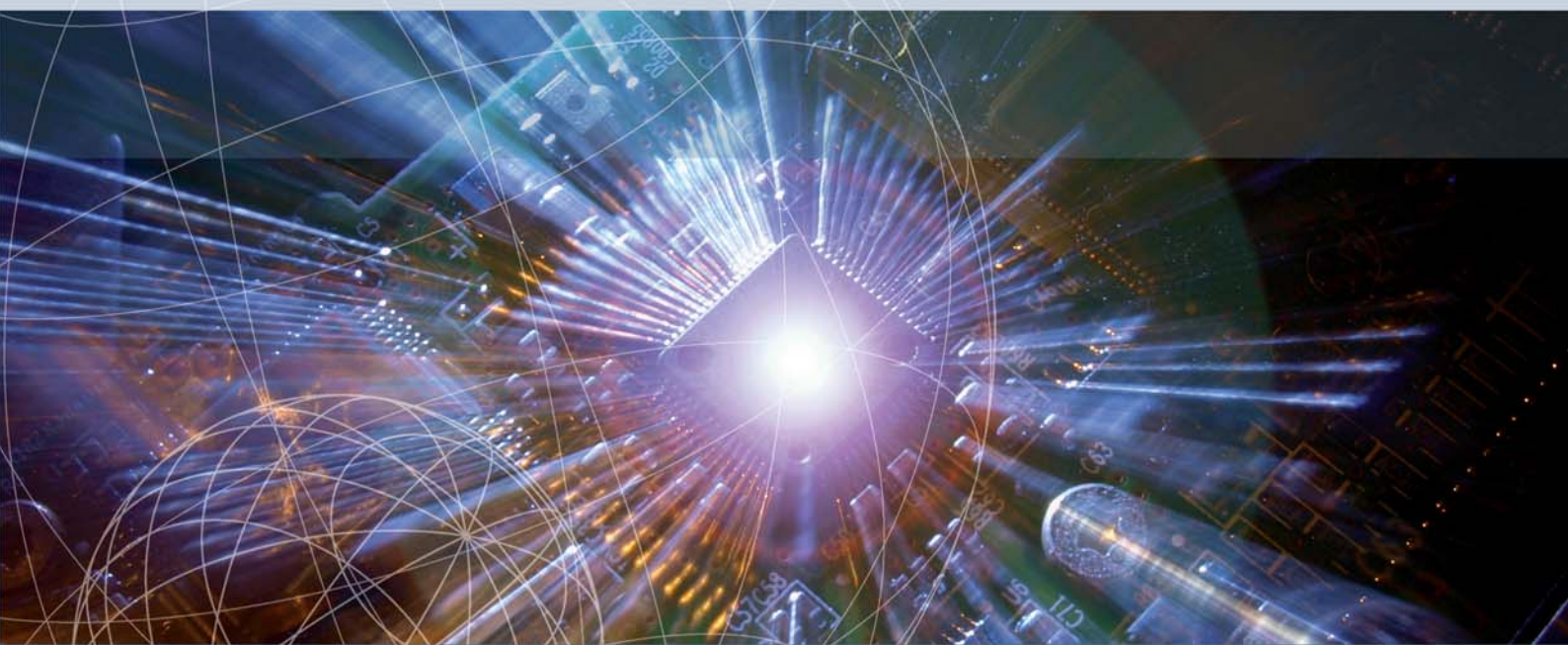


executive briefing



The Ten Myths of Manufacturing

What does the future hold for UK manufacturing?



Written by:

Ornella Benedettini, AIM Scholar, University of Cambridge

Ben Clegg, AIM Scholar, Aston University

Mario Kafouros, AIM Scholar, University of Leeds

Andy Neely, Deputy Director, AIM Research

The Advanced Institute of Management Research (AIM) develops UK-based world-class management research. AIM seeks to identify ways to enhance the competitiveness of the UK economy and its infrastructure through research into management and organisational performance in both the private and public sectors.

Written by:

Ornella Benedettini, AIM Scholar, University of Cambridge

Ben Clegg, AIM Scholar, Aston University

Mario Kafouros, AIM Scholar, University of Leeds

Andy Neely, Deputy Director, AIM Research

AIM consists of:

- Over 300 AIM Fellows and Scholars – all leading academics in their fields...
- Working in cooperation with leading international academics and specialists as well as UK policymakers and business leaders...
- Undertaking a wide range of collaborative research projects on management...
- Disseminating ideas and shared learning through publications, reports, workshops and events...
- Fostering new ways of working more effectively with managers and policymakers...
- To enhance UK competitiveness and productivity.

AIM's Objectives

Our mission is to significantly increase the contribution of and future capacity for world class UK management research.

Our more specific objectives are to:

- Conduct research that will identify actions to enhance the UK's international competitiveness
- Raise the quality and international standing of UK research on management
- Expand the size and capacity of the active UK research base on management
- Engage with practitioners and other users of research within and beyond the UK as co-producers of knowledge about management

contents	AIM – the UK's research initiative on management	2
	About AIM	3
	AIM research themes	4
	Executive summary	5
	Introduction	9
	The Ten Myths of Manufacturing	11
	Conclusion	28
	References	29

AIM research themes

Current AIM research projects focus on:

UK productivity and performance for the 21st century.

How can UK policymakers evaluate and address concerns surrounding the UK's performance in relation to other countries?

National productivity has been the concern of economists, government policymakers, and corporate decision-makers for some time. Further research by scholars from a range of disciplines is bringing new voices to the debates about how the productivity gap can be measured, and what the UK can do to improve the effectiveness of UK industry and its supporting public services.

Sustaining innovation to achieve competitive advantage and high quality public services.

How can UK managers capture the benefits of innovation while meeting other demands of a competitive and social environment?

Innovation is a key source of competitive advantage and public value through new strategies, products, services and organisational processes. The UK has outstanding exemplars of innovative private and public sector organisations and is investing significantly in its science and skills base to underpin future innovative capacity.

Adapting promising practices to enhance performance across varied organisational contexts.

How can UK managers disseminate their experience whilst learning from others?

Improved management practices are identified as important for enhancing productivity and performance. The main focus is on how evidence behind good or promising practices can be systematically assessed, creatively adapted, successfully implemented and knowledge diffused to other organisations that will benefit.

The recent recession, the deepest downturn since the Great Depression, along with other events, such as the takeover of UK firm Cadbury, by Kraft, the US food giant, has cast the spotlight on the UK manufacturing industry.

The impact of the recession on the manufacturing sector has been profound. In the last quarter of 2008 and the first quarter of 2009, for example, commentators described the situation as desperate. With recent economic data suggesting that China's manufacturing output is already growing again, while India's manufacturing sector appears to have weathered the recession remarkably well, as the balance of economic power shifts to the East, what is the future for the once great UK manufacturing industry?

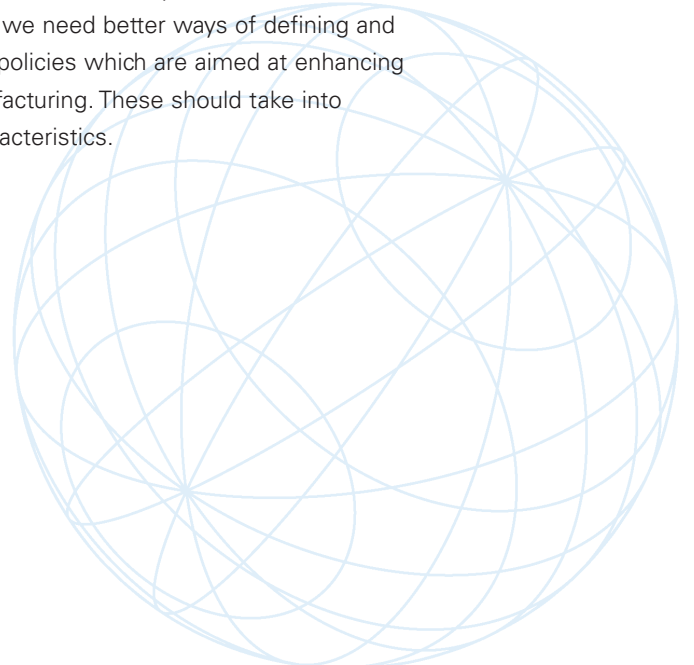
The impact of the recession on the manufacturing sector has been profound.

In late 2009, the Advanced Institute of Management Research (AIM) and the Confederation of British Industry (CBI) convened a forum to explore the future of UK manufacturing. Four questions were discussed: How are UK manufacturing firms currently faring, given the global economic downturn? What strategies are UK manufacturing firms adopting to ensure that they are well placed to cope with the economic upturn? What role will services play in the future of UK high value manufacturing? What role can Government and the University sector play in supporting UK manufacturing, now and in the upturn?

From the responses of the senior representatives attending from business, academia and the policy community, it became clear that there is considerable misunderstanding about modern manufacturing in general and manufacturing in the UK in particular. We have crystallised this misunderstanding into ten 'myths of manufacturing.'

Myth 1: There is a single homogenous manufacturing sector – Not true

Manufacturing is a highly heterogeneous sector, covering a variety of industries from textiles to metals, wood manufacturing to aerospace, and pharmaceuticals to electronics. It can be differentiated in many ways: high and low volume production or product diversification, long and short life-cycle products, or mass-market versus niche products. It differs across industries, firms in the same industry, even across business units and divisions in the same firm. Therefore, we need better ways of defining and thinking about manufacturing and Government policies which are aimed at enhancing the performance and competitiveness of manufacturing. These should take into account industry, firm and product-specific characteristics.



Achieving a manufactured output involves R&D, design, marketing, distribution, service and support.

Myth 2: The UK does not need manufacturing – Not true

Manufacturing adds £150 billion per annum to the economy, generates half of all UK exports, directly employs three million people, and accounts for three-quarters of business R&D. From 1997 to 2007, labour productivity in manufacturing increased by 50%. We need manufacturing for national security, for sustainability reasons, for the development of new technologies. We need to stop talking up the idea that we can survive as a service economy alone, and start investigating how manufacturing and services can coexist, or even integrate with one another.

Myth 3: Manufacturing is production – Not true

Forget the Dickensian image of workhouses and cotton mills, smoking chimneys, and dirty factories, or the 1970s picture of striking car plant workers. In today's business landscape, manufacturers are inventors, innovators, supply chain managers and service providers, as well as producers. Achieving a manufactured output involves R&D, design, marketing, distribution, service and support. Definitions of manufacturing should cover the various activities that need to be coordinated and performed in order to deliver a physical product, as well as encompassing its increasingly global, inter-connected, multi-partner and multi-business elements.

Myth 4: Value only lies in products – Not true

Complementary services required to support the physical product throughout its lifecycle, from systems configuration and purchasing to operations, maintenance, replacement and disposal, are increasingly important. Industry trends suggest that the manufacturing industry as a whole must place substantial economic value in complementary non-production functions, services in particular. Firms should consider innovation approaches that might provide a more sustainable advantage, focusing investment on exploiting technologies and developing new business models in areas that might best address the provision of services related to their products.

Myth 5: Only developed economies, such as the UK, can and will pursue high-value manufacturing – Not true

Emerging countries are moving up the value chain. For example, China is concentrating efforts on the development of high technology industries including aerospace, electronics, communication equipment, and consumer products. Indian and Chinese firms have begun acquiring strategically important firms from developed countries. China is one of the most R&D intensive countries in the world. Firms in the UK must respond by constantly adapting their business models, product offerings, processes and service systems in order to stay competitive by delivering higher value manufacturing.



Myth 6: To capture value, we must retain all our R&D in the UK – Not true

R&D internationalisation comes with a set of potential benefits. These investments provide access to new markets, encourage knowledge spill-overs, and help decrease R&D associated costs. The UK must build international R&D networks to improve knowledge identification and accumulation, increase the flow of intellectual capital into the UK, and help UK firms adapt their product offerings to the needs and demands of foreign customers. Technology and innovation policies should encourage and enable UK companies to access and benefit from the technologies and ideas of other countries. The UK's innovation strategy must be set within a global context, investing in innovation and R&D, both in the UK and overseas.

Myth 7: Manufacturing capabilities can be acquired and developed quickly – Not true

Whilst it is true to say that some elements, such as specific technical assets and skilled workers, may be acquired through an open market, there's an incorrect view that the ability to develop sustainable value-creating manufacturing strategies is purely related to the availability of such resources.



Effective delivery of valuable products and services invariably involves the existence of difficult-to-trade and difficult-to-replicate knowledge assets and requires resources which are simultaneously valuable, rare, inimitable and not substitutable. Therefore, manufacturers must avoid focusing solely on short-term performance goals, and reliance on easily acquired market capabilities. Instead, they should invest in unique hard to replicate assets, metrics, operations and practices which have the greatest potential to generate profitable growth when the economy recovers.

Myth 8: Manufacturing is low skilled – Not true

Modern manufacturing environments are often vibrant fast moving places, involving the application of scientific principles, new technologies and the latest management thinking. They are best thought of as complicated systems involving highly trained people, advanced machines and complex materials working together efficiently and effectively. It requires a highly educated, skilful and increasingly mobile workforce, which UK industry, Government and educational institutions need to work together to provide. This is necessary to prepare for the global economic upturn.

Myth 9: We know what skills we need for the future – Not true

The reality is that the manufacturing skills base is currently in flux. The danger is that universities and other institutions grow out of touch with the needs of the employers. On-going training is increasingly vital. Training policies need to include all types of employers and employees, and training requirements must be communicated to educational institutions, professional training institutions and Government departments.

Myth 10: Government's primary roles are to procure wisely and bail out failing companies – Not true

The UK Government may engage in sensible procurement and bailing out failing companies. However, there is also a strong need for proactive steps to be taken by the Government to help the UK maintain R&D, engineering, and manufacturing capabilities, sustain innovation, recognise the nuanced view of manufacturing, take account of the specific needs of manufacturing industries, and facilitate the emergence of new industries.

The Government must constantly monitor the economic conditions for manufacturing in the UK, making proactive interventions wherever and whenever necessary; which includes prioritising spending on R&D investment, training and education.

In short, we must not take the perpetuation of these ten myths lightly. It is essential for the future of UK manufacturing and the UK economy that these myths are dispelled, and the implications of such widespread misconception addressed.

It is well over a year since Lehman Brothers bank collapsed and the global economy plunged into the deepest recession since the Great Depression. The impact of the financial crisis has been profound not least in the manufacturing sector. In the last quarter of 2008 and the first quarter of 2009, commentators described the situation as desperate. With customers using up inventories, rather than buying new goods, demand plummeted by over 40% in some sectors of the economy. Only in the final quarter of 2009 were there early signs of recovery, with some countries coming out of recession, accompanied by warnings about the possibility of a double dip recession.

Only in the final quarter of 2009 were there early signs of recovery, with some countries coming out of recession...

The question remains: how has UK manufacturing fared during this period and what is the future for manufacturing in the UK? The most recent economic data suggests that China's manufacturing output is already growing again, while India has weathered the recession remarkably well. Yet in the UK, experts have only just called an end to the recession, arguing that the country's economy will remain very fragile throughout 2010, even into 2011.

It is clear that the balance of economic power is shifting to the East. By 2050, Goldman Sachs predicts, the world's three largest economies will be China, the USA, and India, followed by Japan, Brazil and Russia. The UK will be in 7th place.

What does this shift in economic power and activity mean for manufacturing in the UK? Will this help or hinder the UK's recovery? We already know that UK manufacturers cannot compete on the basis of cost alone, but instead have to innovate to deliver higher value products and services. How sustainable is this strategy? Will other countries – most notably China and India – be willing to settle for low value work?

In late 2009, the Advanced Institute of Management Research (AIM) and the Confederation of British Industry (CBI) convened a forum to explore the future of UK manufacturing. Attended by senior representatives from business, academia and the policy community, participants in the forum discussed four questions:

- How are UK manufacturing firms currently faring, given the global economic downturn?
- What strategies are UK manufacturing firms adopting to ensure that they are well placed to cope with the economic upturn?
- What role will services play in the future of UK high value manufacturing?
- What role can Government and the University sector play in supporting UK manufacturing, now and in the upturn?

AIM Scholars working with participants at the forum captured the discussions that these questions provoked. A common theme that emerged was that many people do not understand modern manufacturing. Indeed there are a number of popular misconceptions – the ten ‘myths of manufacturing’ – which need to be addressed.

The rest of this report expands on these myths, highlighting their implications for the business, academic and policy communities.

The ten myths of manufacturing are:

Myth 1 – There is a single homogenous manufacturing sector

Myth 2 – The UK does not need manufacturing

Myth 3 – Manufacturing is production

Myth 4 – Value only lies in products

Myth 5 – Only developed economies, such as the UK, can and will pursue high-value manufacturing

Myth 6 – To capture value, we must retain all our R&D in the UK

Myth 7 – Manufacturing capabilities can be acquired and developed quickly



Myth 8 – Manufacturing is low skilled

Myth 9 – We know what skills we need for the future

Myth 10 – Government’s primary roles are to procure wisely and bail out failing companies

the ten myths of manufacturing

Myth 1: There is a single homogenous manufacturing sector

It is often assumed that there is a single homogeneous manufacturing sector. In fact, manufacturing covers a wide variety of industries ranging from textiles to metals, wood manufacturing to aerospace, and pharmaceuticals to electronics; and the UK has a manufacturing strategy that pays scant regard to the inherent heterogeneity of manufacturing.

There are many different ways of thinking about manufacturing firms and their products. For example, manufacturing can be differentiated with regards to high and low-volume production, high and low product diversification, long and short life-cycle products, mass-market versus niche products, and industrial, capital and consumer market segmentation. Manufacturing industries also vary considerably in their sources and supply of technological and innovation opportunities; while the introduction of new discoveries is rapid and frequent in some industries (e.g. pharmaceuticals and electronics), others (e.g. wood manufacturing) display limited potential for innovation.

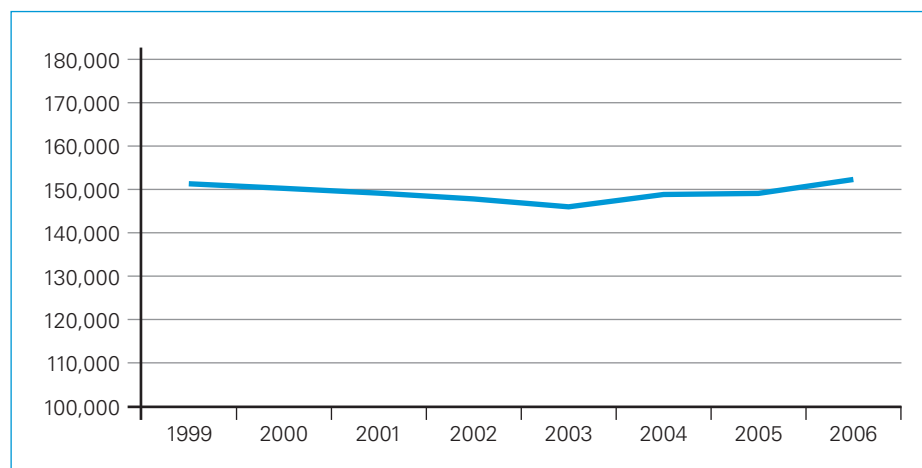
Although such variations are often masked by aggregate statistics for the manufacturing sector as a whole, industry-specific data reveal important differences.

The level of economic activity for manufacturing as a whole has remained relatively stable in the last decade up until the recession (see Figure 1). Output has increased for the food and chemical industries (see Figure 2). By contrast, as Figure 3 indicates, the level of output in such sectors as textiles and leather has decreased significantly over time.

Intriguingly, the impact of the recent economic downturn has been extremely varied as well. The CBI's Industrial Trend Survey results show that, while the chemicals and food and drink sectors experienced only one quarter of very negative results, most of the other sectors have been more badly affected by the recession and have gone through at least two or three quarters of deep losses.

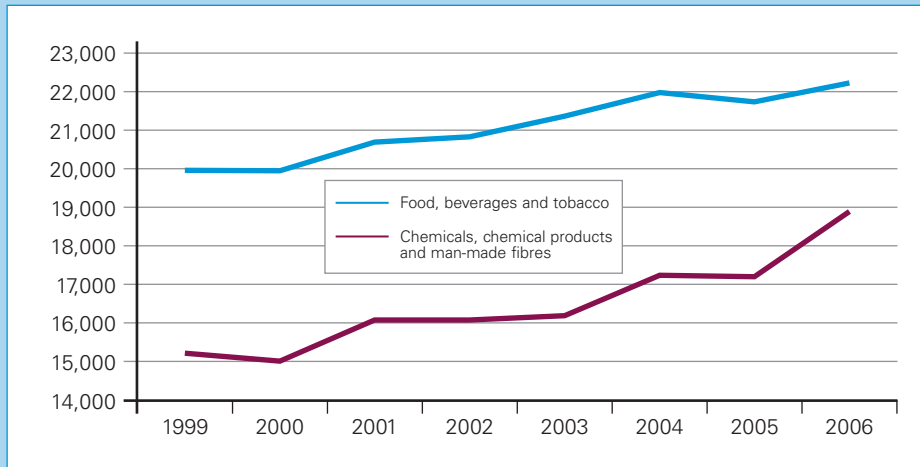
The level of economic activity for manufacturing as a whole has remained relatively stable in the last decade up until the recession.

Figure 1 – Gross value added; total manufacturing (£ million; current basic prices)



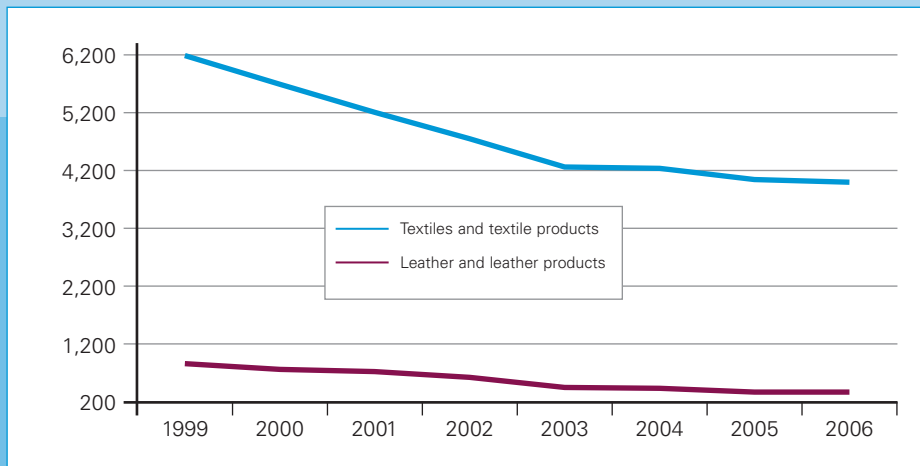
Source: The data have been obtained from the office for national statistics (ONS)

Figure 2 – Gross value added; food and chemicals (£ million; current basic prices)



Source: The data have been obtained from the office for national statistics (ONS)

Figure 3 – Gross value added; textiles and leather (£ million; current basic prices)



Source: The data have been obtained from the office for national statistics (ONS)

Variations in economic and innovation performance can be observed not only across different industries, but also across firms in the same industry (i.e. intra-industry differences) and even across business units and divisions in the same firm (i.e. intra-firm differences). Similar differences exist between larger and smaller manufacturing businesses. For instance, recent empirical findings for the UK indicate that while larger manufacturing firms profit considerably from their own innovative efforts and R&D investments, smaller firms are better able to benefit from external ideas and technologies.

The fact is that manufacturing is a highly heterogeneous sector. Consequently, we need a better way of defining and thinking about manufacturing – particularly when considering interventions designed to help the sector. Manufacturing should be thought of in more disaggregated ways that better reflect what is actually going on.

Accordingly, the development of Government policies aimed at enhancing the performance and competitiveness of manufacturing should take into account industry, firm and product-specific characteristics. Our understanding of how these factors influence the impact of policies is limited, and research institutions should assist by shedding some light on these issues.

There is a common myth that the UK does not need to make products.

Myth 2: The UK does not need manufacturing

There is a common myth that the UK does not need to make products. Instead, the UK can become a pure service economy, buying manufactured products from other countries, such as China and India, which will produce them for us more cheaply. This myth is based on a misunderstanding of the importance of manufacturing to the UK economy. It assumes that the sector is in decline and will eventually disappear, whereas official statistics suggest that this is not the case.

In fact:

- Manufacturing adds £150 billion per annum to the economy
- In 2007, before the recession, manufacturing output reached an all-time high
- From 1997 to 2007, labour productivity in manufacturing increased by 50%
- The manufacturing sector generates half of all UK exports
- Although the numbers have decreased, manufacturing still directly employs three million people and increases employment indirectly by creating related jobs in other sectors (e.g. trade, distribution and services)
- Manufacturing accounts for three-quarters of business R&D which, in turn, contributes to society's stock of scientific knowledge
- The UK is the sixth-largest manufacturer in the world with a strong position in key industries (e.g. aerospace)

The risk is that, by giving credence to the idea that we can survive on the service sector alone, we might allow manufacturing to decline to the point where its direct contributions to the UK economy, as well as the country's capability to develop new technologies, are lost. An absence of manufacturing might easily lead to: a hollowing out of the UK economy, decreasing the nation's absorptive capacity; further reliance on other countries; and eventually, a spiral of decline.

There are also more prosaic reasons why the UK needs manufacturing. For example, national security requires a defence industry. Protecting the security and well-being of UK citizens through a military deterrent requires that the UK retains national control of its defence systems and equipment. A domestic manufacturing capability, therefore, is integral to the UK's ability to maintain its national security directly and indirectly, and reduce the dependence on the manufacturing expertise of other nations.



Other sectors, such as foods, deal with highly perishable goods. Hence local production can be a necessity. Buying increasing amounts of manufacturing goods from abroad also means more questions about the environmental impacts of shipping products around the globe. In a world challenged by global warming, local production of goods might become more economical, as well as socially desirable.

Those who promote the myth that we don't need manufacturing, often fail to recognise the fact that many services are dependent on manufacturing. For instance, manufacturers are major clients of many professional service firms, such as consultants, accountants, lawyers and educators. A quick look at the FTSE 100 reveals a significant proportion of trading takes place in firms involved directly or indirectly in manufacturing.

In a world challenged by global warming, local production of goods might become more economical, as well as socially desirable.

The fact is, we cannot simply survive on a service economy alone. The UK needs a balanced economy, receiving appropriate contributions from, and providing support to, both manufacturing and services. Examining how manufacturing and services can sit side by side, and indeed increasingly integrate with one another, is a priority area for future practice, policy and research.



Myth 3: Manufacturing is production

Historically, the discussion and measurement of manufacturing has been carried out in the context of factory-floor operations. The concept of manufacturing has often been interchanged with production; indeed manufacturing is usually defined as the act of transforming raw materials into finished goods. Therefore, many people assume that manufacturing is effectively the same as production and they see the major activities of manufacturing as the tasks of production (e.g. the cutting, grinding, fabrication, and assembly of materials). In doing so, they ignore all the activities and decisions that occur upstream and downstream in manufacturing.

One of the reasons manufacturing is so strongly identified with production is down to the way manufacturing has been presented in the media, from the traditional view of Dickensian like workhouses and cotton mills, to the 1970s image of car plant workers going out on strike.

We have encouraged and reinforced a perception of manufacturing as unchallenging, repetitive, mundane and unprofessional. For example, a recent engineering survey conducted by the Engineering and Technology Board (ETB) in September 2009 found that only 12% of 11-16 year olds currently claim to have some knowledge of what engineers do, and a worrying 49% of 7-11 years olds think it would be boring to be an engineer. Manufacturing has an image problem which is causing major difficulties for companies who wish to attract and retain talented people.

Yet there are many reasons to believe that manufacturing does not equate solely to production. For a start, in today's business landscape, manufacturers need to be inventors, innovators, supply chain managers and service providers – in addition to producers. Even if production is the defining activity of a manufacturing company, achieving a manufactured output inevitably requires a much broader set of activities involving R&D, design, marketing, distribution, service and support. Secondly, looking beyond the firm and national boundaries, globalisation is profoundly affecting the way value is created and captured along the manufacturers' supply chain.

...in today's
business
landscape,
manufacturers
need to be
inventors,
innovators,
supply chain
managers
and service
providers...

If manufacturing equated solely to production, then only production would be gravitating towards countries of lowest overall cost. However, it is not just production moving beyond UK national boundaries. Globalisation means that the associated financial capital, goods, information, know-how and people, as well as production, are relocating in manufacturing networks spread across the globe.

To capture these new directions a wider definition of manufacturing is required. This definition has to cover the various activities that need to be coordinated and performed in order to deliver a physical product and place manufacturing activities in a wider societal context. In addition, the revised definition should consider its increasingly global, inter-connected, multi-partner and multi-business elements. As Figure 4 indicates, these involve, according to the publication *Defining High Value Manufacturing*, by the Institute for Manufacturing at Cambridge University, the full cycle of activities from research and development, through design, production, logistics and services within an economic and social context.

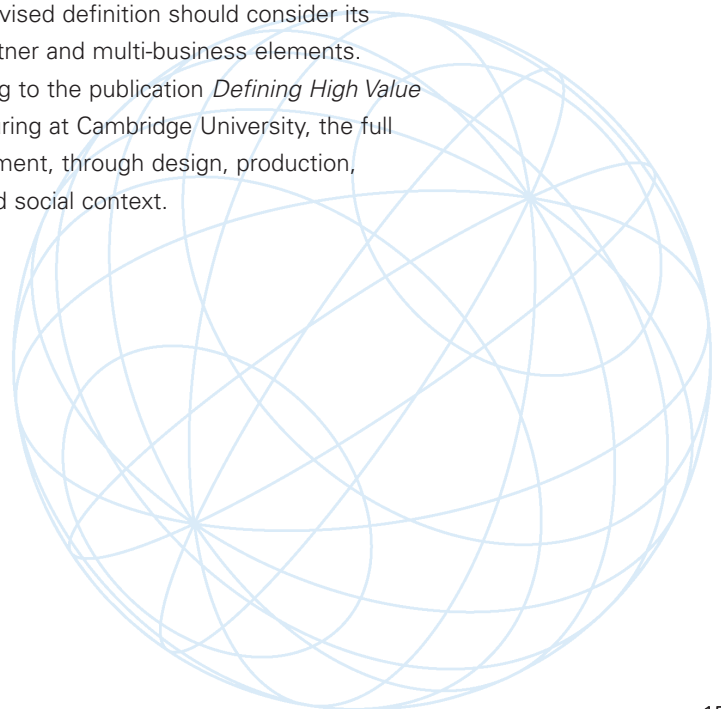
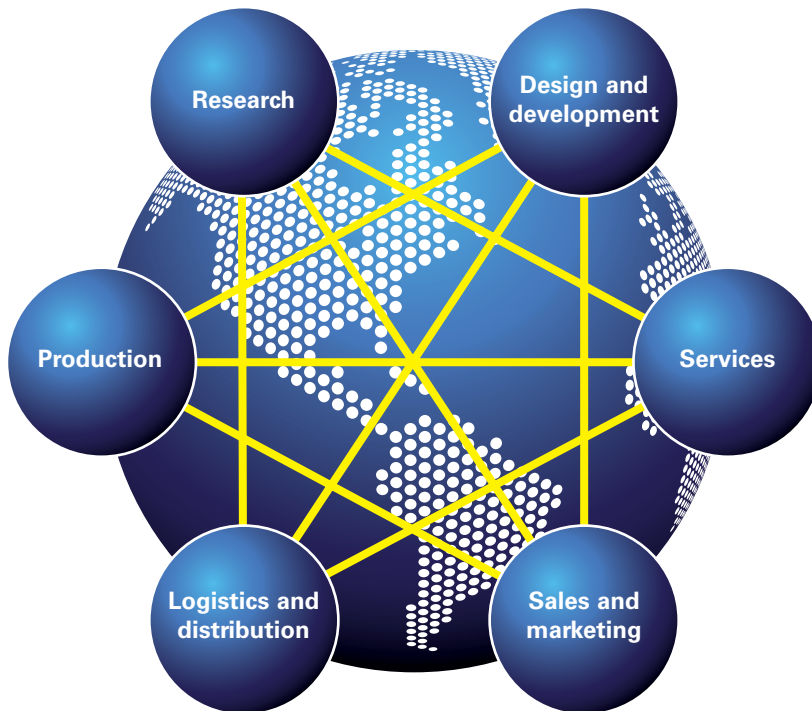


Figure 4 – Definition of modern manufacturing



There's a myth that the value of manufacturing resides solely in the product and production outputs of a manufacturer.

Source: IfM (2006)

Myth 4: Value only lies in products

There's a myth that the value of manufacturing resides solely in the product and production outputs of a manufacturer. Following this to its logical conclusion would mean all manufacturers orientating their competitive strategies towards generating higher performance products and production processes being delivered at lower overall costs.

By perpetually attempting to be the first on the market, and having the best-in-class product, producers may easily be led to over-design their products and production systems, ending up with something that the end-customer neither wants nor values. Additionally, the greater the technological content of the products, the more patenting and intellectual protection becomes necessary to lock out competitors, and this often means diverting significant financial and managerial attention away from the core business.

In short, the risk of an overly product-centric manufacturing strategy is that manufacturers may lose focus of what their customers actually value, and become distracted by engaging themselves in benchmarking races against one another, suffer excessive complexity in their operations and experience repeatedly shrinking margins.

This myth prompts an obvious question: are manufacturing companies actually forced to focus their strategic thinking exclusively on products, or could a wider focus be more beneficial? Indeed, there appears to be sufficient evidence that the entire range of manufacturing activities, rather than those just directly relating to production, can contribute to value creation and hence become a source of positive differentiation from competitors.

In some contexts, such as those related to the production of highly complex and capital intensive technical assets (e.g. military facilities, airplanes, production machines), customer value is moving away from the products and the production function towards the overall range of complementary services required to support the physical product throughout the lifecycle, from systems configuration and purchase to operation, maintenance, replacement and disposal. This is becoming increasingly true for domestic consumer markets, where commoditisation of products and technologies is diffusing through industries and value added is more and more likely to come from the ability of companies to address the overall set of customer needs around the purchased product.

Understanding the value of service elements

Manufacturing firms that understand the value of having an associated service element with their product have been able to achieve very attractive revenues, although questions have been raised about why these revenues have not always been accompanied by increased profits.

Xerox, for example, has strategically restructured itself as a document solution company, offering technologically updated printers and printing systems, and management of documents for the client, together with consulting and outsourcing services. With a sales turnover of £5 billion per year services currently represent almost 40% of the company total sales turnover and are expected to contribute to over 50% of corporate revenues in the next 2-3 years.

In the jet aircraft arena, General Electric (GE) has been able to sustain strong growth and profitability in the face of cutthroat competition by becoming a provider of complete power solutions. It has complemented its jet selling business with a portfolio of activities that buyers need in order to get engine power for their vehicles. These include financing for the purchase, as well as the operational and maintenance services to guarantee availability and performance.

Similarly, Apple's iPod/iTunes business is combining the sales of a very attractive physical product with digital services that allow customers to purchase their own choice of music online. Since 2002, Apple has sold over 206 million iPods and, perhaps even more impressively, has seen over one billion songs downloaded from its iTunes Music store, and the number of application downloads beginning to follow a similar successful trend. Clearly customers value this product-service system, and it also allows Apple to capture significant value.

Industry trends suggest that manufacturing industry as whole will have to place substantial economic value in complementary non-production functions, services in particular. Even without the competition from low-cost economies, opportunities for new product sales may decrease. There are two main reasons for this. Firstly, legislation such as the end of life directive for the disposal of electronic products, means that the life-spans of products are extending in many industries.

Environmental regulations and sustainability concerns are leading to an increase in re-manufacturing and re-use practices, plus strategies for increasing the intensity of use during the product lifecycle. Secondly, the recession means customers are cutting back on purchases, and extending the useful life of products by upgrading rather than replacing them.

Overall, it looks like the myth of equating manufacturing to production has led to people thinking too narrowly about value creation and value systems.

Overall, it looks like the myth of equating manufacturing to production has led to people thinking too narrowly about value creation and value systems. Given the recession and the history of manufacturing during the last century, manufacturers are well aware of the need for innovation in order to compete. However, they should consider innovation approaches that might provide a more sustainable advantage by reflecting changes in customer needs and desires.



Manufacturers should focus investment on exploiting technologies and developing new business models in areas that might best address the provision of services related to their products, as it seems this is where future revenues in manufacturing will lie.

Myth 5: Only developed economies, such as the UK, can and will pursue high-value manufacturing

There is a myth that companies from developed nations, such as the UK, can successfully undertake high value manufacturing, whilst companies from emerging economies, such as China and India, do not possess either the capabilities or desire to do so. In other words, it is implicitly assumed that emerging countries will remain the world's production workshop, and that firms from less developed economies will not succeed in moving up the value chain.

Recent empirical evidence challenges this perception, though. Emerging countries do not intend to stick with low value adding manufacturing; they are moving up the value chain. For example, China is concentrating its efforts on the development of high technology industries including aerospace, electronics, communication equipment, and consumer products. Similarly, India and Brazil are rapidly expanding their automotive industries. Furthermore, Indian and Chinese firms have started to expand their operations abroad and begun acquiring strategically important firms from developed countries. For example, India's Tata Motors acquired Jaguar Land Rover and Lenovo – a Chinese firm – bought the PC division of IBM.

A rapidly growing share of the world's total R&D is now undertaken in emerging economies. Although China, for instance, was initially a low-cost source of unskilled labour, it is now a host for the research and development laboratories of high-tech multinational enterprises. Approximately \$86 billion was spent on R&D in 2006, making China one of the most R&D intensive countries in the world. The presence of such R&D capabilities is enabling emerging countries to enhance the innovation performance of their industries and acquire foreign frontier technology.

The large number of engineering graduates produced by these emerging economies also significantly assists in further strengthening the development of their innovation capabilities. Empirical findings support this view, indicating that many manufacturing industries in emerging economies shift over time from an imitation strategy to practices that place more emphasis on their own R&D and technological capacity. Furthermore, the weak intellectual property laws in emerging countries lead to spill-over effects that often originate from the knowledge that foreign investors bring with them. These spill-over effects, in turn, enable local firms to update their production techniques, improve their organisational processes, and allocate their resources more efficiently.

As a result the myth that developing economies will stick to low value manufacturing raises some important corollary questions:

- How are developing economies achieving R&D capabilities so quickly, and what can UK firms do to protect their technological discoveries from imitators?
- What will the UK (and other developed economies) do once developing economies have built their capability for high value manufacturing?
- What role should the UK Government play?



Firms in the UK need to constantly adapt their business models, product offerings, processes and service systems in order to stay competitive...

In summary, it is important to recognise that high value manufacturing is not a destination, but a race between nations and firms towards greater relative control and profitability. UK national policies should work in favour of UK going-concerns. Firms in the UK need to constantly adapt their business models, product offerings, processes and service systems in order to stay competitive by delivering higher value manufacturing. One thing is for sure; emerging countries do not intend to stick with low value manufacturing for any longer than is absolutely necessary.

Myth 6: To capture value, we must retain all our R&D in the UK

As R&D plays a critical role in the battle for technological leadership, control and superior performance, it is a common belief that the higher value elements of manufacturing, which focuses on the innovative R&D activities, should all be kept in the UK. Clearly this is a naïve view of the world. Even if the UK built a fortress around its R&D activities, some knowledge would still leak out with the flow of people and products, while other countries would invest in developing economies, helping them build their capabilities.

Recent research, supported by AIM, suggests that locating R&D facilities overseas is beneficial to the R&D exporting country. These investments provide access to new markets. There are also knowledge spill-overs where co-location enables the R&D facility to access knowledge in the host country.

Clearly knowledge spills-over imperfectly across national borders as it is often integrated in local contextual settings. Take, for example, the difficulties that many European firms had in adopting Japanese manufacturing methods. The fact that knowledge diffusion and the production of ideas are geographically contextualised will limit the ability of firms to access and benefit from knowledge residing in foreign countries.

The UK must build international R&D networks in different countries around the globe to improve the process of knowledge identification and accumulation, and therefore increase the flow of intellectual capital into the UK. This should, in turn, facilitate continuous learning and assist UK firms to develop new skills and capabilities, and achieve resource positions that can support sustainable growth in global markets.

An international R&D network may also help UK firms to decrease the costs associated with R&D and adapt product offerings to foreign customers' needs and demands. This practice could also help alleviate the UK's perpetual problem of seemingly never being able to cash in on its innovations. These benefits, along with the key challenges of internationalisation, are summarised in Figure 5.

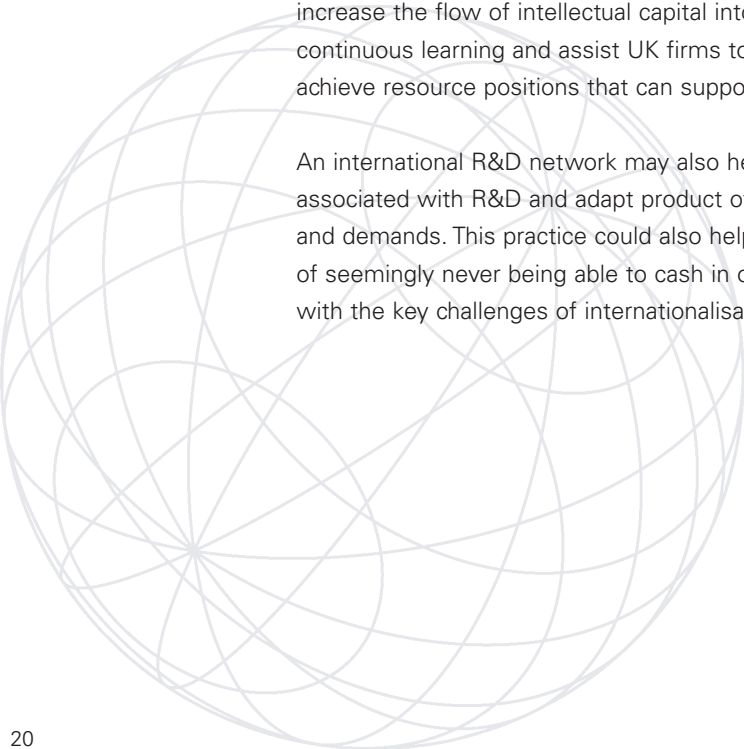
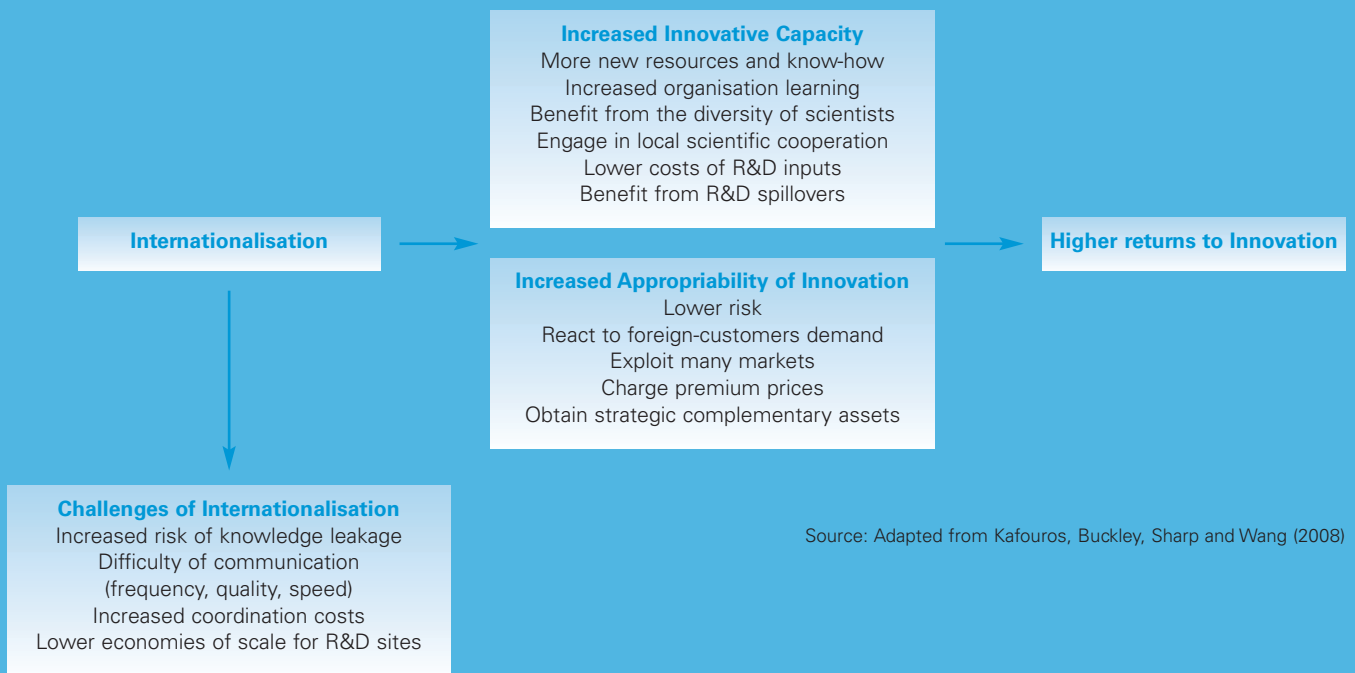


Figure 5: The implications of internationalising R&D



In an era where countries are increasing their participation in foreign markets on a daily basis, it is not realistic for UK firms to keep all their innovative activities in the UK. Some researchers suggest that in the modern world the internationalisation of knowledge is the most crucial source of value creation, and that success hinges on the ability to participate in a growing array of knowledge flows in order to replenish a firm's repository of knowledge.

Therefore, manufacturing firms should be mindful of the importance of coordinating their innovation strategy with their internationalisation strategy. One particularly important point is protecting technology from imitators, especially in countries with weak intellectual property protection regimes. In such cases, UK firms can ensure that any potential value contribution by technologies developed in emerging countries, only becomes apparent when combined with complementary resources and technologies held at their corporate headquarters.

Similarly, technology and innovation policies should encourage and enable UK companies to access and benefit from the technologies and ideas that other countries develop.

In other words, it is imperative to set the UK's innovation strategy within a global context. We cannot opt out of the race for technological leadership and we must not forget this. We need to continue to invest in innovation and R&D, both in the UK and overseas. This is particularly important to remember in the light of the recent economic recession that has forced many firms to emphasise cost reduction, rather than the development of their technological competencies.

Myth 7: Manufacturing capabilities can be acquired and developed quickly

There is a myth that manufacturing capabilities (including facilities, people, skills and operational systems) are easy to build. It's a myth that also assumes production resources can be closed and re-opened without any major consequences; because if needed, they can be easily re-assembled by simply purchasing the right technical assets and employee skills. In addition, general managers and CEOs have come to believe that the ability of their firms to compete mainly resides in their R&D laboratories, and have, therefore, tended to disregard production resources as a long-term source of economic value, competition and business profitability.

The Resourced Based View (RBV) of the firm, which assumes the root of competitive advantage within firms lies in their resource endowment, provides a counter argument to this myth. In particular, RBV holds that the ability to develop sustainable value-creating strategies is related to the availability of resources that are simultaneously valuable, rare, inimitable, and non-substitutable (i.e. the so-called VRIN resources).

Although some elements, such as specific technical assets and skilled workers, can be acquired in the open market, it is not possible to build VRIN manufacturing resources quickly. Effective delivery of valuable products and services invariably involves the existence of difficult-to-trade and difficult-to-replicate knowledge assets; namely the institutional architectures, governance structures and tacit operational practices necessary to take advantage of firm-specific physical resources. Manufacturing capabilities take time to build. They need to be understood and embedded within an organisation, and this is a combination of human, technical, cultural and financial considerations.

Manufacturers should be more conscientious about their capability decisions and avoid focusing only on short-term performance goals. They also need to consider carefully which assets, metrics, operations and practices have the greatest potential to generate profitable growth when the economy recovers.

Lean management is not enough. Experienced operations managers know that if capacity utilisation is to be optimised, even introducing variations in product mix and volumes in the short-term is hard to achieve, let alone the rebuilding of whole facilities and competences.

It is a lesson learnt by many of the firms that experienced the last UK recession, at the end of the 1980s (the extreme examples being the coal and steel industries). This time round firms have been more cautious about plant closures, taking steps to ensure that they remain at least partially operational at all times, if at all possible. Both management and workers have had to adopt a flexible approach to ensure firms remain open, ensuring jobs aren't lost and valuable skills remain in the UK. For instance, many workers have taken long term periods of unpaid leave, or taken pay cuts or reduced their hours.

Therefore it is important for companies not to get rid of their manufacturing capabilities in a knee jerk reaction to economic change. But how then should a firm retain capabilities when demand is low and ruthless cost-cutting imperatives are afoot?

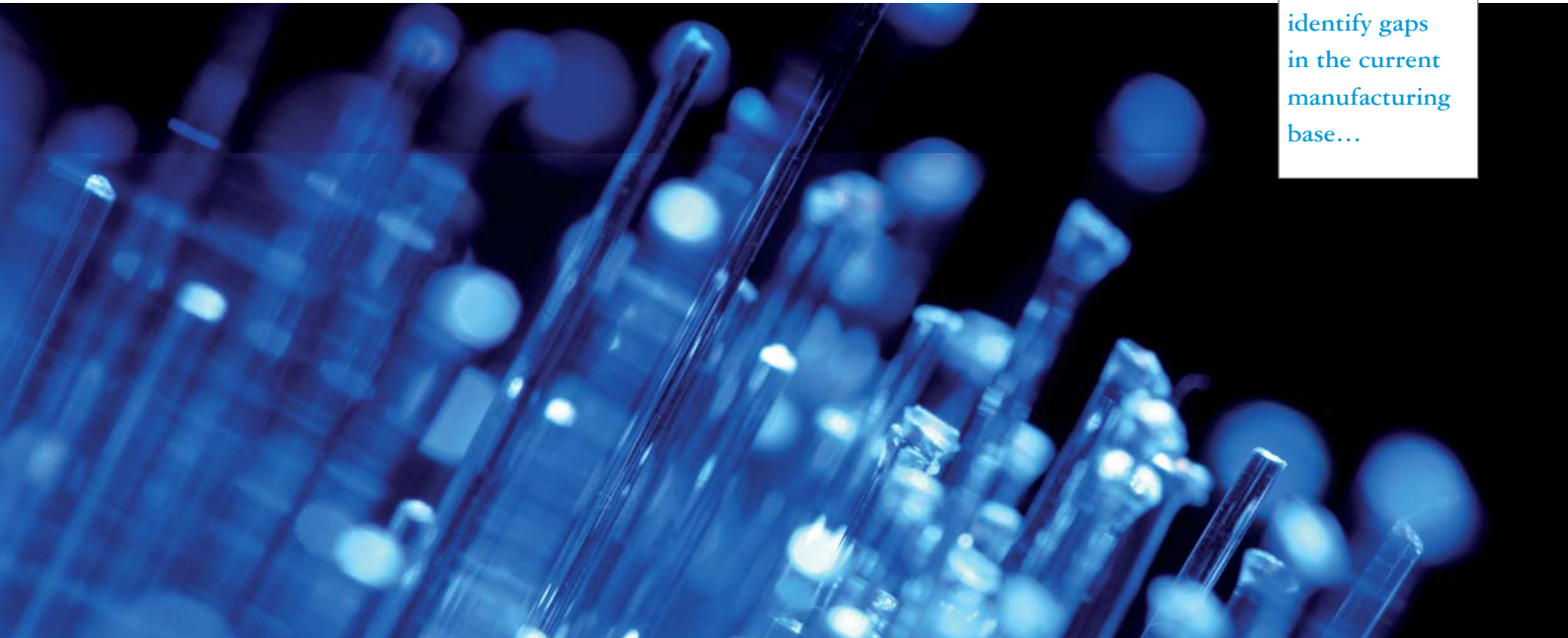
One recommendation is for companies to review their supplier contracts, inventory holding practices, pricing policies and hedging strategies enabling them to better manage demand and price instability. The key is to maintain flexibility and be able to scale the output of production plants up and down. Business, academia and Government should work together to identify gaps in the current manufacturing base and develop a sector specific roadmap reflecting what is expected in the coming years.

Myth 8: Manufacturing is low skilled

There is a common perception that manufacturing is an unskilled, dirty, unprofessional and mundane job. This outdated view of UK manufacturing dates back to a time of labour intensive traditional heavy industry. It's a myth, of course.

Unfortunately, media coverage has tended to reinforce this negative stereotype by focusing on factory closures, disputes and job losses, rather than heralding the successes of manufacturing, such as the creation of new opportunities and technological innovations, which would portray a much fairer and positive image of manufacturing.

Business, academia and Government should work together to identify gaps in the current manufacturing base...



Today, the unsafe factories with poor working conditions are a thing of the past. Even when intensive manual processes are involved, the implementation of various legislation means that manufacturing workplaces are far safer than before. Modern manufacturing environments are often vibrant fast moving places that warrant careful control through the application of scientific principles, new technologies and the latest management thinking. They are best thought of as complex systems that involve highly trained people, advanced machines and complex materials working together efficiently and effectively; something that is challenging and not always easily achievable.

Whilst it is true to say that the UK has seen a decline in manufacturing employment in recent years, from approximately 11% in 2005 to approximately 9% in 2009, (see Figure 6), at the same time the UK has also seen a rise in productivity, as the output per hour worked has actually increased.

The proportion of highly skilled jobs in manufacturing is larger and rising faster than it has been in recent years.

Productivity in manufacturing has risen faster than the economy as a whole (see Figures 6 and 7). The most likely explanation is that the job losses experienced were in the unskilled areas. Staff were replaced with more efficient automation, information technologies and new working methods; many of which required up-skilling as manufacturing tasks become more complex.

Such progress is inevitable in a competitive environment. Rather than try to prevent these advances, they should be embraced, by ensuring an adequate supply of highly and relevantly skilled people to fill new opportunities. In the UK the result is a highly educated and skilled workforce. The proportion of highly skilled jobs in manufacturing is larger and rising faster than it has been in recent years. It is now typical for manufacturing employees in positions of responsibility to be educated to degree level, with additional specialised training and appropriate professional qualifications.

Figure 6: Manufacturing Share of Total UK Employment

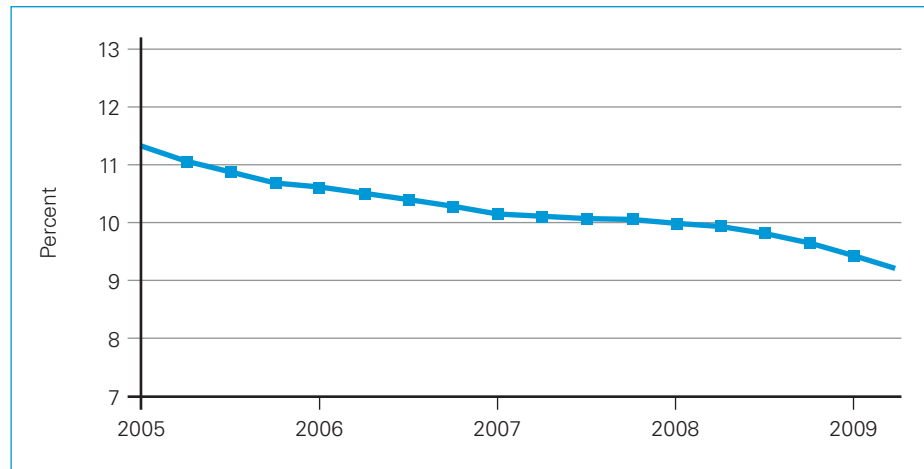
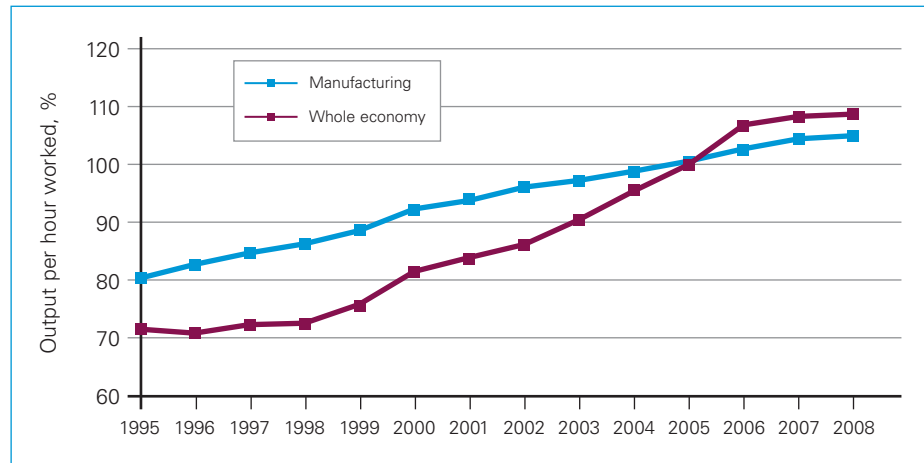


Figure 7: UK Labour Productivity (indexed 2005=100, 1995-2008)



Source: The data have been obtained from the office for national statistics (ONS)

A typical manufacturing manager today is concerned with many different aspects of the business, from the design of products for ease of manufacture, to the management of flows of materials and information, both within their business and between their business and their suppliers and customers.

The interests of manufacturing firms do not necessarily end when the product is delivered, as an increasing number of firms are offering additional value-added services throughout the lifecycle of their products. Delivering these additional value added services means dealing with a new set of challenges for manufacturing managers, such as configuring international supply chains, assessing and testing new materials and ways of processing them, using new information technologies more wisely, and building more flexibility into offerings.

Employees may work for multiple employers during their working lives, as higher skills increase mobility. Many of the most successful people will move internationally between consulting, managing and training roles throughout their career; whilst also maintaining links with universities in some capacity (e.g. for training or research). This is especially true for employees in non-traditional areas of manufacturing such as bioscience, pharmaceuticals, materials and electronics in both large and small organisations.

UK industry, Government and educational institutions need to work together better, to encourage firms to up-skill, increase worker mobility, transfer knowledge and prepare for the global economic upturn.

Myth 9: We know what skills we need for the future

If one believes that manufacturing is not changing we can then know what skills we need for manufacturing in the future. Surely it is just a case of finding someone who can switch on a machine, perform simple repetitive tasks all day, and then switch the machine off again before going home? By believing this myth it means that the UK will have no newly trained people to cope with new business requirements, and the UK would never develop any highly skilled people to work in manufacturing.

The view that manufacturing is not changing is not true. The manufacturing skills base is currently in flux. It is neither static nor dominated by low-ability skill sets. As a result it is difficult to know what skills we need for the future of UK manufacturing.

Research conducted both in firms and the scientific community is constantly introducing new materials and process technologies that are being adopted by manufacturers. Hence, there is a constant need to upgrade existing employee skills and accurately predict future skills requirements; especially hard hit is the supply of experienced technicians and professional engineers. The current perception amongst employers is that universities and other institutions are out of touch with the needs of employers, which has inevitably led to a shortage of highly skilled workers for manufacturers to draw upon.

Hence, all too often, employers believe the development of generic skills falls to them. As there is often little alternative viable means for education, it is likely to occur 'on the job'. This decreases the chance for radical step changes to occur in practice, as fresh ideas are not brought into organisations from outside.

Many of the most successful people will move internationally between consulting, managing and training roles throughout their career...

In the future, a successful career in manufacturing will likely require somebody to have skills in areas such as leadership and team building, qualitative and quantitative problem solving, engineering and IT skills, as well possessing a willingness to explore and exploit new product or process technologies (e.g. dry cell batteries for automotives) and have a holistic systems-thinking perspective.

On-going training will be increasingly vital. Training policies need to be more inclusive, enabling all types of employers and employees, from all walks of life, to be able to access training. In turn, these requirements need to be passed onto and understood by educational institutions, professional training institutions and Government departments.

The difficulty lies in predicting exactly what skills will be needed, and the UK would benefit from more tightly joined-up thinking between industry, universities and Government in order to deliver the requisite skills far more fervently. The manufacturing community firmly believes that the UK is good at creating new ideas and knowledge, but admits that it needs assistance with exploiting them. It is in this cross-over area, from innovation to revenue generation, where further skills-building initiatives need to be aimed. Steps in this direction should start with young school leavers, and extend to all areas of the workforce, including up-skilling the existing workforce towards professional status.

Myth 10: Government's primary roles are to procure wisely and bail out failing companies

The final myth that needs dispelling, concerns the role of Government in supporting UK manufacturing. In recent years there has been a flurry of white papers and Government reports – Innovation Reviews (e.g. Innovation Nation), the Sainsbury Review (The Race to the Top), and the UK's Manufacturing Strategy. Each of these has called for the Government to procure more wisely, using its considerable purchasing power to stimulate innovation and creativity in both manufacturing and services.

Clearly this is a sensible recommendation and one that the UK Government should pursue, but it is not the only lever at the Government's disposal. Indeed, recent events have highlighted another Government intervention – bailing out failing companies. Clearly, interventions were necessary in the banking sector but one could argue that sometimes financial support for failing firms simply delays their demise. For example, perhaps the seeds of car manufacturer Rover's demise were sown in the 1970s.

We need to move beyond procurement and bail out as the Government's primary interventions. Firstly as this report has suggested, we need policies that recognise the nuanced view of manufacturing, and take into account of the specific needs of manufacturing industries.

Secondly, Government needs to consider more carefully the UK's sovereign assets and capabilities. Recent research, from Harvard professors Gary Pisano and Willy Shih reveals that decades of outsourcing has led to the US losing its ability to develop the next generation of high-tech products. Countries need a certain base level of activity in particular the sectors which contain the 'country commons' argue Pisano and Shih.

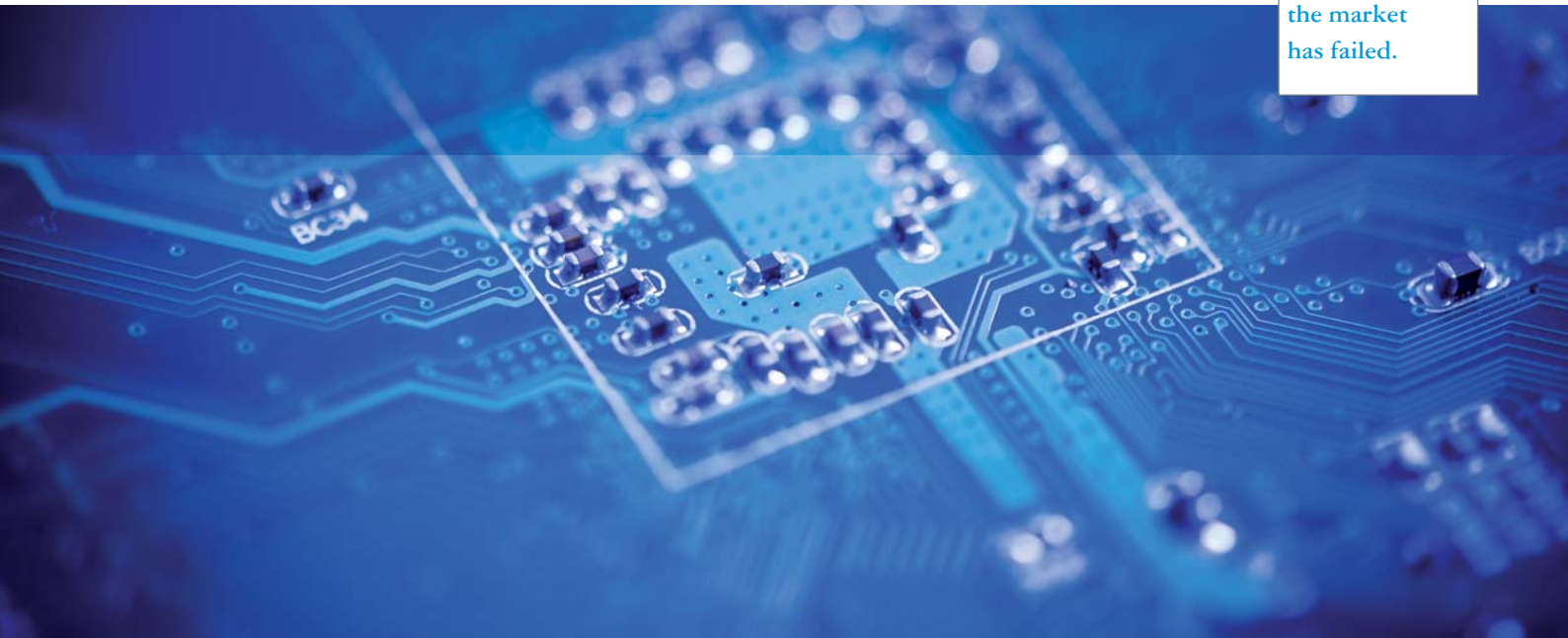


These are 'the collective R&D, engineering, and manufacturing capabilities that sustain innovation'. Without appropriate country commons firms cannot survive as there are simply not enough openly available resources for them to access. Just think about how difficult it would be to set up a domestic manufacturing firm to produce consumer electronics or semiconductors in the UK.

Thirdly, we need policies that facilitate the emergence of new industries – whether these are green technologies or plastic electronics.

Often the UK Government focuses on market failures, arguing that it should only intervene when the market has failed. But recent events show us that markets are always imperfect. Even those markets held up as exemplars (as the City was for many years) have their imperfections. Markets can fail dramatically if unchecked, but often the process that leads to their failure is a cumulative one, consisting of numerous small decisions and actions that can finally result in dramatic market failure. To assume that some markets are perfect and need no intervention, whilst others have imperfections and hence need Government support, is no longer tenable.

Often the UK Government focuses on market failures, arguing that it should only intervene when the market has failed.



Therein, the Government's first role is to constantly monitor the economic conditions for manufacturing in the UK, making small proactive interventions wherever and whenever necessary, rather than reacting to large obvious market failures with grand gestures. The Government might do this through procurement, but it can also influence markets by prioritising spending trends, most notably in R&D investment, training and education.

In summary, the UK needs an integrated approach to ensure that Government investments support the strengthening of the UK's country commons. Recent speeches containing references to industrial activism are a shift in the right direction, but it is not speeches that are required but action, if UK manufacturing is to have a viable future.

conclusion

Myths may be considered harmless, but they are not. The myths perpetuated about UK manufacturing are, potentially, highly damaging to the UK economy. The effects of such misconceptions go beyond affecting our basic understanding of the UK manufacturing sector. Instead they shape the way that firms and policymakers, develop corporate and national strategies for growth. They allow us to create firm and Government policy built on erroneous assumptions. In short they threaten UK international competitiveness and economic prosperity.

We must dispel these myths. Moreover we must develop policies and strategies that reflect the reality of modern manufacturing in the UK, and not the outdated views of the past. Only by escaping the constraints of our limited understanding, building our innovative capacity, developing a highly educated workforce, and striving to make the UK a global manufacturing force to be reckoned with once more, will the UK secure a place among the economic success stories of the next century.

Myths may be considered harmless, but they are not. The myths perpetuated about UK manufacturing are, potentially, highly damaging to the UK economy.



- AIM Innovation Fellows (2009) *At the edge of innovation – why shifts in the boundaries of innovation matter*, Advanced Institute of Management Research, London, UK.
- Allemandiger, G. and Lombreglia, R. (2005) *Four strategies for the age of smart services*, Harvard Business Review, 83(10), pp.131-145.
- Barney, J. B. (1991) *Firm resources and sustained competitive advantage*, Journal of Management, 17, pp.99-120.
- Beinhocker, E., Davis, I. and Mendoca, L. (2009) *The 10 trends you have to watch*, Harvard Business Review, 87(7-8), pp.55-60.
- Binder, M. and Clegg, B. T. (2006) *A Conceptual Framework for Enterprise Management*, International Journal of Production Research, 44(18-19), pp.3813-3829.
- Brax, S. (2005) *A manufacturer becoming service provider – Challenges and a paradox*, Managing Service Quality, 15(2), pp.142-155.
- Davies, A. (2004) *Moving base into high-value integrated solutions – A value stream approach*, Industrial and Corporate Change, 13(5), pp.727-756.
- DIC (2009) *Securing Britain's Future and Prosperity*, Defence Industries Council, London, UK.
- Dierickx, I. and Cool, K. (1989) *Asset stock accumulation and sustainability of competitive advantage*, Management Science, 35(12), pp.1504-1511.
- EEF (2008) *Manufacturing IT – Boosting Productivity by Managing Performance*, Engineering Employers Federation, London, UK.
- Gebauer, H., Fleish, E. and Friedli, T. (2005) *Overcoming the service paradox in manufacturing companies*, European Management Journal, 23(1), pp.14-26.
- Goldman Sachs (2003) *Dreaming with BRICS – The path to 2050*.
- Gottfredson, M. and Aspinall, K. (2005) *Innovation vs complexity – What is too much of a good thing?*, Harvard Business Review, 83(11), pp.62-71.
- Griffith, R., Haskel, J. and Neely, A. (2006) *Why is productivity so dispersed?*, Oxford Review of Economic Policy, 22(4), pp.513-525.
- Hagel III, J., Brown, J.S. and Davison, L. (2009) *The big shift – Measuring the forces of change*, Harvard Business Review, 87(7-8), pp.86-88.
- HMSO (2006) *Prosperity for all in the Global Economy – World Class Skills*, Leitch's Review of Skills, Department of Trade and Industry, London, UK.
- IfM (2006) *Defining High Value Manufacturing*, Institute for Manufacturing, Cambridge University, UK.
- Kafouros, M. I. and Buckley P. J. (2008) *Under what conditions do firms benefit from the research efforts of other organizations?*, Research Policy 37(2), pp.225-239.
- Kafouros, M. I., Buckley P. J., Sharp J. A. and Wang, C. (2008) *The role of internationalization in explaining innovation performance*, Technovation, 28(1-2), pp.63-74.
- Kim, W. C. and Mauborgne, R. (1997) *Value innovation – The strategic logic of high growth*, Harvard Business Review, 75(4), pp.172-180.
- Kogut, B. and Zander, U. (1993) *Knowledge of the firm and the evolutionary theory of the multinational corporation*, Journal of International Business Studies, 24(4), pp.625-645.
- Mont, O. (2000) *Product-Service Systems*, International Institute of Industrial Environmental Economics, Lund University, Stockholm, Sweden.

- Monteiro, F., Arvidsson, N. and Birkinshaw J. M. (2008) *Knowledge Flows in Multinational Corporations: Explaining Subsidiary Isolation and Its Performance Implications*, *Organization Science*, 19(1), pp.90-107.
- Neely, A. (2008) Exploring the financial consequences of the servitization of manufacturing, *Operations Management Research*, 1, pp.103-118.
- Nelson, R. R. and Winter. S. G. (1982) *An Evolutionary Theory of Economic Change*, Harvard University Press, Cambridge, UK.
- NRC (2004) *New directions of Manufacturing*, National Research Council, The National Academies Press, Washington, DC, USA.
- OECD (2008) *Main Science and Technology Indicators*, Organisation for Economic Co-Operation and Development, Paris, France.
- Oliver, N., Holweg, M. and Carver, M. (2008) *A systems perspective on the death of a car company*, *International Journal of Operations and Production Management*, 28(6), pp.562-583.
- ONS (2009) Office for National Statistics, UK.
- Pisano, G. and Shih, W. (2009) *Restoring America's Competitiveness*, *Harvard Business Review*, 87(7-8), pp.114-125.
- Rosenkopf, L. and Almeida, P. (2003) *Overcoming local search through alliances and mobility*, *Management Science*, 49, pp.751-766.
- Sapienza, H. J., Autio, E., George, G. and Shaker, A. (2006) *A capabilities perspective on the effects of early internationalization on firm survival and growth*, *Academy of Management Review*, 31, pp.914-933.
- SEMTA (2008) *National Employers Skills Survey 2007 – Summary for SEMTA*, Sector Skills Council for Science, Engineering and Manufacturing Technologies, Watford, UK.
- Shi, Y. and Gregory, M. (1998) *International manufacturing networks – To develop global competitive capabilities*, *Journal of Operations Management*, 16(2-3), pp.195-214.
- Slack, N. (2005) *Operations strategy: will it ever realize its potential?*, *Gestão & Produção*, 12(3), pp.323-332.
- Tellis, G. J., Prabhu, J. C. and Chandy, R. K. (2009) *Radical Innovation across Nations – The Preeminence of Corporate Culture*, *Journal of Marketing*, 73(1), pp.3-23.
- TSB (2008) *High Value Manufacturing – Key technology area 2008-2011*, Technology Strategy Board, London, UK.
- Wang, C. and Kafourous, M. I. (2009) *What Factors Determine Innovation Performance in Emerging Economies? Evidence from China*, *International Business Review*, 18(6), 606-616.
- Wheelwright, S. and Bowen, K. (1996) *The challenge of manufacturing advantage*, *Production and Operations Management*, 5(1), pp.59-77.
- Wise, R. and Baumgartner, P. (1999) *Go downstream – The new profit imperative in manufacturing*, *Harvard Business Review*, 77(5), pp.133-141.
- Zahra, S. A. (1996) *Governance, ownership, and corporate entrepreneurship – The moderating impact of industry technological opportunities*, *Academy of Management Journal*, 39(6), pp.1713-1735.
- Zhao, M. (2006) *Conducting R&D in Countries with Weak Intellectual Property Rights Protection*, *Management Science*, 52(8), pp.1185-1199.

AIM Research Reports

Executive Briefings

- 2009 **Building a strategy toolkit**
Lessons from business
- 2009 **Outcome-based contracting**
Changing the boundaries of B2B customer relationships
- 2009 **Risk management gets personal**
Lessons from the credit crisis
- 2009 **Radical Innovation: Making the Right Bets**
- 2009 **Racing For Radical Innovation**
How motorsport companies harness network diversity for discontinuous innovation
- 2009 **Capability vs. Productivity**
Identifying the weaknesses in the UK Retail Industry
- 2008 **High Value Manufacturing**
Delivering on the Promise
- 2008 **Is the UK's science base performing?**
- 2008 **When organisations change**
A middle management perspective on getting it right
- 2008 **Leadership of Business Schools**
Perceptions, Priorities and Predicaments
- 2007 **Dancing with gorillas**
How SMEs can go global by forging links with MNCs
- 2007 **Adapting to the China Challenge**
Lessons from experienced multinationals
- 2007 **Twelve search strategies that could save your organisation**
Is discontinuous innovation on your corporate radar?
This report is accompanied with a self-assessment booklet
- 2007 **The Future of Business School Faculty**
- 2007 **The Future of HR**
How Human Resource outsourcing is transforming the HR function
- 2007 **The Importance of Meetings**
How the structure of meetings affects strategic change in organisations
- 2007 **The International Success of British Companies**
An industry perspective
- 2007 **Making sense of workplace performance**
- 2006 **From Modern to Paternalistic**
How does your firm type affect your performance?
- 2006 **How does UK retail productivity measure up?**
- 2006 **'Who does what' and 'who gets what'**
Capturing the value from innovation
- 2006 **Is Organisational Learning a Myth?**
- 2006 **Attention HQ**
Strategies for UK subsidiary companies
- 2006 **The Asian Century**
Opportunities and challenges for the UK
- 2006 **The Future of Business Schools in the UK**
Finding a path to success
- 2006 **Acting on Information**
Performance management for the public sector
- 2006 **Signing up for Competitive Advantage**
How signature processes beat best practice
- 2006 **Biotech Clusters in the UK**
Challenges and opportunities
- 2006 **Give and Take**
Understanding attitudes to learning in the collaborative process
- 2006 **Intelligent Design**
How managing the design process can boost company performance
- 2005 **Dealing with Discontinuity**
How to sharpen up your innovation act
- 2005 **The Ambidextrous Organisation**
- 2005 **Leading for Innovation**
The impact of leadership on innovation
- 2005 **The Cluster Effect**
How clusters policy can make the UK more competitive
- 2005 **Making Best Practice Stick**
How UK firms can increase productivity by adopting leading-edge working practices
- 2005 **Offshoring: Myth and Reality**
What the global trade in business service means for the UK
- 2005 **Pathways to Value**
How UK firms can create more value using innovation strategically
- 2004 **i-works**
How high value innovation networks can boost UK productivity

Academic Publications and Working Papers

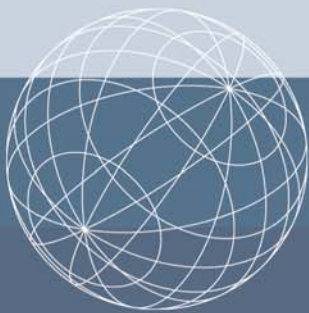
Academic Publications and Working Papers are also available from our website www.aimresearch.org

AIM – The UK's research initiative on management

If you are interested in working with AIM Research, require further information or to access the following:

- Full UK programme of AIM workshops, conferences and event listings
- Fellows' profiles and full research project details
- AIM quarterly Newsletter and press releases
- Research papers and AIM publications available as downloads
- Information for the media

please visit AIM's website **www.aimresearch.org**



For all enquiries please contact:

Advanced Institute of Management Research (AIM)
4th Floor, Stewart House
32 Russell Square
London WC1B 5DN

Tel: +44 (0)870 734 3000

Fax: +44 (0)870 734 3001

Email: aim@wbs.ac.uk

Web: www.aimresearch.org

The Advanced Institute of Management Research (AIM) was founded in October 2002. It is a multi council initiative of the UK's Economic and Social Research Council (ESRC) and Engineering and Physical Sciences Research Council (EPSRC) – with activities at over 180 institutions in the UK and overseas.

ISBN 978-1-906087-26-5