for sale with services and through multiple routes to market. It seeks to demonstrate the difficulty of understanding our economy through standard industrial classification codes and the need to review this model. Behind each of these transaction points sits a further set of supply chains, covering everything from marketing and promotional activities to raw material inputs and manufacturing processes.

The Work Foundation have also highlighted the impact of design, alluding to its value, chrysalis like often remaining hidden until a late or final stage in the value creation. In their report, "UK Design as a Global Industry", they examined the value of design in the context of the creative industries and knowledge economy, its function in facilitating innovation, the increasing shift towards "manuservices", with these businesses making products, but gaining most of the profit and value from services bundled within those products.

Explaining how creative businesses are multi-skilled and fluid, thriving on the margins and creating hybrids, the report highlights the UK's position of strength globally with the fourth highest concentration of design businesses and the number of designers working here having increased by over 40 per cent since 2003. The Work Foundation do not see great value in the DCMS categorization of 13 sectors within the creative industries, stating, "this categorisation does a poor job of capturing 'design' – much of which takes place in organisations whose primary purpose isn't design. This means that, identifying the value created in the economy through design is challenging."

To overcome this, they identified six design-intensive sectors where employment of design skills is above average, accounting for 590,000 jobs or 11 per cent of total UK employment. Whilst contributing just 7 per cent of the UK's economic value added these six sectors contributed 35 per cent of UK exports, 66 per cent of which came from advanced manufacturing alone. Through what could be described as their catalytic impact in taking concepts from ideas to new products across these sectors, their combined output in turn contributed £678 billion of value – or roughly half of total UK GDP.

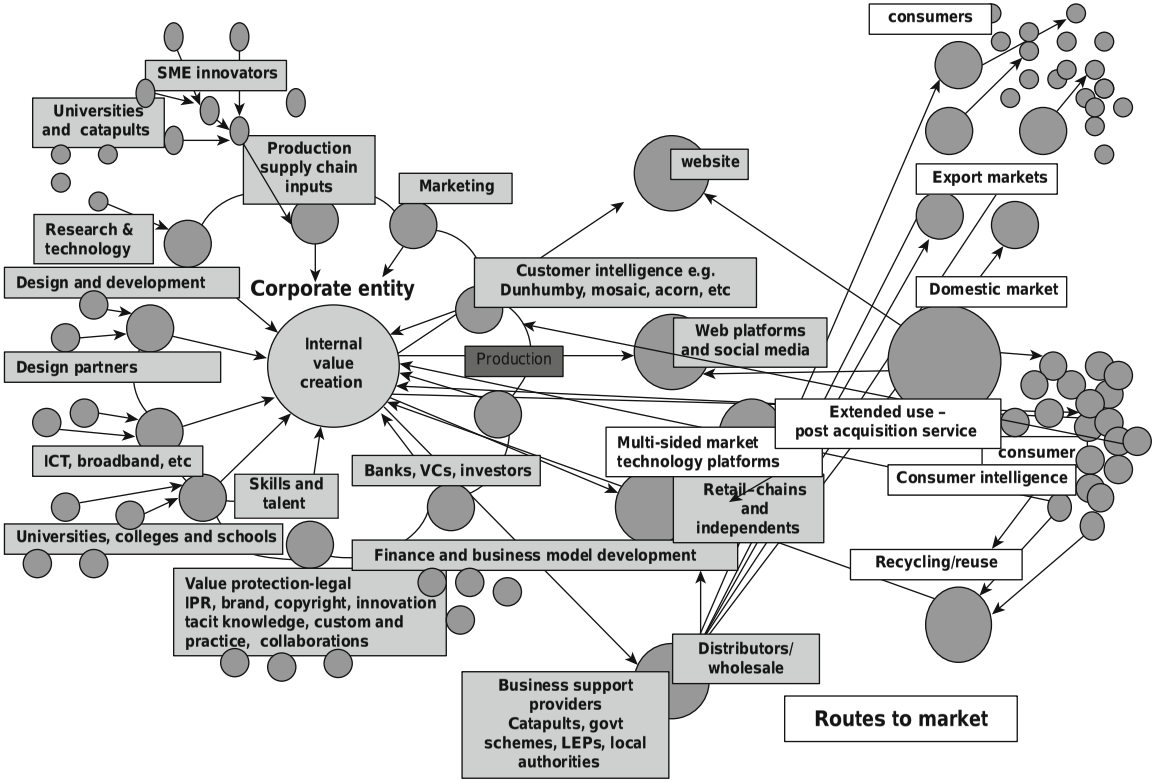

Figure 8.1 Designing distributed value creation

A West Midlands experiment

Birmingham City University recently commissioned economists at the West Midlands Economic Forum (WMEF) to look at the impact of outsourcing and servitization and how these are affecting the comparative contribution of manufacturing to the Midlands economy. This looks at the dynamic and productive relationship between manufacturing, production and services, suggesting the potential for enhanced value added in the context of rebalancing. It seeks to propose a means of quantifying this interaction to provide an alternative approach to benchmarking the economy.

This approach estimates that the wider impact of manufacturing to the UK may represent a 30 per cent comparative contribution to gross value added (GVA) as opposed to 10 per cent as stated (Figure 8.5), whilst in the Midlands where manufacturing contribution to GVA is assessed as making a 14 per cent contribution to GVA, manufacturing could, taking into account the direct and indirect contributions, represent 38 per cent of GVA, with WMEF economists assessing it might even be as high as 53 per cent whilst the overall production sector impact is estimated as being close to 41 per cent GVA of the Midlands economy and could be as great as 58 per cent (Figures 8.2 and 8.6). WMEF recognize that further research is required to refine this data; however, they suggest the case remains that services sectors dependent on manufacturing demand are a key component of the Midlands economy and taken together they form a significant driver of economic growth.

Figure 8.3 demonstrates, as shown below, that manufacturing output has continued to expand and per capita sector productivity has increased with output in 2007 being 130 per cent of that achieved in 1950, close to a quarter greater than that achieved in 1970 and about 30 per cent larger than in 1980. However, labour patterns have shifted markedly. In the 1980s manufacturing accounted for a quarter of all jobs, while in 1996 it still accounted for one in seven workers, but by 2014 this had fallen close to one in 15.

The shifts in labour may be indicative of deeper shifts in the structure of the economy, with this distinction between manufacturing and the services sector becoming increasingly hard to identify. This is partly due to outsourcing and partly due to the trend towards servitization, or selling products bundled with ancillary services customized to meet client needs.

As the manufacturing sector is judged to be heavily integrated with other economic sectors it has a higher multiplier impact on the overall economy. In terms of comparative impact, for every pound spent within

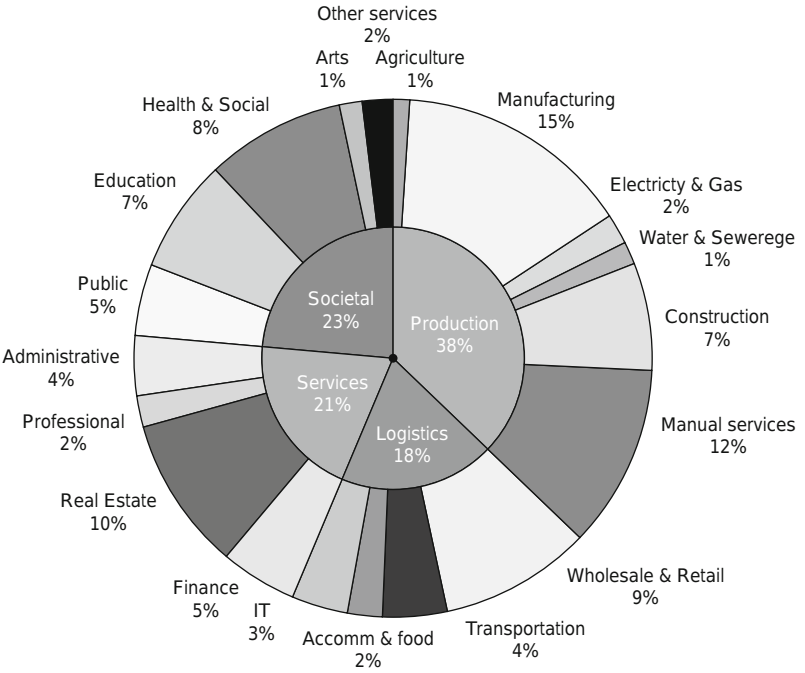

Figure 8.2 Midlands output structure taking into account the wider impact of manufacturing

Source: West Midlands Economic Forum

the manufacturing sector, it is calculated that this creates £1.76 of expenditure in the wider economy (Figure 8.4). Only agriculture (£1.80) and construction (£1.84) produce greater returns. This is due to manufacturing's purchase of research, development, sales, digital, computing, programming, automation and other technologies, media, distribution, logistics, customer and marketing services, legal and professional support, amongst others.

With increased onshoring and further attention focused through the wider supply chains, both manufacturing and service based, the impact of both outsourcing and servitization is set to increase. Rolls-Royce is an early example of the transition from pure manufacturer to provider of integrated solutions through its power by the hour service, estimated to account for over half the company's revenues.

Rather than attempt to assess the scale of the interaction between services and manufacturing, the method used by WMEF has been to

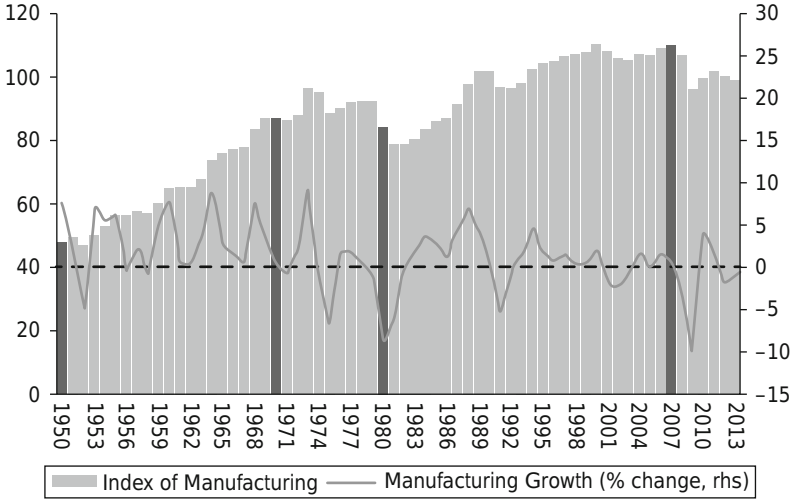

Figure 8.3 UK Manufacturing output performance, 1950–2013
Source: West Midlands Economic Forum

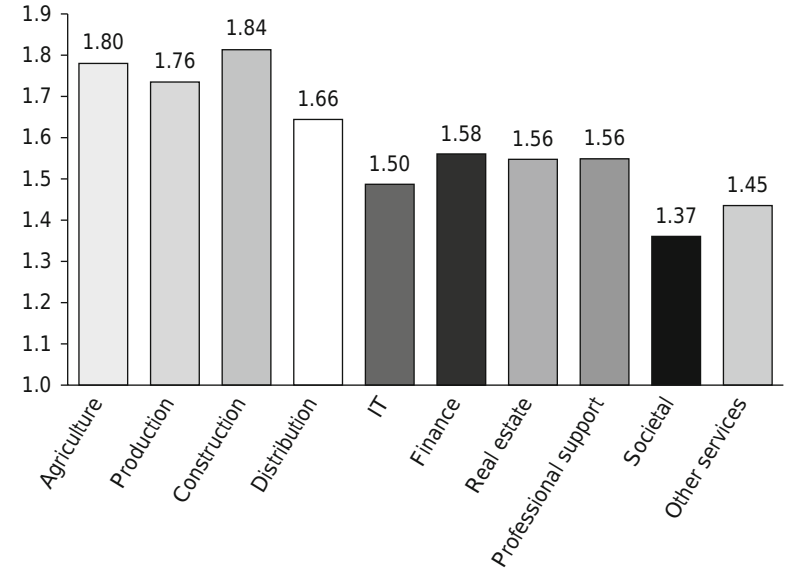

Figure 8.4 Comparative GDP impact of sector product spend
Source: West Midlands Economic Forum

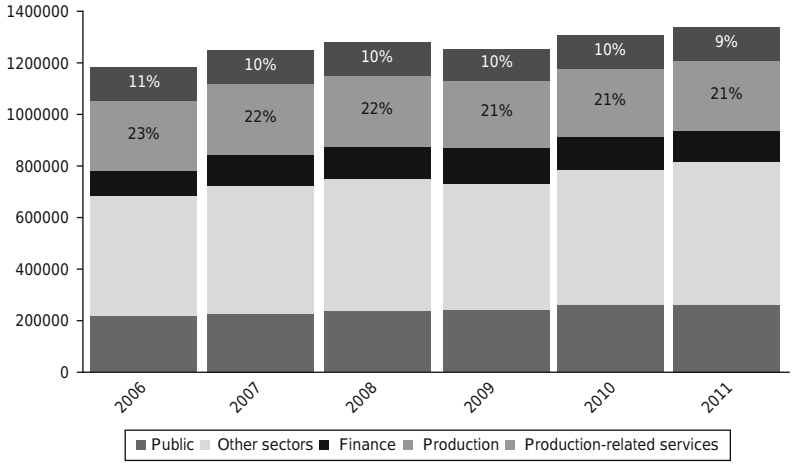

Figure 8.5 Assessment of comparative contribution of production to UK GDP, 2006–2011 (wide definition £GVA)

Source: West Midlands Economic Forum

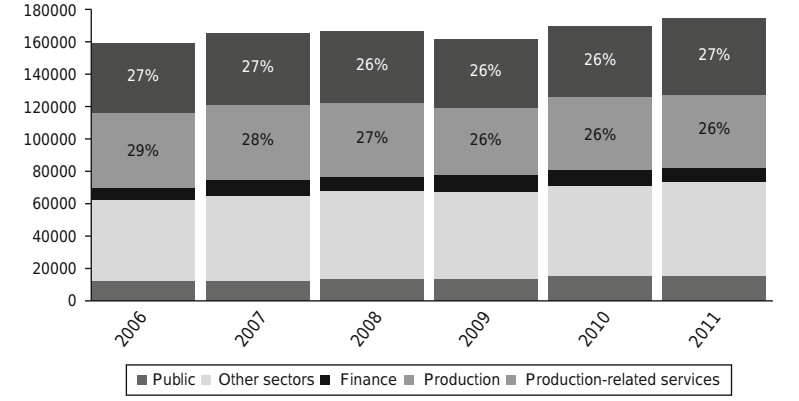

Figure 8.6 Assessment of comparative contribution of production to Midlands GDP, 2006–2011 (wide definition, £GVA)

Source: West Midlands Economic Forum

weight the services sectors by the notional demand manufacturing makes on each of the respective sectors. Whilst recognizing that further work needs to be undertaken to establish these weightings, at this stage the relative proportions of the manufacturing and production sectors

have been used to indicate the level of likely demand and interaction regionally.

In the case of manufacturing a weighting of 0.15 was given, and for overall production of 0.26. In addition a qualitative assessment was then applied to each of the various sectors and where it was judged that there was likely to be either no or a slight relationship then a 0 weighting was applied. For a few others it was concluded that the service was deeply dependent on manufacturing or production, and as a result a weighting of 1 was applied. Accurately defining the secondary impact of manufacturing would require analysis of industry down to five-digit SIC level and sampling of key enterprises within these industries to examine their use of services and their degree of servitization.

However, even with the ongoing reassessment of the contribution to GVA made by manufacturing, on the basis of current measures the sector has continued to outperform financial services, for example, contributing £140 billion compared with £116 billion GVA in financial services in 2011, as Figure 8.7 demonstrates. Midlands manufacturing accounts for 14 per cent of UK manufacturing GVA with Midlands exports growing at over 20 per cent in the past two years.

The Midlands has shown impressive export growth over the past three years – with export volumes moving from £40.7 billion in 2011 to £48.4 billion in 2013, compared with London and South East export performance which have both declined over 10 per cent, moving from £36 billion in 2011 to £32.6 billion in 2013 in London, and from £44.9 billion to £41.8 billion in the South East in the same period. A leading contribution to the success of Midlands export performance is attributable to four businesses – Jaguar Land Rover, Rolls-Royce Aerospace, GKN and JCB – and their impact on supply chains.

According to Markit analysis below (Figure 8.8), the Midlands has been a consistent engine of UK growth with growth momentum comparing favourably against the largest European economies.

How do manufacturers use ecosystems?

Within this increasingly distributed value chain manufacturers stressed their dependence on ecosystems to deliver the necessary components for success, with skills, talent, finance, new knowledge, applied research, brand, design and process being highlighted. A full range of collaborations across and within sectors was thought essential to meet accelerating consumer expectations for enhanced connectivity and customization as well as global requirements for low carbon and sustainable solutions.

Midlands Basic Economic Data

£'000		2006	2007	2008	2009	2010	2011	2012p	2013	2014H1
GVA	UK	1,204,841	1,274,877	1,312,112	1,280,261	1,327,923	1,360,925	1,383,082		
	East Midlands	70,742	74,601	75,182	73,425	77,144	79,703	79,698		
	West Midlands	90,407	93,284	93,508	90,624	95,196	97,086	98,346		
	Midlands	161,149	167,885	168,690	164,049	172,340	176,789	178,044		
	London	244,766	267,945	285,638	278,453	289,376	303,369	309,339		
	South East	173,092	181,995	186,525	183,325	192,621	196,105	202,597		
Manufacturing	UK	139,966	140,378	142,516	131,913	138,150	140,539			
	East Midlands	12,339	12,392	12,727	11,316	12,068	12,585			
	West Midlands	14,501	14,102	13,312	11,948	12,872	13,368			
	Midlands	26,840	26,494	26,039	23,264	24,940	25,953			
	London	9,067	9,019	8,189	7,660	8,038	8,137			
	South East	16,787	17,132	17,056	16,102	17,006	16,857			
Financial service	UK	102,421	117,702	125,273	137,395	126,695	116,363			
	East Midlands	3,007	3,752	3,740	3,456	3,147	2,827			
	West Midlands	5,232	5,782	5,796	7,281	6,413	5,652			
	Midlands	8,239	9,534	9,536	10,737	9,560	8,479			
	London	45,711	53,189	57,994	61,791	61,706	60,027			
	South East	10,239	11,700	12,213	13,969	12,326	10,037			
Exports	UK	243,822	219,919	248,808	225,792	263,052	295,392	296,326	298,665	142,867
	East Midlands	17,910	15,154	16,975	15,326	16,548	19,416	19,949	21,465	9,823
	West Midlands	17,953	15,366	17,463	14,368	18,515	21,330	22,795	26,997	14,155
	Midlands	35,863	30,520	34,438	29,694	35,062	40,746	42,744	48,463	23,977
	London	29,336	22,479	25,090	22,684	29,557	36,233	35,028	32,623	13,626
	South East	34,256	33,433	43,202	40,372	44,064	44,960	43,448	41,834	19,469

Imports	UK	301,965	310,760	341,776	307,981	360,556	394,556	403,793	408,096	198,201
	East Midlands	13,683	14,711	17,643	16,068	17,478	19,319	20,128	21,487	10,605
	West Midlands	22,187	22,541	24,150	20,038	24,916	32,221	34,948	33,437	17,869
	Midlands	35,869	37,252	41,792	36,106	42,394	51,540	55,076	54,923	28,474
	London	48,909	48,981	55,504	51,243	64,379	74,079	75,478	71,880	32,651
	South East	67,897	69,468	74,734	71,981	84,317	89,769	90,425	89,371	43,701
Trade balance	UK	58,143	–90,841	–92,968	–82,189	–97,504	–99,137	–107,467	–109,432	–55,334
	East Midlands	4,227	443	–668	–742	–930	97	–176	–21	–782
	West Midlands	–4,233	–7,175	–6,687	–5,670	–6,401	–10,890	–12,153	–6,439	–3,714
	Midlands	–6	–6,732	–7,354	–6,412	–7,331	–10,793	–12,332	–6,461	–4,496
	London	–19,574	–26,502	–30,415	–28,559	–34,823	–37,846	–40,450	–39,257	–19,025
	South East	–33,641	–36,035	–31,532	–31,609	–40,253	–44,809	–46,977	–47,537	–24,233

Source: ONS, HMRC & WMEF

Figure 8.7 UK GVA, manufacturing, financial services and export shares, 2006–2014 (H1)

Source: West Midlands Economic Forum

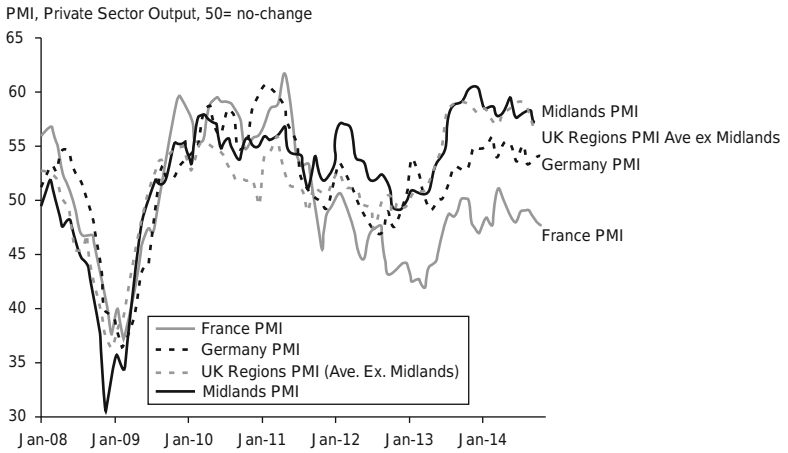

Figure 8.8 PMI productivity, January 2008–2014
Sources: Markit, Lloyds Bank

STEM and STEAM capabilities were deemed indispensable as connectivity increasingly brought together form and function, including high- and low-solutions, art, craft and emotion within systems of design-driven innovation, allowing "emotional functionality" to inform how products look and feel to meet consumers' changing lifestyles, behaviours and expectations. These trends taken together were driving the need for greater collaboration within supply chains and into sources of expertise along with a greater requirement to understand what expertise could be accessed where. Manufacturing businesses were not waiting for help, but mobilizing themselves to form new networks and groups promoting, sharing and marketing their collective skills in accessing and winning new orders.

What more needs to be done?

At national level a cross-party plan for growth, with manufacturing at its heart, is required to support and stimulate the sustainable balanced economic revival required. This must reach into and across the arms of government as the only sure route to addressing the scale of the challenge. This would deliver the long-term perspective with the permanent support structures needed to take root, evolve to meet new needs and develop relationships, and the systems *linking* together sources of knowledge, expertise and skills and creating the confidence in business to rely

on the support offered, trust in its continuity and thereby feel secure in investing for the future.

Scale in terms of units of economic development is required to reduce fragmentation, enhance systemic support and deliver greater co-ordination. Transparency into sources of knowledge and systems is needed to enable greater access to expertise and knowledge. In spite of much good work, at every stage of skills development manufacturers needed to become more engaged with their local communities, from primary and secondary school through further and higher education and in the provision of targeted continuing professional development to meet future needs. For schools "success" needs to be broader than numbers of pupils attending university.

Greater connectivity and dialogue needed to be encouraged, raising awareness of and building on some of the good practice exemplars already in place, such as STEMnet and their ambassadors, the Engineering Development Trust (EDT), the Design and Technology Association and Inside Manufacturing. However, it was important this did not lead to more fragmentation and complexity; the desired result was greater understanding of opportunities available for career development within industry.

Some industries were already employing "boundary spanners", with GKN, for example, employing highly qualified, experienced and inspirational Engineering Fellows to disseminate new technologies across company and sector boundaries as well as engaging with schools and universities. This approach could be adopted by universities, for example, teaming up together to employ jointly appointed Visiting Fellows and Professors to understand the challenges of manufacturers in their city regions and relate that back to their specialist expertise, sources of knowledge and applied research.

With the 2013 BIS Growth Dashboard indicating 22 per cent of vacancies were hard to fill due to skills shortages and with shortages in trade and professional skills, there was a need for new models of employer engagement leading to much greater local and regional engagement between manufacturing, business and education. UKCES had been piloting Employer Ownership Pilots (EOPs) as one approach using competitive funding to drive greater engagement with employers in sectors and supply chains, drawing on a £340 million programme to deliver desired outcomes, with Simon Perryman, Executive Director, UKCES, stating:

> Where there are labour shortages requiring infrastructure for the future, this is enabling new products and services to be developed

which are more relevant to these sectors. This approach has been running for three years and £100 millon has been put into it so far. We have 115 projects up and running. It is looking quite encouraging. Ten group training organizations and agencies have been established, stimulating 26,000 apprenticeship places and over 100,000 work training places.

Conclusion

The industrial strategy has been widely welcomed as a key element in any functioning industrial ecosystem. More needs to be done to build on this start. We must create a long-term view with an enduring, broadly supportive infrastructure that is not held hostage to changing political fortunes yet has the dynamic capacity to establish the links and connectivity vital to keep knowledge, skills and other vital assets moving through the distributed value creation chains.

We need to develop "mind to market" and "learn by doing" cultures. The Catapults, although recently formed, need to be strengthened and linked more strongly to the existing infrastructure. We need to realign support for manufacturing, clearly signalling sources of knowledge and patient finance. Measures for applied research need to be strongly linked to delivery of economic impact. A key part of the future would involve greater devolved accountability and budgetary control to empower and energize our regions, but this must not involve simply developing new "layers" and complexity; it must provide sufficient scale and clout as well as the systemic capacity required to link together partners – all set towards the "high road" for competitiveness, whilst charting their agreed course.

9
Conclusion and Implications

Introduction

In this final chapter we focus on the implications of our research for the manufacturing sector's stakeholders. Given the thrust of our book, we do not dwell on macroeconomic policy (others have done fine work in this area) or industry-specific policy (again, others are better placed to do this). Given our findings and the emphasis on ecosystems, we also reject simple solutions such as copying Germany, the USA, Japan or others (although we believe much can be learned from their experiences). Instead we focus primarily on addressing the sector's pressing needs to retain and attract employees, investment capital and stakeholder support. After addressing these challenges, we identify a number of other implications emerging from the research in the previous chapters.

Remaking manufacturing's image

Manufacturing's image is rather paradoxical – in reality the sector is upbeat whereas the image remains one of decay, downturn, insecurity and boredom. This needs to change. Although focusing on image at first seems trivial, we believe addressing this challenge is the key to solving the sector's pressing current and future needs for new staff, and investor and stakeholder interest. In Chapter 2 we identified that manufacturing needs to take advantage of the current "making" zeitgeist. At a time when even tech gurus such as Chris Anderson are investing in making, the manufacturing sector needs to align itself with this widespread interest in making and benefit from the associations enjoyed by art, craft, design, innovation and creativity more generally. Critically, the

sector has many stories to tell, and thereby adds significantly to the maker movement more generally. To do so, the sector should:

1. Reframe the sector's narrative in positive terms. Although the sector still faces many barriers and challenges that require a more negative or urgent tone, a sole focus on this tone of voice (particularly when framed against lay-offs and factory closures) reinforces the view that the sector is insecure, reliant on government goodwill for survival and generally in decline.
2. Building on the above, too much public emphasis on wage policy or cost policy is a turn off for future employees. The sector has done a great job of remaining competitive through productivity improvements and much low-cost manufacturing has already gone offshore. The sector could do better by identifying the prospects for rewarding careers across a range of functional areas (including but not solely focused on STEM subjects).
3. Expand the associations of the "manufacturing brand". Brand consultants often use an onion metaphor to describe brand meaning. What this means is that the image of a brand is made up of layers and layers of associations, many of which add more value to the consumer/customer or user than the product or service at the heart of the brand. The sector is still dogged by associations with engineering and production. Yet, as our previous chapters highlight, these are but a tiny part of modern manufacturing in the UK.
4. Talk about manufacturing as a modern, thriving sector, and do so in a way that balances the human scale with the bigger picture. The sector's image problems are reinforced by the fact that its successes are discussed primarily in statistical terms – increased orders, exports and productivity – while its failures or missteps are all too often presented in ways that everyone can relate to and empathize with – plant closures, distressed workers, angry union officials and politicians, and people concerned about the impact of a plant's closure on the local economy. It's easy to see why negative impressions remain. The sector needs to change this, focusing on successes at a human scale to complement the generally upbeat statistical picture (and in so doing they need not only to focus on CEOs and star designers and inventors but also on non-managerial staff).
5. Employ a sector champion who is genuinely knowledgeable and enthused about the sector and who can then equip media specialists, bloggers, parents, teachers and careers advisors (and even academics) with material that provides a richer and more positive view of the sector and the opportunities within it.

6. Use ecosystems to build positive associations at the local or regional level. Recently there has been a focus placed on the value of creative sectors to local economies. The Brighton Fuse project identified the value of the creative industries to the region and as a result helped reframe a local policy agenda. Similarly, identifying the existence and value of the creative sectors in Bath and Bristol has helped change policy narratives and also highlighted the opportunities such sectors offer young talent. The sector has much to gain by drawing closer links with local creative sectors, particularly since the collocation of creative services with manufacturing is critical to a robust ecosystem.
7. With recent figures indicating that manufacturing contributes up to 53 per cent of gross value added to the Midlands economy, the sector has much to gain by identifying this region as a manufacturing powerhouse. In particular, this provides a counter-balance to stories focusing on the importance of services to London and the South East and the North–South divide more generally.
8. Finally, if manufacturing is not smokestacks and large factories then say so. Many industry insiders remain frustrated that this image persists, but it persists precisely because no one counters it where it matters most – in the public eye.

Overall, the sector needs to think of manufacturing in branded terms. Creating a desired identity and managing the ways in which users form an impression or image of the brand builds brand value. Brand identity is something that can be controlled and directed while brand image is less controllable but can be influenced. Currently, the sector lacks an identity strategy but it does have an image – primarily a negative one.

To combat this, the sector needs to decide what the brand "UK manufacturing" should mean and then reinforce that through consistent marketing activities. Part of this strategy will involve points of parity – those things one needs to address if one is in the game (in this case the game for talent, investor interest and policy support). But the sector also needs to identify clear points of difference with sectors it competes against for the same resources. This section and those that follow identify how the sector could do that with reference to particular audiences.

Recruiting staff

Estimates suggest that just to maintain its current size the sector needs to attract at least 800,000 employees by 2020. Given the narrow focus on STEM-based disciplines this figure may even underestimate the scale of the challenge. The sector needs to realize it is in a market for talent and

market its story accordingly. Currently the services sector is more effective at presenting its case to future employees, and it does so primarily through appealing to self-interest and potential economic reward. By way of contrast, creative sectors also appeal to young people, and they do so primarily through the heart, focusing on identifying opportunities to be involved in work that you find personally rewarding and meaningful (and with some possibility, however distant, of economic reward and superstardom). Both also have the benefit of positive images, and thus benefit from their own symbolic ecosystems that mean any downsides of these careers are downplayed or ignored.

Although staff retention is primarily something that individual companies need to focus on (supported by policies that help sustain the sector more generally), we believe the sector could be more effective at presenting its case to potential employees. To do so, we recommend the following approaches:

1. In terms of points of parity, the sector needs to adopt some of the policies identified above and complement these with data on high-value career paths, rewarding projects and the robustness of the sector more generally.
2. Put brands at the centre of your strategy. The power of brands is well known by decision-makers and your potential employees understand the benefit of working for a strong brand. Although the sector does utilize its star brands, it should expand the range of career paths identified within each, talk about the benefits and value of each brand more generally (rather than just feature the logo), and expand the range of brands to cover some of the smaller, often lower-tech brands that may appeal to people who may be concerned about their ability to be creative within a large corporate environment.
3. Walk away from the false dualism of high vs. low technology. This dualism is not only of little use analytically but it has a pernicious effect on skills policy. First, it leads to calls to de-skill in areas of need. Second, the emphasis on high-tech frames the skills debate in a narrow way. Your audience is not stupid; they judge your messages as much by what is not said as by what is. Thus, if you want to attract the next generation of craftspeople, or those people with the mid-level skills the sector is desperate for, then you need to include them in the picture and identify the rewards to such choices.
4. Start early. Research on the sector's image identifies that negative attitudes to manufacturing harden with age. By the time students are finishing their university studies they (particularly women) are

far less likely to consider manufacturing as a career choice. Thus, draw on the success of programmes like the James Dyson Foundation that seek to excite youngsters about making things. Although this programme is skewed towards engineering and science, it could easily provide the basis for a more expansive approach focused on making more generally.

5. Pick up on the interest in making by sponsoring maker labs at a local level that are linked into schools and universities. Maker labs are small workshops that provide tooling and 3D printers that can be shared by school children, university graduates and local tinkerers alike.
6. Use these maker labs to connect different disciplines at the university level. Few business schools offer design courses or even innovation courses, and certainly none offer the ability to get one's hands dirty and actually make a prototype and sell it. Likewise, while design schools and engineering departments encourage making, they are disconnected from the business disciplines essential to the success of the sector. Developing programmes that combine the two in specialist courses or even in competitions would be welcomed by universities and students alike.
7. The sector is struggling to recruit mid-level skilled employees. These employees are often metal workers, welders and other skilled craftspeople, many of whom are nearing retirement. The decline of the manufacturing industrial commons in the UK means many of the pathways to these jobs have been closed off. The sector needs to place greater emphasis on apprenticeships at a policy level.
8. Target programmes at key decision-makers and influencers including parents, teachers and guidance counsellors. Start with qualitative research that seeks to understand how they frame the sector and what things drive their decisions to recommend (or not) certain professions to those in their care. Follow this up with quantitative research to validate the initial findings and then develop targeted information resources accordingly.

The sector needs to attract employees. To do so, it needs to reframe manufacturing as an exciting, viable alternative to services and move itself closer to the creative sector. In so doing it needs to widen its appeal, invest in programmes that allow people to experience making (in a real and business sense), and those that highlight the value of sector to future employees and those that may influence their choices, particularly at a young age.

Attracting investment

The second challenge the sector faces is attracting investment, particularly patient capital. Much of what we have written about reframing the manufacturing sector in more positive terms applies to this problem. Investors are focused on future returns, and thereby are unlikely to invest time and money into a sector framed as being in perpetual decline or as surviving on government bailouts and interventionist policies. Although there have been calls to view manufacturing strategy in ways empathetic to investors, even these fall short of understanding how these stakeholders make decisions. Investors are primarily concerned about future return and risk. The sector needs to reframe its image and messaging with these two things in mind:

1. Talk about intangibles. Over 70 per cent of the value of a share is driven by intangibles. Intangibles can be many things, but primarily they are reputational assets and capabilities. If investors hear messages that talk about how the sector is investing in capabilities to generate future cash flows and shareholder returns they will become more interested in it than if they hear about new technologies, inventions and other one-offs focused on maintaining the present state or that have only a small percentage chance of succeeding some time in an unspecified future.
2. Brands make up a big part of the intangible value of a firm. We've stressed the importance of branding in previous chapters and critically identified how it is a brand-driven business rather than a logo per se that delivers long-term value. Although investors may not understand exactly how brands work they understand that they do work. Brands deliver value by attracting customers, driving loyalty, improving margins and providing a platform for expansion (through brand extension), and bring cost efficiencies. Critically, they do so to the extent that they are well positioned. Positioning is the brand's identity and involves decisions to carefully target one market and then build a brand identity around meaningful values (as opposed to values that annoy no one but equally fail to excite). Get some help with your brand position, use it to drive your business and tell investors about it.
3. Talk about innovation pipelines. All too often the focus of makers is on invention, breakthroughs, risky research and development and one-off innovations. The sector needs to attract blue-chip investors that take a long-term view. To do so, they need to move beyond one-offs or long-way-offs and talk about the capabilities they have in bringing

new innovations to market. The products launched are less important to investors than the capabilities underpinning them and importantly the ability to successfully launch new products year after year.

4. Talk about your business model. Again, this emphasizes capabilities and also talks the language investors understand. Critically, recognize that all those fit-related strategies and investments (such as productivity improvements, the move to servitization and so on) mean little if you have no strategy to shape markets and drive value. Fit-based strategies are always points of parity, important to mention when concerns are raised by commentators and investors, but less critical for attracting and retaining those same investors. Position yourself as a firm that creates markets, opens up new categories and generally takes a leadership position, and you'll be more attractive to investors.
5. Know what type of capital you need. Patient capital can refer to blue-chip investors, or it can refer to angel investors who are happy to forgo immediate returns in the hope of long-term breakthroughs. The first is what manufacturers need, while the second is primarily what inventors or scientists require. In many ways, the need for investment in highly speculative STEM-driven projects with highly uncertain outcomes and payback periods is best left to the state, universities, or combinations of those and industry.

For the sector to attract investor interest they need to reposition manufacturing's image and then talk up their successes and attribute these to capabilities including branding, shaping markets and innovation pipelines. A greater understanding of how different types of investors make decisions and then targeting those needs is required.

Policy support

The sector has spent a great deal of time seeking support from policy-makers at all levels of government (see Chapter 8 for details). Too often much of the support sought reinforces the negative image of the sector and also is at odds with what policy-makers can deliver economically and politically. Rather than focusing on particular policies in the points below we identify how the sector can better position itself with this stakeholder audience:

1. Firstly, reframe the sector in positive terms by adopting the policies above. Policy-makers are unlikely to expend economic and political

capital on sectors they perceive to be engaged in rent seeking or in perpetual decline. Since the UK manufacturing sector has much to cheer about, positioning any support in future-oriented terms is likely to be received positively by policy-makers.

2. Place an emphasis on ecosystems and the need for joined-up thinking. Much benefit can be realized through ensuring that tiers of government and even Whitehall departments are on the same page when it comes to manufacturing policy. Such strategies are complex but they are relatively costless and play to "cutting red tape" or "efficiency savings" mind-set that many policy-makers have. However, the message needs to be conveyed in a way that ensures support from those departments rather than attributes blame – after all often individuals within different departments and tiers are as unaware of the problems as policy-makers are.
3. Regarding ecosystems, the government's impact agenda in the university research excellence framework offers much potential. Currently 25 per cent of a universitiy's research performance is assessed against this measure. Unlike the research publication component, impact is measured over the long term (20 years), and impact cases can only be counted at the university in which the research was done (unlike publications which travel with the academic and thus drive poaching efforts). Increasing the impact component and tying it to a national agenda would allow universities to invest into ecosystems for the long term and rebuild some of the industrial commons.
4. Seek to better utilize what already exists. Chapter 8 identifies benefits from existing programmes as well as problems in Catapults and other programmes. Fixing these both capitalizes on existing investments and often involves little cost.
5. Focus on hubs that may create linkages between ecosystem actors. For example, a common complaint is that universities often do not provide sector-specific training. This is unlikely to get much traction among universities simply because it does not sit easily with their missions. Likewise, ignoring universities means forgoing potential gains from access to research and development and intangible skills. Universities are also more functionally driven than many outsiders imagine and not as open to working with each other as one would think. Thereby look for high-profile points of leverage that balances all of these things. One of these is the various grant schemes that require cross-functional teams from multiple universities. Therefore push for a manufacturing agenda in these schemes and include

business and other non-STEM-related angles to these projects to ensure greater co-operation.

6. Reflecting on the above, also look to develop centres of excellence that reflect the broad nature of manufacturing excellence but that overcome the reluctance on behalf of universities to co-operate. This reluctance to co-operate often affects universities with different market positions and/or levels of status. For example, in Birmingham the University of Birmingham is rightly regarded as a world-class institution. However, Aston University has a highly-rated business school and Birmingham City University has a great reputation in the creative disciplines such as art and design. These outcomes reflect different histories but although the benefits of all three working together are obvious, their different profiles may lead to a reluctance to work together (particularly if they are competing). Although it would be silly to encourage one university to develop expertise in all these things as it would be inefficient and also self-defeating – for example, the University of Birmingham's research-driven culture is appropriate to engineering and STEM but less so to design schools, while Birmingham City University's more practical focus would in general work against the culture necessary to drive pure research in STEM related subjects. However, the investment in a regional manufacturing sector requiring the interaction of all three could overcome this. When paired with a maker lab and a focus on designing for sale in real markets, it could also connect directly into local entrepreneurs and even the local economy and schools.
7. Shift the focus away from picking winning technology platforms to capabilities. Many reports have sung the praises of green automotive technology. In a sense, far from moving away from picking winners, we've simply replaced winning businesses with winning technologies. Leaving aside the necessity of an ecosystem underpinning the development and commercialization of a particular technology, it is capabilities that drive manufacturing success and it is here that policy-makers can leverage existing capacity in the UK's world-class education system.
8. Since manufacturing contributes significantly to exports, policy aimed at enhancing market access and the skills needed to expand the number of markets served and the depth of that access are useful. Many manufacturers identify the importance of government departments in setting up trade fairs, bringing UK exporters from different industries together and providing contacts and on-the-ground advice. Some went as far to note that the power of the Union Jack was such that it sold products by itself. Building on the idea of a symbolic

ecosystem, policy-makers should be encouraged to expand their services in this area as it will help grow the power of brand Britain overseas.

9. Since the symbolic ecosystem relies on interactions between small and large players, policies that encourage the collocation or co-existence of such firms should be pursued. Small firms with strong niche brands often build the exclusivity of the UK brand in a particular category and gain most of the headlines thereby providing a halo effect for the larger brands (which with their coverage reinforces the value of the symbolic ecosystem more generally).
10. Finally, policy-makers should be encouraged to continually adapt SIC codes and other measures in ways that highlight (objectively) the real nature of manufacturing and its value-adding role.

Policy-makers, like potential employees and investors, view things in terms of return on investment. They only have so much political capital and energy to expend and there are many calls on their time and resources. Apart from pushing for macroeconomic changes and industry-specific policies our research suggests there is much to be gained from pushing for policies that connect policy-makers with one another and across regions, leverage ecosystems, reinforce and draw on the symbolic commons, and enhance the industrial commons in innovative ways and in ways that reflect the complex and integrated nature of modern manufacturing.

Conclusion

We began this book by highlighting the differences between the respective experiences of the manufacturing and creative sectors. Building on this we identified how the manufacturing sector could improve its image by expanding its associations beyond narrow STEM and historic associations to embrace the whole craft of making. We challenged the existing debates, identifying how too much of the debate was framed in fit-driven terms that only reinforced the poor cousin status (vis-à-vis the service and creative sectors) of manufacturing. In drawing on exemplar cases we identified an alternative view of manufacturing, one that is strongly branded, innovates in multiple ways, shapes its markets, and draws on industrial and symbolic ecosystems. In so doing we hope we contribute in some small way to a renaissance in making in the UK and help the manufacturing sector move to a more sustainable basis for future generations.

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