IfM

UNIVERSITY OF CAMBRIDGE

Defining High Value Manufacturing

Finbarr Livesey

January 2006

Defining High Value Manufacturing

First published in Great Britain by the University of Cambridge Institute for Manufacturing, Mill Lane, Cambridge CB2 1RX.

ISBN: 1-902546-48-2

Executive summary

Manufacturing has a strong future in the UK. That future is based on generating high value – to the company, to shareholders and to the country. High value manufacturers have strong financial performance, are strategically important, and have positive social impact.

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.

Value is more than profit

When thinking about value it is easy to assume it is the same as profit or revenue. However, a firm's value goes beyond its financial performance and includes social impact and strategic importance to the regional and national economy. Each type of value will be considered important in varying degrees by companies, individuals and countries.

HVM companies create financial, strategic and social value

High Value Manufacturing (HVM) companies have strong financial performance but they also generate significant value externally. For example, at a strategic level HVM companies may be significant contributors to national R&D investment. In terms of social impact, HVM companies may be measured for environmental performance, sourcing policies or their community involvement.

There is no simple definition of high value manufacturing

High value manufacturers can create value in a variety of ways. For example they may have unique production processes, high brand recognition, rapid delivery times, or highly customised services. Three examples of HVM from the UK are provided by Cadbury Schweppes, Rolls-Royce, and GlaxoSmithKline (GSK).

Cadbury Schweppes focuses on production aligned to a strong brand

In 2004 Cadbury Schweppes, a confectionary and soft drinks producer, had £2,266M in value added. The company has a strong base in production with a core focus on quality. Its strategy is brand led and customer focused. However, even Cadbury, with such a strong production focus, has an element of service revenue from its bottling franchises.

Moving into service provision has strengthened Rolls-Royce

In 2004 Rolls-Royce reported that over half its revenue came from services. While still investing heavily in R&D and engine production, Rolls-Royce generates its revenue through service contracts – power by the hour. In this way it has become a service-led producer.

GSK's value is based on its research strength linked to production and marketing
GlaxoSmithKline is ranked fifth overall in the UK in terms of value added (£12,538M) and is first overall in terms of R&D spend (£2.8B globally). Its value creation comes from the invention of new chemical entities and it captures value through a highly intensive sales and marketing process. Essential to the overall value proposition is the synergy of R&D, production and commercial activities.

The IfM has developed a framework for analysing high value manufacturing

Since a simple definition is not possible, the IfM has developed an initial HVM framework that builds on the financial measure of value added, categorises manufacturers into one of four types, and provides a matrix in which the nature of the financial, strategic, and social value generated by a company for a variety of stakeholders can be illustrated.

High value manufacturers come in many shapes and sizes

- **Service led producers** who provide customers with services based on a significant production capability
- **Product manufacturers** who focus on generating value through production
- **Service manufacturers** who have little or no production and generate value from services which are based around a product
- **System integrators** who control the channel to customers and manage an external production network

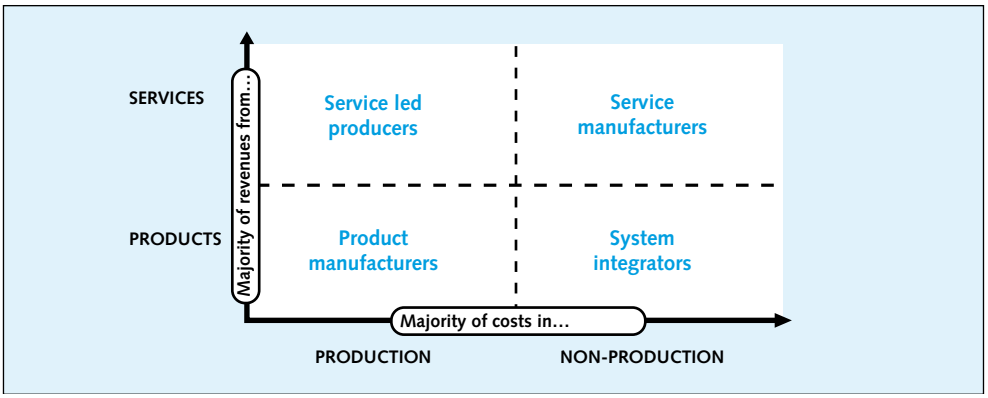

Figure 1 – types of manufacturers

Each of these approaches can be high value – it depends on the context and capabilities of the company.

UK manufacturing has to be high value in the future

If the UK is to maximise the potential of its businesses it is essential to broaden our perception of manufacturing beyond production. The HVM framework provides a basis for doing this. This initial framework will be developed further and it is hoped will be adopted by policy-makers and industry, and be used to help change public perceptions of manufacturing.

In a highly competitive global market the prosperity of the UK is dependent on companies that deliver high value – to the country, to investors, to their employees and to themselves. Many parts of the UK's current industrial base already deliver high value; the challenge is to make high value the standard.

Table of Contents

Introduction

UK companies are being encouraged "… to move up the value chain and to reap the benefits of high-skilled, knowledge-intensive manufacturing operations" while competing on "… unique value and innovation."[1] At the core of this strategy is the concept of a high value manufacturer. Companies who are able to move up the value chain are considered to be high value, and this is assumed to be what is best for companies and the countries in which they are located.

Unfortunately there is no accepted definition of a high value manufacturer or high value manufacturing (HVM), making this high value vision hard to achieve or to support in policy. Most conceptions of value revolve around simple financial measures but they do not consider the question of "value to whom?" It is assumed that what is good for the company financially is good for the country and individuals. While any business' primary objective must be to be profitable and to satisfy shareholders, the corporate social responsibility agenda (amongst others) is highlighting that different stakeholders may well make judgments about value in non-financial terms.

How could we define high value manufacturing and what issues might it raise? In order to answer these questions the Department of Trade and Industry (DTI) and the Confederation of British Industry (CBI) jointly sponsored the Institute for Manufacturing (IfM) to investigate the definition of high value manufacturing (HVM).

This report provides a summary of the project which discusses current definitions of manufacturing and value, and outlines a framework for understanding high value manufacturing.

This work has been an initial investigation into a complex area – how should the manufacturing sector of an economy be defined and measured, and how can we assess its value to a broad set of stakeholders? There is much work to be done following on from this study and it is hoped the DTI and other government departments will continue to investigate these issues.

Methodology

The High Value Manufacturing (HVM) project was carried out over a six month period from June 2005 and involved:

- desk based research work on the definitions of manufacturing and value,
- a one day workshop with large and small companies, and
- the development of case notes for a small number of manufacturers to illustrate the application of the high value manufacturing framework.

[1] Government's Manufacturing Strategy, DTI 2002, and UK Competitiveness: Moving to the next stage, DTI Economics Paper, 2003.

The desk based research included a review of literature on value and existing definitions of manufacturing, and formed the basis of the framework we used in the workshop and case note writing parts of the project.

The workshop was attended by fourteen companies from a range of sectors and varying in age and size from start-ups to established multi-nationals. The workshop was a strong test bed for the concepts developed in the framework and assisted in tightening the definition and metrics used in the framework.

Finally, case notes were developed based on discussions with the companies themselves and so represent how each company thinks of itself in value terms. While not intended to represent these companies as exemplars, they are intended to highlight across sectors how the terms can be interpreted.

Report structure

This report is structured as follows:

- **Understanding manufacturing** outlines the difficulties with traditional definitions of manufacturing and provides an extended definition of manufacturing.
- **Thinking about value** discusses the theory of value and how a framework can be developed to contain multiple stakeholders and types of value
- **Constructing the high value manufacturing framework** brings the extended definitions of manufacturing and value together in one to provide a framework for thinking about HVM.
- **Case examples** provides the case notes that were developed within the project to give real life examples of HVM.
- **Conclusions** brings together the outputs of the report and indicates where the project team feel there is scope for further work.

Understanding manufacturing

In thinking about whether a manufacturing company is high value or not a first task is to have a clear definition of manufacturing. The common conception of manufacturing is of an old industry, with large factories having a significant and probably negative environmental impact, employing largely unskilled labour doing repetitive work on production lines. Not only have existing manufacturing companies evolved significantly, but new industries have emerged making it clear that such an image of manufacturing is out of date.

Traditional definitions of manufacturing are very narrow. The classic definition of manufacturing usually defines manufacturing as the transformation of raw materials into finished products.[2] This definition has formed the basis of industrial classification schemes such as the Standard Industrial Classification (SIC) for the UK, which is discussed in more detail below. Such a narrow definition does not admit the complexity of modern manufacturing operations and the broad set of activities that manufacturers undertake.

However, other attempts to broaden the definition may go too far. For example, in the 2004 *Economic Report of the President* in the United States there was a brief discussion of how to define manufacturing. The discussion focused on the blurring of the distinction between products and services and asked "When a fast-food restaurant sells a hamburger … is it providing a "service" or is it combining inputs to "manufacture" a product?"[3] While many people would consider this as going too far in flexing the definitions, the Report did highlight why this should be a concern. "The distinction between non-manufacturing and manufacturing industries may seem somewhat arbitrary but it can play an important role in developing policy and assessing its effects." This means we need at the very least an updated definition of manufacturing, if not a new classification for manufacturing and services.

A broader definition

An extended definition of manufacturing has been developed by the Institute for Manufacturing which equates manufacturing to the full cycle of activities from research and development, through design, production, logistics and services, to end of life management, within an economic and social context.

For the purposes of this project, we have taken that definition and focused the activities listed down to a group of six, as shown on the left.

Manufacturing is not best represented by a linear set of activities. Manufacturing can involve a large number of different companies acting together, with each company undertaking many

[2] For example the Merriam-Webster's definition of manufacture is "… to make from raw materials by hand or by machinery …" (accessed online at http://www.m-w.com/).

[3] (2004) *Economic Report of the President 2004*, United States Government Printing Office.

activities. Each company will have a different set of linkages between its activities, and so no one mapping of manufacturing activities will describe all companies.

A key distinction that this extended definition makes is that manufacturing and production are not the same. Production is but one activity of a manufacturing company. It may or may not be the defining activity of the company. For example, if a company has outsourced all of its production activities and is focusing on brand management or R&D, that company can still be a manufacturer.

Another way to emphasise the distinction between production and manufacturing is to highlight the different types of production in which manufacturers may engage. These are shown in the diagram below as a generalised set of types of production across the activities of a company.

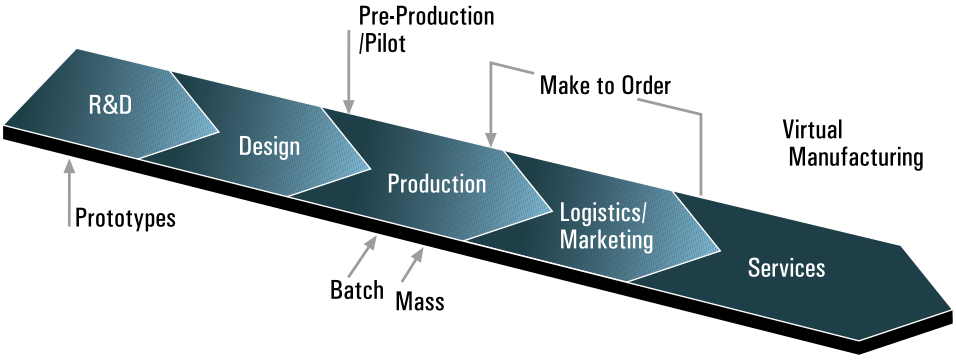

Figure 2 – different kinds of production

The common image of production is mass production, but production can be required to develop prototypes or on a make to order basis. This re-emphasises the distinction between production as one of the activities of a company, and manufacturing as the collection of activities that is required to develop, produce and deliver goods and services to customers.

Categorising manufacturers

Thinking about manufacturing as a single sector or group, as if all manufacturers are alike, is misleading. While there is considerable commonality between manufacturers in different sectors, modern manufacturing companies may or may not have production as their core activity and they may also undertake significant amounts of R&D and design, and deliver a range of services around their products. This means we have to have a better way of categorising manufacturers. How are manufacturers currently categorised?

SIC codes

The main tool for describing the industrial structure of most countries is a system of industrial classification, such as the Standard Industrial Classification (SIC) codes for the UK (revision 1992). These are hierarchical systems for defining what a company does focusing on their principal activity rather than the type of business they are engaged in.

In the UK while companies can report in up to four SIC codes, for companies of any level of complexity even this can oversimplify what they actually do in the market place.[4]

There are many examples of where such classification systems act in curious ways. In the USA, software delivered via a disk format is classed as 'manufacturing', but when provided through the Internet, is identified as a 'service'.[5] Similarly, in Australia, timber fashioned into furniture is described in the country's official statistics as manufacturing, whilst timber used to build a house is categorised as 'construction'.[6]

To remove the SIC code system and start again would be a massive undertaking. As Jacobs and O'Neill note "… any proposed changes to SIC codes of whatever system tend to be resisted .."[7] This comment is even stronger when placed in the context that they are discussing updating SIC codes rather than building a completely new system. In the UK, the Allsopp review of statistics for economic policymaking in 2004 was a potential point where options for significant change could have been outlined. However, the report stopped well short of criticising the fundamental basis of the system.[8] Their recommendations essentially boil down to adding more SIC codes to cover emerging service industries and to provide more regional level data (at NUTS1 level) in order to assist regions in making policy.

Is a whole new SIC code system required? Or are their alternative categorisations that can work alongside the existing system? The next section outlines a potential method for categorising companies at a relatively high level that could complement existing classification systems.

A new categorisation

In thinking about how to develop a new categorisation for manufacturers, there are two dimensions that are immediately obvious – revenues and costs. As the top level distinctions are products and services, we can potentially group companies according to whether the majority of their costs are within production or outside production and whether the majority of their revenues is derived from products or from services.

4 SIC codes are given as four digit number, for example 24.61 (manufacture of explosives), 28.62 (manufacture of tools) and 34.10 (manufacture of motor vehicles). See the online SIC code reference at: http://www.statistics.gov.uk/methods_quality/sic/contents.asp

5 Mike Gregory et al., (2003) "Making the Most of Production," Institute for Manufacturing, University of Cambridge.

6 Clark, C., Geer, T., and Underhill, B. (1996) "The Changing of Australian Manufacturing," ed. Australian Government Productivity Commission.

7 Jacobs, G., and O'Neill. C. (2003) "On the Reliability (or Otherwise) of Sic Codes." *European Business Review* 15, no. 3, 164-69.

8 (2004) *Review of Statistics for Economic Policymaking - Final Report to the Chancellor of the Exchequer, the Governor of the Bank of England and the National Statistician,* HM Treasury.

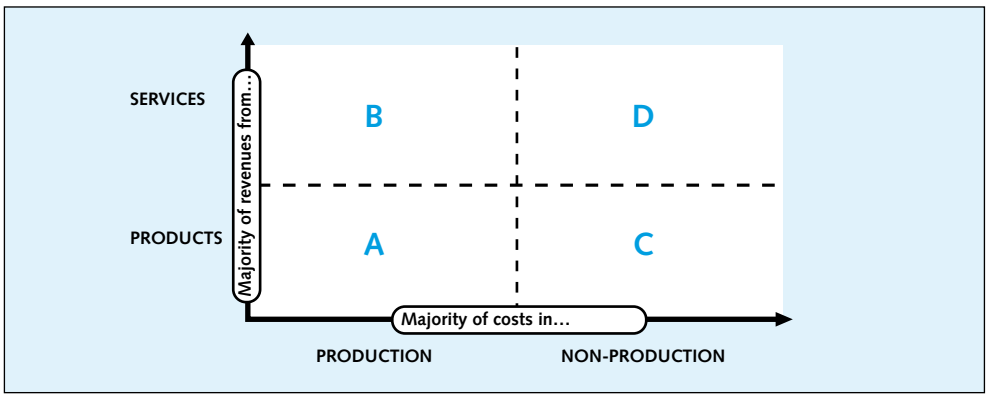

Figure 3 – Qualitative categorisation of manufacturers

This provides us with four categories of manufacturers, indicated as A through D in the figure above. Type **A** manufacturers are relatively traditional manufacturers and have the majority of their costs in production and the majority of their revenues from selling products. An example of a leading UK company in this category is Cadbury Schweppes. Moving into category **B** we have companies that are still strongly based around production, but have begun to derive their revenues from services. Rolls-Royce is a clear example of such a service led producer in the UK. The companies who are in category **C** are relatively complex, as they sell products but the majority of their costs are not associated with production. These are companies, such as GB Innomech, who for example build one-off specialist machinery that requires significant R&D and design input. Finally, we have those companies who have moved into providing services and have detached from their production base (category **D**). IBM is an example of this type of company, driven by their recent sale of their PC production to Lenovo in China and a model based on providing software services and support.

This categorisation is summarised below, with the four broad types of manufacturers highlighted.

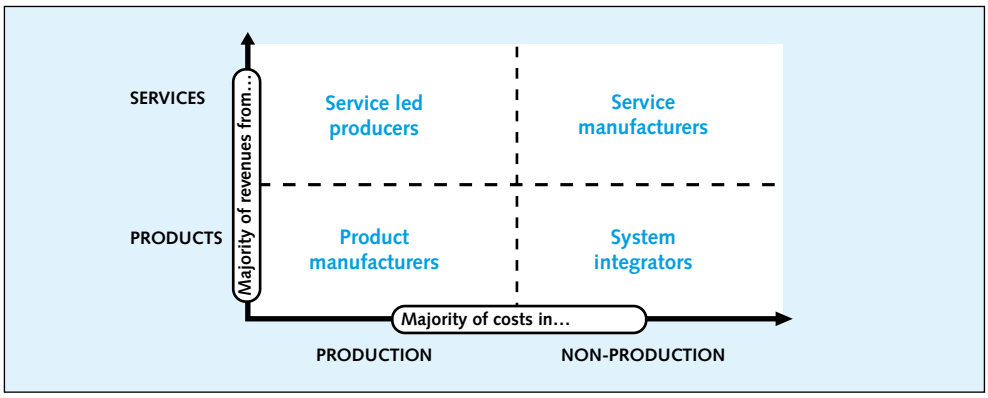

Figure 4 – types of manufacturers

This high level categorisation provides us with a more subtle picture that demonstrates how services are an integral part of many manufacturing companies. However, we are not asserting that high value can only be delivered with a strong service focus - high value companies can exist in each category.

Thinking about value

Value is a term much used in modern management without serious consideration of what it actually means. This has led to the emergence of terms such as value mapping, value chains, and value added all of which use the same root word to describe very different things. This section provides a brief introduction to the use of value terms, and comments on the issues for companies in attempting to understand and articulate value.

What is value?

Possibly the simplest perspective on value is that it attempts to quantify the fair, proper and intrinsic worth of something whether in ownership or exchange. Current commentators, such as Porter, reduce the definition of value to the price in exchange. Value is "… The amount buyers are willing to pay for what a firm provides them. Value is measured by total revenue …"[9] However, this approach contains many debateable concepts including what is the 'fair' worth of a good?

Thinking about value simply as price will give us a very narrow perspective. The theory of value (axiology) extends quite broadly from a concept of the price of a good to abstract units of measurement that bring together a variety of fields, for example morality and aesthetics. In this work, while the economic aspects of value are important, we will want to go beyond narrow financial measures as we think about value in a broad sense.[10]

Moving up from the level of a single product or transaction, we need to think about the value of a company. A widely used metric for companies is value added. This is defined in the Department of Trade and Industry's (DTI) Value Added Scoreboard in the following way "Wealth created is measured as value added which is sales less the cost of bought-in materials, components and services."[11] An example from the scoreboard is given below, showing the reported value added for British Telecom in the UK for the 2001 to 2004 period.

Value Added (£m)	2001	2002	2003	2004
BT UK	11,332	9,269	10,164	10,175

Table 1 – Value added for BT UK 2001 - 2004

Most discussions of value added assume that value is added at each stage of a supply chain from raw materials extraction through production and assembly to sales and service to the end

[9] Porter, M. E. (1985), Competitive Advantage: creating and sustaining Superior Performance, The Free Press, New York pp. 36-38.

[10] For a broad overview of evolution of theories of value (and other economic concepts) see Blaug, M. (1996) *Economic Theory in Retrospect*, 5th Edition, Cambridge University Press.

[11] See the DTI's Value Added Scoreboard online at http://www.innovation.gov.uk/value_added/home.asp?p=home.

customer. While this may not be the intention of the definition, this image of value building through the supply chain is an attractive one that may mislead us as we are thinking about relationships between companies.

One aspect of the discussion of value in economic theory that appears to be useful in thinking about value in the supply chain is the distinction between use and exchange value.[12] This distinction has been recognised for many years, and in simple terms can be stated as follows –

- Use value is perceived by the customer, based on their perceptions of the usefulness of the product, and is subjective and changing over time.
- Exchange value is realised when a product is sold (price) and is a one time transaction

Building on this approach, we can think of the interactions between customers and companies as being a combination of considerations of use value and exchange value. This is sketched in the diagram below, which builds on and adapts that of Bowman and Ambrosini.[13] At each stage, the buyer has an acceptable level of exchange value (probably defined by the use value of the item to the buyer amongst other things), as the seller has an acceptable exchange value (probably based on costs of production and expectations of profit).

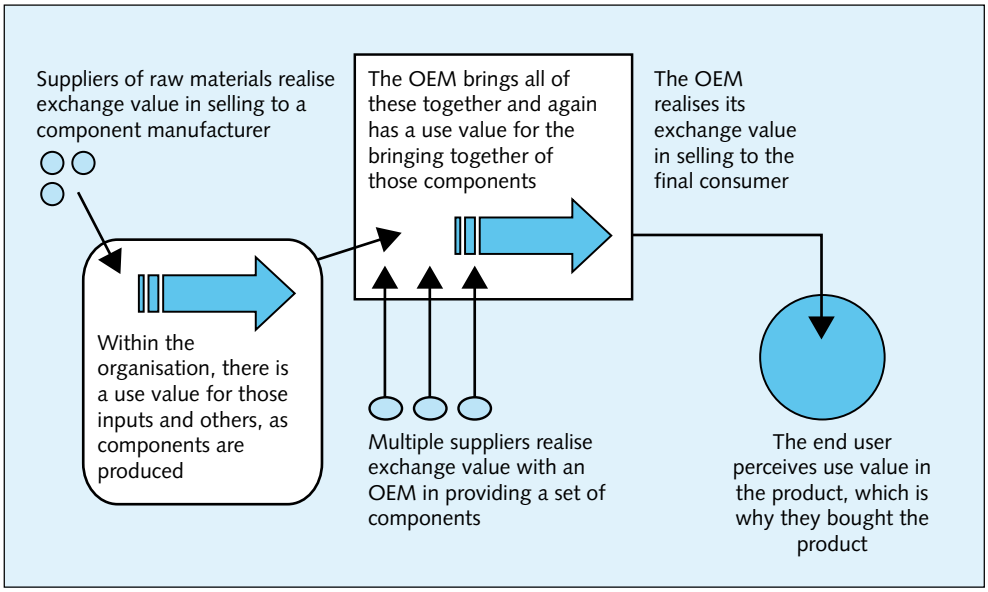

Figure 5 – Theoretical chain of exchange and use value from raw materials to the end customer of manufactured goods

Within this approach, the concept of value added changes, as here there are a number of exchanges which may or may not result in a higher price depending on the perceived use value for the buyer amongst other factors. This means the linear idea of value added will not help us as we try to provide a more detailed way of thinking about value across a number of stakeholders.

[12] See for example Bowman, C. & Ambrosini, V. (2000) Value Creation Versus Value Capture: Towards a Coherent Definition of Value in Strategy, *British Journal of Management*, vol. 11, 1 – 15.

[13] *Ibid*.

Value to whom?

When we speak of a company being 'high value' we need to understand to whom it is high value – is it the employees of the company, the investors, the owners of the firm, or the country as a whole? This is a key question for the definition of high value manufacturing, as it situates the question in a specific context – each stakeholder will have different expectations of value and what is to be valued. For example, employment will be a concern of the national government and the company but in different ways. This means the government and companies will potentially view the outcomes of outsourcing, for example, in completely different ways.

The contrast between value in the public sector and the private sector was highlighted in a 2002 discussion paper from the Prime Minister's Strategy Unit.[14] This was an attempt to develop a framework for the value created by government based on three categories for value - services, outcomes and trust – leading to a definition of 'public value'. A key point, which reflects into the framework outlined for high value manufacturing, is that while public and private value may overlap there are strong differences between the two. These are based on distributional equity, a lack of a 'price' mechanism to aggregate individual preferences, and the diversity of goals and opinions on what public goals should be contrasted to the stable private sector goal of creating returns to shareholders.

In this work, as we are attempting to develop a definition or relatively simple framework, we have restricted ourselves to considering the following groups – the firm, the nation/region, investors, and employees. We considered individuals not directly connected to the firm to have their perspectives represented within the national/regional actor.

In this way, when we speak of value we will have to specify which group we are speaking of so that we can contextualise the question of whether the company is high value to that group.

Types of value

Current measures of value (such as value added) provide a perspective on value for the company and indirectly as an indicator of worth for investors. However, in thinking about the company as having an impact on its employees, the region in which it is situated and the national economy, it is obvious that we need to go beyond this type of single indicator.

Financial value

As we have outlined above, the simplest conception of value is price (or revenue at the level of the firm). Many financial indicators have been developed that can act as indicators of value for companies and it is not an aim of this project to review all of these indicators. Our approach has been to focus on one of the most commonly used indicators, value added, and to leave a more complex treatment of value for the firm to further work.

However, there are a number of issues with value added, and these have been a significant impetus for this project in developing a definition of high value manufacturing. Value added is limited because it is a one time historic measure and it is a macro level measurement that does not provide any lower level of detail for companies to assist in decision making. However, as a financial measure value added is probably the easiest to use as it has readily available data and is well understood by companies and investors.

[14] Kelly, G., Mulgan, G., and Muers, S. (2002) *Creating Public Value: An analytical framework for public service reform*, Prime Minister's Strategy Unit, Cabinet Office.

Strategic value

What will ensure that the company retains its competitive edge in the coming five years? Moving beyond the pure financial, we have a concept of value that is not quantifiable but may be open to inquiry and analysis. For example, to what extent is a company a holder of a key technology platform for a broader industry? Or is the company making long term investments in research and development? Each of these cannot be easily quantified in immediate financial returns but it should be included in a discussion of the long term value of a company.

Social value

Moving beyond the firm and what is of value to the firm we can think of a category that is broadly defined as 'social value'. Here are many of the corporate social responsibility (CSR) measures that have been developed in the past decade and more to measure the impact of the company on the community in which it is placed – be that environmental or otherwise.

Again, some of these measures may be open to quantification, but by making this value explicit and looking for measures that fit in this category it is felt that this extended concept in terms of various groups and types will be clearer.

Constructing the HVM framework

As outlined above, while the concept of high value manufacturing may appear simple it has significant complexity due to the multiple stakeholders involved and the types of value that a company can create. Because of this, a simple two to three line definition will not suffice and a framework approach appears to be the best way forward when developing a definition of high value manufacturing.

What will the framework need to achieve? The overarching purpose of such a framework is to provide a broad set of stakeholders with an understanding of whether a specific company is high value to them. If possible for each company it should give a better understanding of the type of manufacturer they are and their strategic positioning. Finally, it should be able to provide a basis for each stakeholder to make a decision on the trade-offs that exist between themselves and other stakeholders in terms of the types and magnitude of value created by a company.

The following section outlines the elements of the framework, giving examples where possible, and showing how the different elements relate to one another.

Value and the company

The first element of the framework recognises the fact that companies need to be financially viable entities if they are to generate other types of value for all stakeholders. For this reason, the first part of the framework is an overall financial measure of the value of the company.

The measure we have decided to use is value added. This measure has been used as it is in widespread use by government and industry to talk about the value of companies and there is readily available data on most companies (and where a company's value added is not available it is relatively simple to calculate).

As mentioned above, there are a number of issues with value added. The core weakness of value added is that is a macro indicator that provides no detail below the level of the whole company. In part, it was this weakness that encouraged the research team to look for other measures of value and led to the other categories of value beyond the financial.

Other measures of a companies value could have been used (market capitalisation or economic value added for example) but the ease of data availability for value added meant this was the simplest approach to take. If further work merits, a line of inquiry should be on the most appropriate financial measures to use for this kind of framework, which would be readily available and allow comparisons between all types of companies.

Categorising the company

Our next task is to be able to categorise the company so that we can recognise how the company creates value (both internally and externally) from which we can discuss the broad strategic

options for the company to become higher value. The qualitative categorisation developed above allows us to have a measure of the balance for the company between production and non-production costs and product and service revenue.

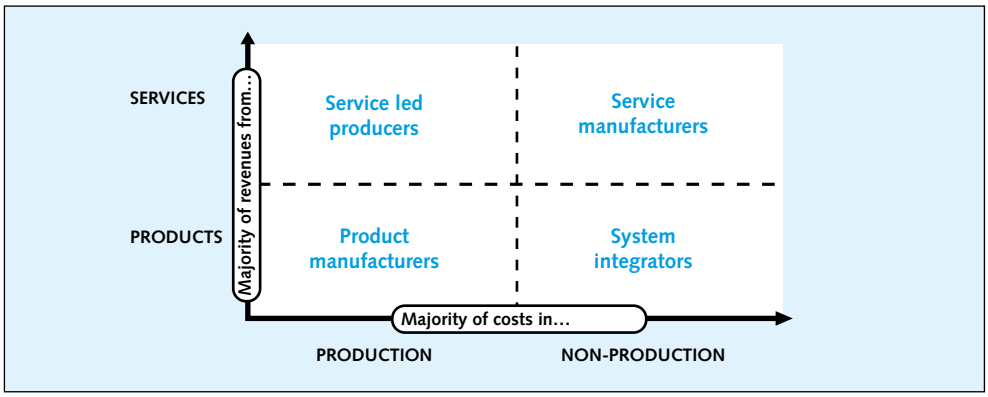

Figure 6 – types of manufacturers

In the workshop companies were asked where they would place their company and where they would they see themselves moving in the future. One example of this type of qualitative mapping is given below for IBM.

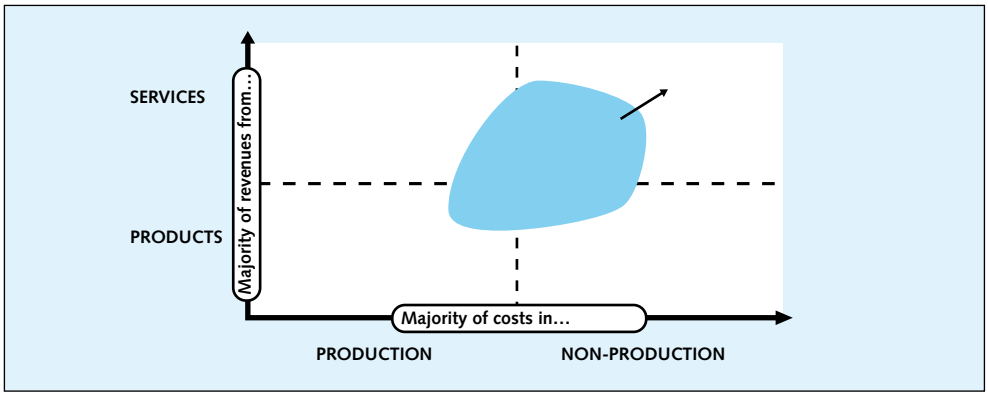

Figure 7 – Qualitative mapping of IBM

The diagram shows where IBM could be placed, with a strong emphasis on service revenue and a minority of costs in production since the sale of the PC manufacturing arm to Lenovo in late 2004. The arrow indicates the expected strategic development, with the company moving further into services and away from production related activities.

If the mapping were purely qualitative it would have limited use for assisting companies and other stakeholders in understanding where the company creates value and how it may evolve in the future. In order to test whether the categorisation was possible using actual company data ten manufacturing companies in the South East region were asked to provide a basic breakdown of their current costs and revenues.[15]

[15] These companies were interviewed as part of another IfM project, Value Creation and Capture. The companies self describe themselves as manufacturers and range in employees from 20 to 300 and in turnover from £2 million to £35 million.

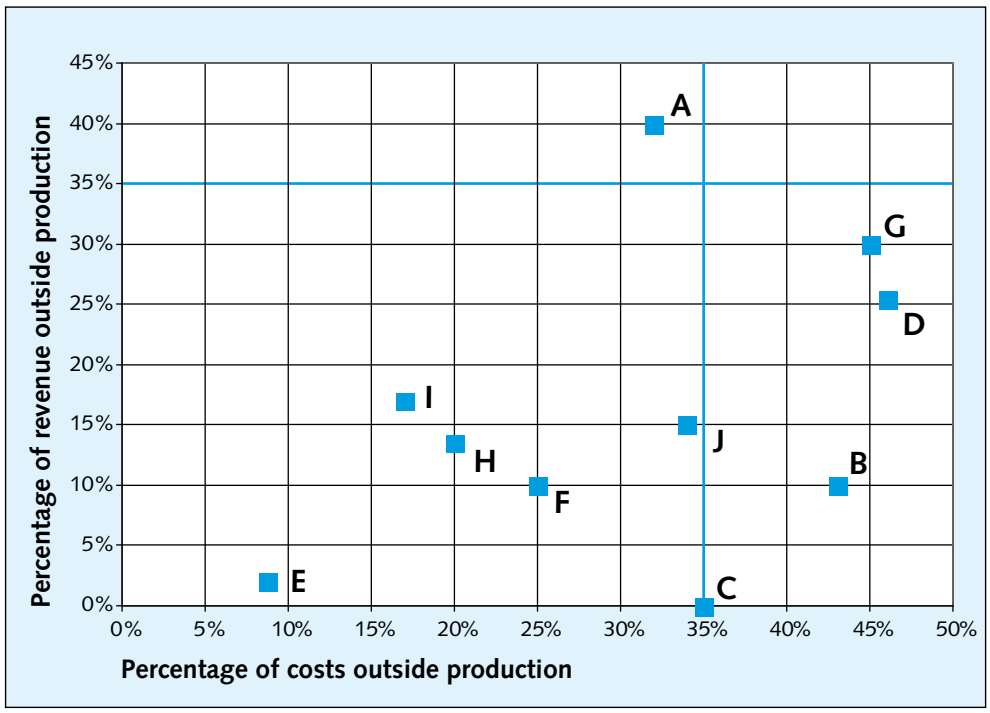

Figure 8 – quantitative mapping of ten companies in the South East

The results of this process are shown in the graph above and conversations with the companies confirmed their general positions as shown by the dividing lines. No company was a service manufacturer, the majority were traditional manufacturers. Overall, the companies found the framework useful for situating themselves and to discuss what their value creation was based on now and potentially in the future.

Value outside of the company

The first two elements of the framework, the company's value added score and the categorisation according to costs and revenues, have been strongly focused on the company itself. As highlighted above there are other stakeholders for whom we need to answer the question on whether the company is high value or not. In order to answer this question we have constructed a matrix of external value which attempts to provide metrics for each stakeholder and each type of value for a company.

The matrix is based on the stakeholders and types of value outlined in the sections above. Considering the company to be addressed in the first two measures, we have focused the stakeholder set down to the country (including the general public not associated with the company), investors and employees. In terms of value, we then have the three types we outlined above – financial, strategic, and social.

Putting the matrix together, we have stakeholders in each row and the different types of value as each column, as shown below.

Stakeholder/Value	Financial	Strategic	Social
Country			
Investors			
Employees			

Figure 9 – Basic structure of the external value matrix

With the structure of the matrix in place, the key question is what metrics are appropriate to use in each cell, and how do we understand whether a company is high value or not?

There are many metrics that could be assigned to each cell of the matrix, and as part of the company workshop (with other attendees to represent the broader stakeholders) a brainstorm was held to develop metrics for each stakeholder and type of value. Groups were asked to work stakeholder by stakeholder on what they thought were the best metrics, and each participant then scored the metrics. The full list of metrics from the workshop is given as an appendix, and the highest ranking metrics in each category are shown in the diagram below.

	Financial	Strategic	Social
Country	• GDP impact payed	• Sustainable employment • Intellectual capital development • Employee capability development	• Minimal environmental impact
Investors	• Return adjusted for risk • Long term growth	• Adaptability, sustainability	• Acts ethically
Employees	• Pay, wages • Funding of retirement	• Lifelong learning • Opportunities for growth	• Personal development • Social interaction • Work-life balance

Figure 10 – External value matrix for a company

The matrix provides a framework for thinking about whether the company is high value beyond its immediate financial performance. However, it does not attempt to address the issue of trade-offs between each stakeholder, as that will be specific to the context of each company and the stakeholders in question.

A key task for further work for this project would be to operationalise this matrix, so that it could be tested with companies. A core element of such work would be to review existing corporate social responsibility (CSR) scorecards and frameworks so that in the same way as using value added we could build on data that is already available.

Cases of HVM

In order to have a better understanding of what a high value manufacturing company might look like, the project team developed a number of short case studies of companies who would be considered to be high value. The companies were all involved in the stakeholder workshop that was held as part of the project, and all have contributed to these short case notes reflecting on the ideas put forward in the framework outlined above.

The companies who agreed to participate in the case studies were Cadbury Schweppes, Eurotherm, GlaxoSmithKline and GB Innomech.

Cadbury Schweppes

The Cadbury Schweppes group comprises a confectionary business and a soft drinks business. Both businesses derive their revenues from product sales to retailers. In addition to its manufacturing base it has a significant proportion of its costs in the maintenance of its brand's equities. The soft drinks business has an additional services revenue dimension in that there are a number of bottling franchises. As well as a strong UK presence, the business has a significant global reach.

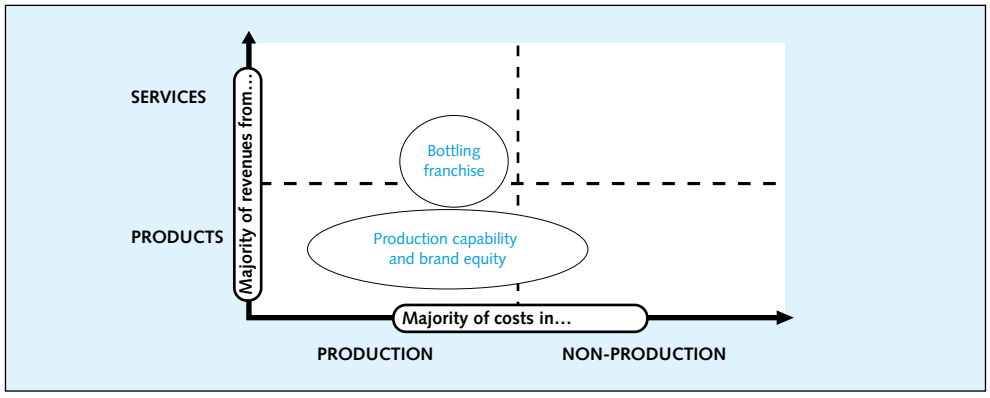

Figure 11 – Mapping of Cadbury Schweppes

Cadbury-Schweppes was 51st overall on the 2004 R&D Scoreboard and is 2nd in its sector (£53M investment in R&D, R&D is 0.8% of sales) only beaten by Unilever. Companies selling only branded products tend to have higher R&D investment levels (to deliver differentiation through design, special ingredients etc) than those manufacturing products branded by retailers, which tend to be less innovative. Cadbury Schweppes is a research collaborator with Reading Scientific Services Limited (RSSL). That said, the primary value creating activities of the business are design & development, production, logistics and sales & marketing with the core focus being production quality and marketing capability.

This reflects their strategy as a brand led, customer-focused company. In the value-added scorecard in 2004 Cadbury-Schweppes was ranked 31st overall and was 2nd in its industry sector (food producers and processors).

Year	Value added (£M)
2004	2266
2003	2021
2002	1881

Table 2 - Value-added figures for Cadbury-Schweppes

The value proposition to the immediate retail customer is built on brand(s) investment, margin and production and distribution excellence. The value proposition to the consumer for both confectionary and soft drinks is a mixture of quality, style, taste indulgence and health.

Investors see the company as a solid and reliable stock. The Cadbury Schweppes portfolio none-the-less continues to be under constant review. The share price has outperformed the FTSE 100 in recent years. The business has a record of growth and a pattern of successful acquisitions and divestments.

Cadbury Schweppes has a significant UK footprint and, as such, is a major employer and financial contributor to the country. They also maintain a UK based R&D and product development capability. The other distinctive UK contribution comes from the 'Britishness' of some of their global brands and their unique contribution to UK tourism. The company is also the sponsor of the UK television series 'Coronation Street' and the winner of numerous 'business in the community' awards.

There are several areas in which Cadbury Schweppes is a net contributor to the UK skills pool. It is, for example, a company who would add value to the curriculum vitae of any marketing professional. They also develop the national skills capability in food science and FMCG production.

Cadbury Schweppes plc was named Britain's "Most Admired Company" for 2004 in the Management Today Awards after voting by 220 peer organisations. On the international stage, the Cadbury name carries a long and impressive history of social concern, which reflects in the ethos of today's company. It has a high focus on ethical trading and environmental responsibility.

Eurotherm

Eurotherm Limited is a supplier of control, measurement and data recording instrumentation. Annual turnover is £122 million. Worldwide employees are 1200 of which 460 are UK based. The company is now a division of Invensys plc. The company manufactures in Europe and USA. A new production facility in Shanghai will serve the China market. Eurotherm is a supplier to the processing and equipment manufacturing industries. In the UK, design and assembly is carried out at two sites in Worthing, West Sussex. Product offerings include temperature and process controllers and indicators, data recorders and data acquisition systems, and complete process automation solutions. The product is typically uniquely customized and commands a premium price. The global spread of sales is currently 60% Europe, 20% North America and 20% in Asia Pacific.

The essence of value creation in Eurotherm is in the expert understanding of their customers' operations and the ability to exploit that knowledge to provide technical solutions that significantly enhance the customers' efficiency.

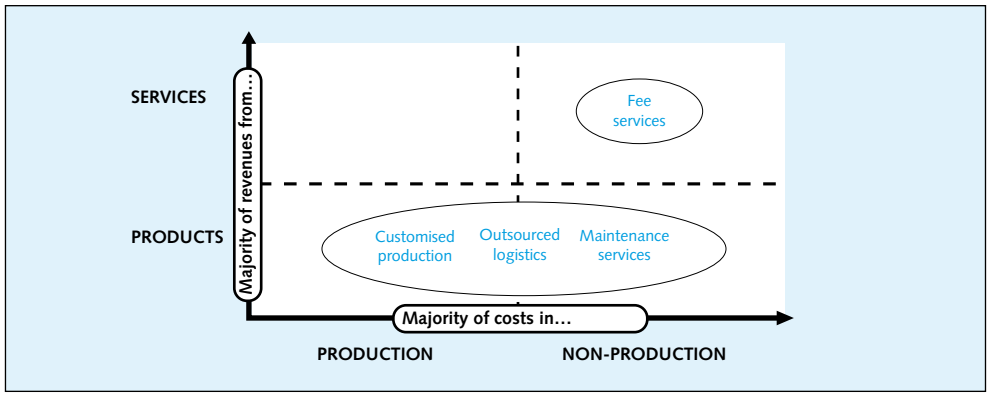

Figure 12 – Mapping of Eurotherm

Today's business is focused on the design and development of customised products and solutions with very personalised customer support services included in the solution. Longer-term strategy will extend the small fee services activity that is already underway.

The UK based R&D investment represents 10% of the cost of sales of the UK company. The split of manufacturing costs are 83% bought-in materials and 17% labour content. The overall direct labour content at 8% of cost of sales is thus relatively small. Distribution is entirely handled by an external provider and represents about 2.5% of the cost of sales.

The value added (sales less the cost of bought-in goods and services) is in excess of £50k per employee.

The customer value proposition is built on expert application knowledge, distinctive design and the ability to offer and participate in total solutions. The additional advantage they enjoy is the potential for solution synergy with other Invensys companies. The flexible and responsive distribution is essential to the total customer offer but not a differentiator. A feature of the value added is the ability to offer small customers the same level of support as large customers enjoy.

As a medium sized enterprise, all be it part of a larger group, Eurotherm's contribution to the community is inevitably most significant at a local and national level. Their UK footprint includes an engineering skilled workforce in an area of the South Coast from which other technology employers have recently withdrawn. It has been the practice to sustain an investment in the training and skills of this technical workforce. Eurotherm enjoys close research collaboration with the University of Sussex.

Eurotherm operates within the Invensys intent on environmental issues. Sustainable development is recognized as central to the customer offer. Invensys environmental performance has been benchmarked using the annual Business in the Environment (BiE) Index of Corporate Environmental Engagement. In the most recent Index, Invensys was ranked 33rd out of 192 participating organisations in the FTSE 250.

GlaxoSmithKline (GSK)

GlaxoSmithKline (GSK) is a world-leading pharmaceutical company headquartered in the UK. The company is estimated to have seven percent of the world market in pharmaceuticals with operations in the UK and the USA.

In GSK there is a functional distinction between manufacturing entities and the commercial operations that handle all sales and marketing. The manufacturing capability in GSK comprises a global network of primary (large scale manufacture of actives) and secondary (conversion to finished product) manufacturing sites. They operate in a highly regulated industry. Central to their value creation are the technologies and processes that deliver patented drugs to patients in a safe and compliant manner. New products must be simultaneously launched in multiple countries. Their drive is to develop production processes that are continuously sensitive to the properties of the product under manufacture.

The core of value creation is from the invention of new chemical entities that meet previously unmet medical needs. The R&D budget is 20% of the cost of sales. Patented products are marketed to prescribers on the basis of their unique capabilities. Generic products are marketed through wholesalers to pharmacists on the basis of price and supply continuity. The sales and marketing process is highly labour intensive and represents over 50% of the cost of sales. Essential to the overall value proposition is the synergy of R&D, manufacturing and commercial capabilities operating seamlessly for customer benefit.

GSK is primarily focused on the development, production and distribution of its own products.

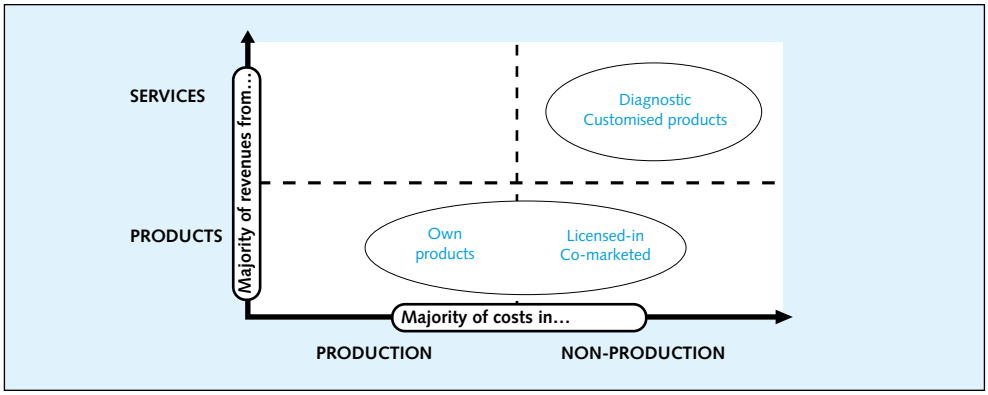

Figure 13 – Mapping of GSK

In addition to these products that have been developed entirely in-house, GSK does also 'in-license' other products at various stages of development, regulation and production to enlarge their commercial offer. In the longer term it is envisaged that unique formulations may acknowledge differences in populations.

According to the DTI value-added scoreboard in 2004 GSK was ranked 5th overall compared to UK companies and was 1st in its industry sector (Pharmaceuticals and Biotech). Value added is defined as 'sales less the cost of bought-in goods and services).

Year	Value added (£M)
2004	12,538
2003	11,631
2002	10,445

Table 3 - Value-added figures for GSK

In the DTI R&D scoreboard for 2004, GSK was ranked first in its sector (£2.8B global investment in R&D) and first overall. More than half of that spend is in the UK.

Investment analysts see GSK as a large-capital growth company and is expected to match the market with very low risk. The price-to-sales multiple is significantly higher than the average. The price-to-earnings multiple at 17 is close to the average for all stocks. Significant in the value perception of the company is the quality of their new product pipeline.

The company employs 44,000 people in Europe, with a significant number in the UK, and is the 4th largest UK company by market capitalization. GSK is an important contributor to the national skills pool in areas of chemical and pharmaceutical research, manufacturing, management practice and sales & marketing.

GSK is a global company with 29% of sales made in Europe and nearly 50% in the USA. R&D, manufacturing and sales and marketing are all global operations. The GSK umbrella brand adds an important integrity to the product brands internationally.

Total community investment in 2004 was £328 million ($600 million). This includes support for the elimination of lymphatic filariasis, a debilitating disease that threatens one billion people in the developing world. GSK is a leader in improving access to medicines in the developing world. Over 80% of shipments of preferentially priced tablets to help alleviate HIV/AIDS have gone to Africa. Five voluntary licences were recently granted to African companies to produce HIV treatments locally.

GB Innomech

GB Innomech is a Cambridgeshire based manufacturing solutions provider. They specialise in solving manufacturing problems from concept, design, prototypes and development equipment through to turnkey automation. They are additionally integrators for robotics, vision and servo systems. They have a market focus on the pharmaceutical and electronics sectors. Their business vision is to make UK industry world class and cost competitive.

The company's offering is a premium product. As such there is considerable value added to the materials bought in. The equipment and solutions provided enable their customers to add significant value to their operations, contributing to exports and innovation as well as potentially avoiding the pressure for off-shore production. As an employer Innomech recruits and develops a high skill workforce. They currently employ 26 people. Employees enjoy above-average remuneration as well as significant investment in the company's business success. Much

of the output is exported directly via our customers as agents. Additionally much of the output from the installed Innomech systems is itself exported.

The company also actively lives its high values for environmental impact. Their aim is to make their site self sufficient in all but telecom systems. The company investment strategy is for long-term stability and growth. The central core of the business, representing about 66% of revenue, is the design and manufacture of one-off machines and solutions.

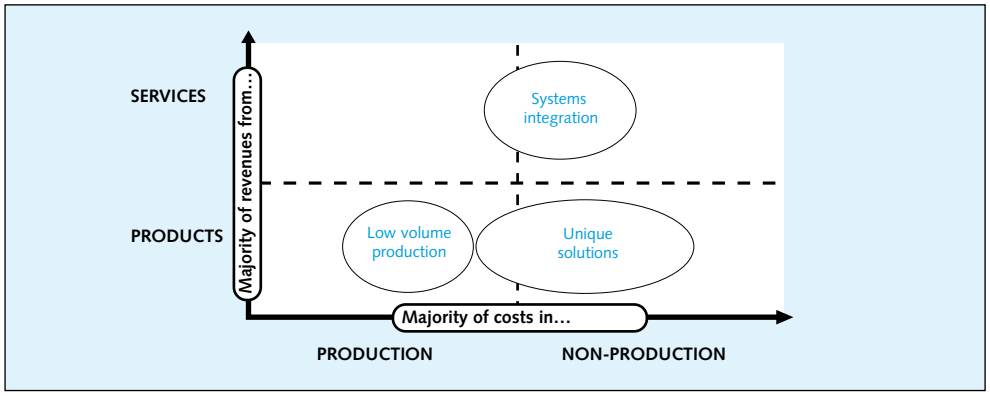

Figure 14 – Mapping of GB Innomech

Alongside that they also produce repeat builds of machines. The number of repeat machines required is increasing. Typically used for production ramp-up, these machines may have limited expected useful life. Such scale-up production of a product may need 5-10 machines per year over 2-3 years for example. The repeat build machines provide a low risk secure income to balance the higher risk R&D and new machines development. Innomech also operate as a systems integration partner for automation systems and equipment from other leading providers.

Innomech positions itself as "an expert provider of advanced automation to solve difficult manufacturing problems." They seek to translate their advanced manufacturing know-how and innovation into affordable high performance manufacturing systems that deliver high returns for customers.

Most of the costs are in research, design and development and production (manufacture of equipment). The revenues come from delivering a working solution (not typically for the R&D or design itself). Innomech do undertake some paid feasibility studies. Research typically represents 2-5% of project costs and contributes to their ability to offer follow-on service support.

The customer value proposition is based on a commitment to finding the very best solution to their problems to help them maximise their business return.

Year	Value added (£M)
2005 (est)	1.85
2004	0.90
2003	0.52

Table 4 - Value-added figures for GB Innomech

On a turnover of £1.5 million in 2003/4, the value add per employee was £47,700. Profit as a percent of sales was 11.8%. The continuing annual investment in R&D is approximately 60% of sales revenue.

On an international level, some of the new projects they are working on will be used to produce new global products. Some will be consumer products while others will have a significant benefit to humanity.

The company has high aims for its ability to make a difference in the area of environmental responsibility. GB Innomech were presented with a Major Commendation Award from the Business Commitment to the Environment (BCE) for the design and build of their new business premises, the Innovation Centre. These premises, which they developed themselves, comprise an ecologically friendly suite of offices and a workshop. The whole project was focused on maximising the use of natural resources and minimising waste.

Conclusions

The definition of high value manufacturing is more complex than may be first thought. As there are many stakeholders who may ask whether a company is high value or not we have to consider a broad set of metrics when answering the question.

Due to the level of complexity in types of value and number of stakeholders a simple definition of high value manufacturing is not a feasible goal. While a definition may be drawn up for individual stakeholders, that will avoid the main goal for this kind of work – to bring together the perspectives of the private and public sectors and to engage in productive discussion on the trade-offs between the various stakeholders involved.

As we have seen, manufacturing and production are terms that are not well specified in most discussions on companies. A key point in defining HVM is that manufacturing is not production and vice versa. The extended definition of manufacturing allows us to see how services and production interact for many companies, creating new types of manufacturers who may or may not have a strong focus on production.

In developing a new categorisation for manufacturers it should be emphasised that there is no judgement as to whether some are high value and some are not. There are high value manufacturers in each of the four types of manufacturer identified in our categorisation and so there is no overarching trend in one direction or another.

A key to structuring the external value matrix was to realise that there were other types of value beyond the financial. This allowed us to include elements that are more qualitative, such as community involvement, and broadened the potential use of the framework.

The challenge for the UK is to make all manufacturing companies high value – whether they fall into the traditional manufacturing category or they are service manufacturers. We will have companies in each category and to ensure that they can compete on a global basis they have to strive to be high value to as many stakeholders as possible.

Follow-on work

This work has led to an initial framework and a clarification of the issues surrounding the definition of high value manufacturing. There is much work that could follow from this report, and it is hoped that work will continue in this area to support companies and policy-makers.

The key areas for further work include:

- How can we link the R&D scoreboard ranking and the value added score for companies?
- Can we operationalise the framework so that companies could use it to self assess?
- Do the new categories for manufacturers help in refining national statistics between the macro level and that of individual SIC codes?

Appendix

Workshop output – metrics for external value matrix

The following is the list of criteria developed as part of the workshop brainstorm for the external value matrix. Each stakeholder is shown with the criteria and their aggregate score from the brainstorm participants.

Stakeholder	**Criteria** (vote in brackets)
Country	Sustainable employment (20) Tax payed (corporate and PAYE) (4) Trade balance (1) GDP impact (direct and indirect) (9) Employee capability development (3) Minimal environmental impact (2) Intellectual capital development (9) Technological independence Currency risk management International prestige and reputation Route to market for science/education base (2) Support for general national infrastructure Attract skills from other countries (1) Brand reputation (Britishness) Reputation for innovation (1) Reinvest in science (FE, universities) (2)
Investors	Cash flow – sustainable dividends High growth, low volatility, share price Return adjusted for risk (12) Perks Acts ethically (3) Short term returns Long term growth (7) Engage with company/product goals Reinvestment (1) Adaptability/sustainability (6) Loyalty/employee share ownership (1) Production facility (visible tangible investment) Lower risk Longevity Communication and no surprises (1) Well communicated strategy Intellectual property/asset base Strong management

Stakeholder	Criteria (vote in brackets)
Employees	Pay, wages (9) Fund my retirement (4) Pride in working for company Work-life balance (1) Lifelong learning (2) Promotion Personal development (12) Keep safe at work (1) Enjoy being at work, having fun (1) Listens to employees (1) Social interaction (3) Social status Free chocolate Communication with employees Job security Part of a company's success Provides a sense of belonging Provides opportunities to grow (4) Good working environment Pride in the product/job Good Ts and Cs, flexible working (1)
Other	Recycling Energy efficiency (3) Safety Environmental leadership (6) Reduction of pollution Regeneration Higher value/quality of employment (2) Inspire next generation (training, direction ..) (4) Image in schools, community (1) Positive global impact of activities – ethical trade (1) Advances society (4) End user versus payer Resource utilisation (natural) Community waste management Critical mass Scale effects Global influence and impact on policy (4) Retention of skills/people

Acknowledgements

The Institute for Manufacturing would like to thank all of the company attendees who took the time to participate in our workshop and especially to those companies who agreed to spend further time working on case studies with us.

The author would also like to acknowledge the contributions of Paul Christodoulou and Phil Hanson of the IfM, and the support and encouragement provided by Mindy Wilson at the Confederation of British Industry (CBI) and Keith Hodgkinson, Stuart Barthropp and Dan Ninan at the Department of Trade and Industry (DTI).

Finally, the project team would like to thank the members of the DTI's Manufacturing Forum for their support and constructive comments throughout the project.

Department of Trade and Industry

THE VOICE OF BUSINESS

This document is the final report produced as part of a project co-funded by the Confederation of British Industry (CBI) and the Department of Trade and Industry (DTI) to investigate the definition of High Value Manufacturing. The report contributes to the work on improving the understanding of manufacturing that is being taken forward by the DTI's Manufacturing Forum, a joint industry and Government-led body responsible for the development and implementation of the Government's Manufacturing Strategy.