MANUFACTURING, PAST, PRESENT AND FUTURE

Part 2: The Present

David Little, FIOM, University of Huddersfield

INTRODUCTION

This is the second part of a three part series based upon David Little's inaugural lecture at the University of Huddersfield.

MANUFACTURING : THE PRESENT

Part 1 in the series examined the important change from craft based manufacture to mass production. This enabled the low cost manufacture of large volumes of standard goods such as clothes, furniture, domestic appliances and so on. The change was important because the low cost of manufacture placed these items within reach of the majority of the population of all developed nations. In this way mass production both fuelled and fed the rampant consumerism of the post war period and changed the lifestyles of millions with over 40% of UK employment based on the factory system.

However, all was not entirely rosy. The UK's share of world trade was declining rapidly, our productivity was comparatively poor and many industries had serious quality problems.

So, where are we now?

This is a good question, but a difficult one to answer because the goal posts for manufacturing keep moving. As can be seen in Figure 7, many markets changed dramatically from demand for high volumes of standard items to demand for smaller volumes of products with greater variety.

The change invalidated the mass production approach and required a totally different approach to manufacture. Responsiveness became the key and the term 'agile manufacture' was born. Agile manufacture assumes a change from a make-to-stock to make-to-order philosophy and requires major changes to production processes and the information systems that control them. In particular, emphasis is placed upon demand and supply chain management.

FIGURE 7:
The Moving Goalposts of Manufacturing

FIGURE 7

THE MOVING GOALPOSTS OF MANUFACTURING

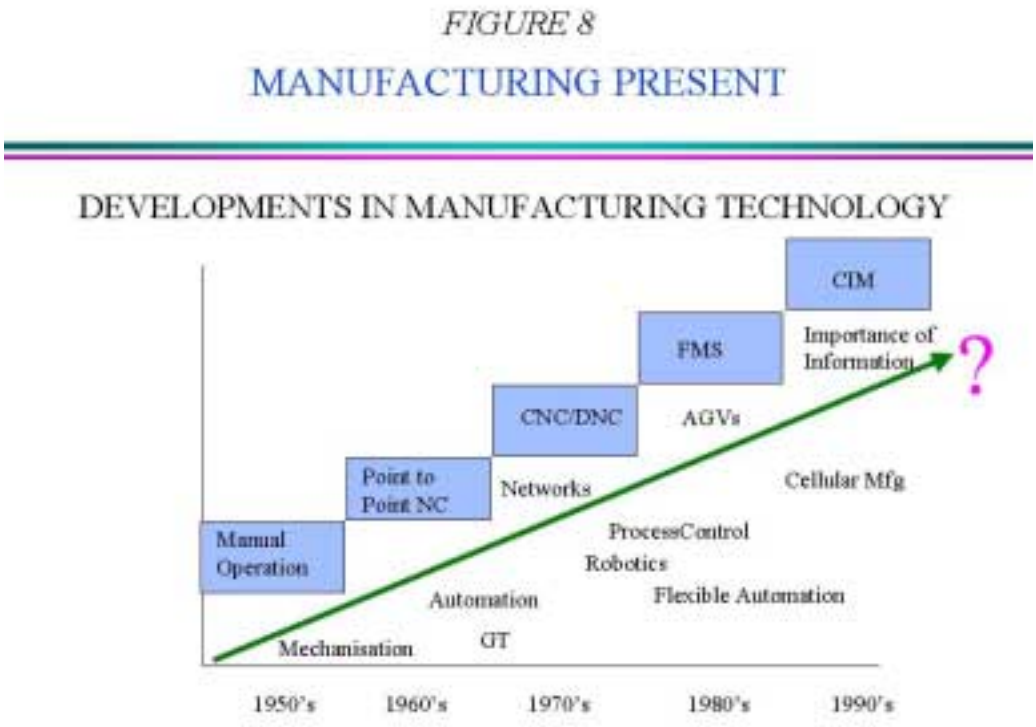
Initially the UK did not respond well to these changes. In tables of GDP per head, by 1970 we had slipped to 11th place and, in the 1996 third annual report on competitiveness, we had fallen to 16th place. In fact this was an improvement - up two places from the two previous years. But we also have some good news. Our comparative productivity was rising steadily, as supported by the table of output per head below:.

1960 - 1969	+35%
1970 - 1979	+18%
1980 - 1989	+57%
1990 - 1996	+20%

The result of this is that the 1996 worker is three times more productive than their 1960 counterparts – largely through improvements in manufacturing process technology and the planning and scheduling of manufacture. The catch is that whilst productivity has virtually doubled, we have not increased our total output nor significantly increased our share of world trade.

The ability to produce the same output with only half the workforce is a great indicator of the levels of automation and degree of plant complexity employed in our better plants. The key technology trends in the development of manufacturing technology are given in Figure 8.

FIGURE 8:
Developments in Manufacturing Technology

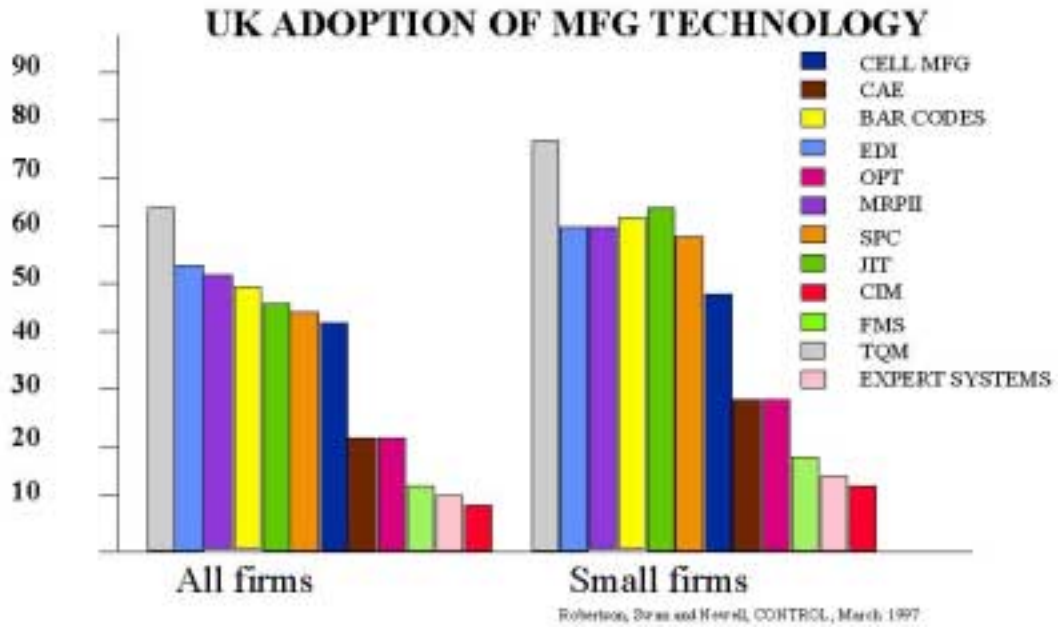


One problem has been the UK's comparatively poor level of capital investment in manufacturing technology. Robertson, Swan and Newell demonstrated modest adoption rates in a report published by Control (Robertson, Swan and Newell, 1997) and shown in Figure 9. Too often our plants are running equipment that has passed its sell by (scrap by?) date. The cynical view is that much of our productivity improvement is by the inward investment of foreign companies, for example Nissan, Jaguar and Rover. Whilst partly true, great strides have also been made by many indigenous British firms.

FIGURE 9:
UK Adoption of Manufacturing Techniques

FIGURE 9

MANUFACTURING PRESENT



It is important to remember that technology should not be an end in itself. General Motors pursued technology relentlessly in an attempt to compete with the Japanese car makers. They even invented the Manufacturing Automation Protocol and inflicted this on the world. It is said that GM spent so much money on pursuit of technology that they could have bought Toyota - they would have done much better to do so. They forgot two of the basic lessons of manufacturing:

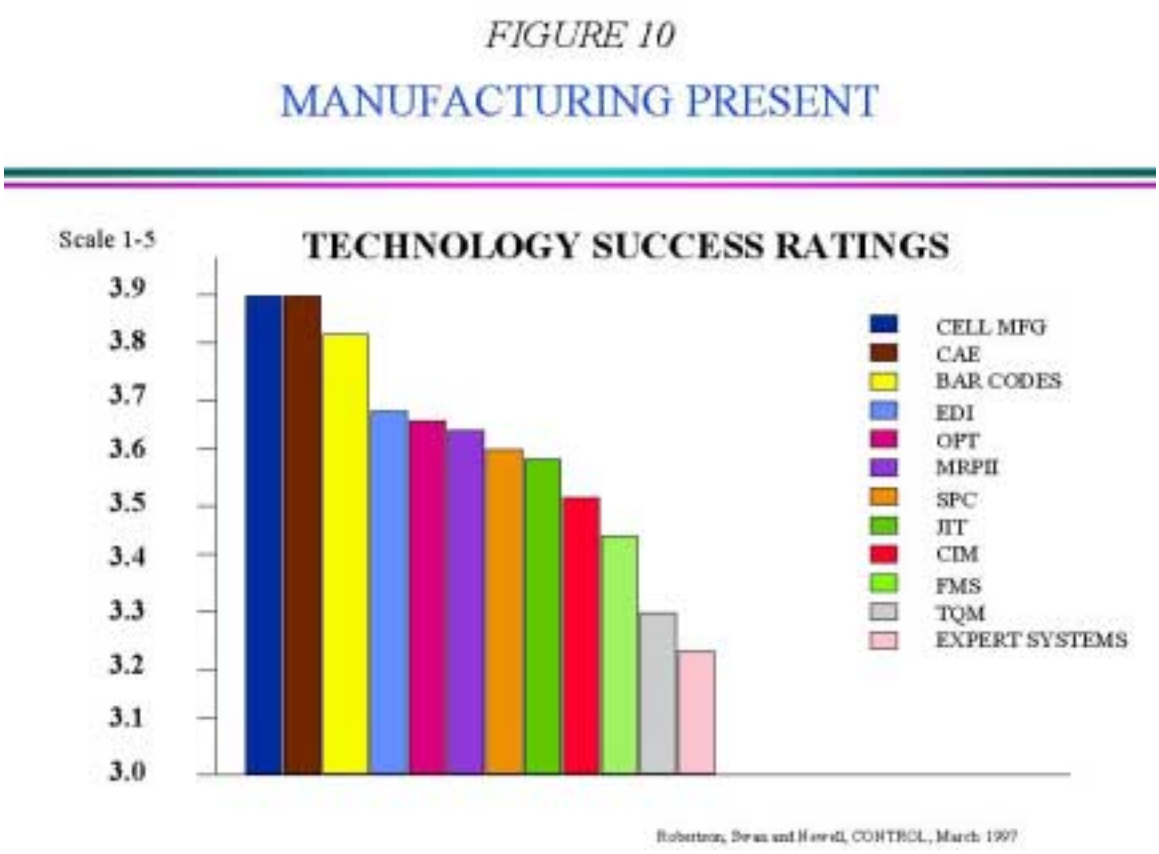
1 Technology and systems must suit the needs of the business
2 It takes people to make technology work

As a French industry minister once said "*There are three main paths to ruin that an industrialist can take: wine, women and technology*".

Women, he claimed, were the most pleasurable route to ruin, wine the quickest route but technology was the most certain.

However, whilst amusing, this is unfair, and should we remember the two rules, appropriate technology can be very effective, as the next Figure drawn from the work of Robertson, Swan and Newell shows:

FIGURE 10:
Technology Success Ratings



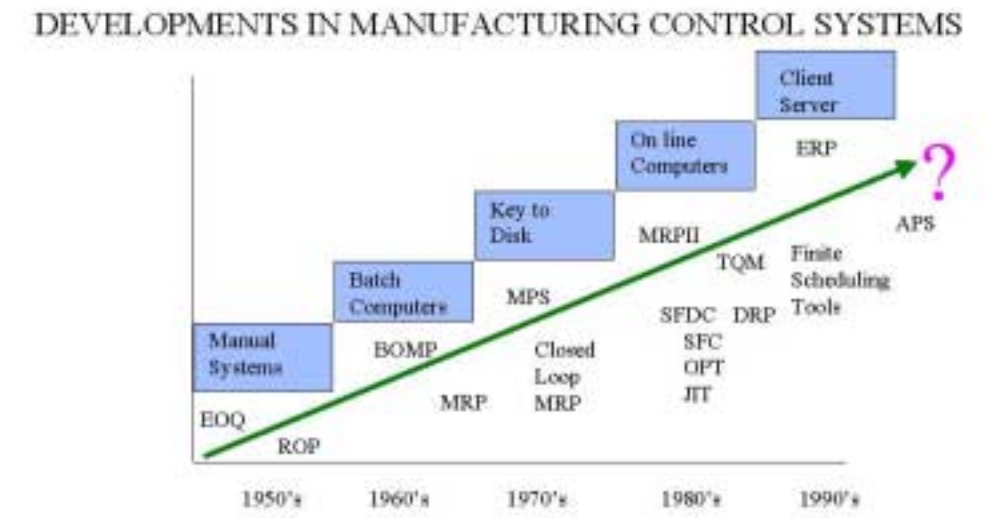
They found adoption rates for the 675 responding firms ranging from 64% for TQM through about 50% for EDI and MRPII (although my own work would suggest a higher adoption rate for MRPII) through to less than 15% for FMS, expert systems and OPT. The four most successful of these technologies were cellular manufacture, computer aided engineering, bar coding and electronic data interchange.

But our productivity increases are not due to technology alone, a good thing bearing in mind our comparatively poor rates of investment. They are also due to the organisation and efforts of the people on the shopfloor and to the information systems used for the planning and scheduling of manufacture. This latter area, I believe to be critical. Key developments in manufacturing control systems are vital to this.

FIGURE 11:
Developments in Manufacturing Control

FIGURE 11

MANUFACTURING PRESENT



This is where my research colleagues, Keith Porter, Carl Gavin, Mathew Peck, Ralph Rollins, and I spend much of our time. A fast changing area where I detect the start of a paradigm shift, as evidenced by the recent upsurge in interest for the IOM's APS Special Interest Group. The challenge for the future will be meeting the needs of the smaller, wealth creating company who will dominate much of manufacturing in the new millennium.

However, the good news of dramatic productivity increases must be tempered with the knowledge from a world class manufacturing survey by Voss and Hansen. They compared UK manufacturing performance across a range of sectors but found that outside of the world class pharmaceuticals and aerospace industries, many of our sectors are not in the premier league. Indeed, it is vigorous overseas investment that has kept some of the other sectors afloat. This is a major cause for concern.

The World Economic Forum produce a competitiveness league which is based on a complex index of GDP growth per person and a competitiveness index. For the portion I have shown we can see UK right in the centre of Figure12. The target is to be in the top right hand corner with high competitiveness and high GDP growth. The UK is shown to be 24th in the league and this sounds bad. But when we examine the data, the picture starts to look rather better.

FIGURE 12:
Global Growth and the Competitiveness Index

FIGURE 12

MANUFACTURING PRESENT

Although we are placed 24th in the league, most other developed countries lie below the line with the newly industrialised countries above it. We are behind US, Norway, Canada, Australia and Denmark but ahead of Japan, France, Germany and Italy. The recent performance of the Euro, which John Major so wisely withdrew from (and on which Tony Blair bravely avoids a decisive approach), suggests that we are not yet finished as a manufacturing nation, although the high pound is hurting northern companies.

According to the World Economic Forum, we score well on openness to trade, finance, and flexibility (we have had to be flexible to survive). We have however, been weak on fiscal policy (when did the treasury ever get anything right?), infrastructure, technology and the labour force. Heavy issues for manufacturing.

Manufacture and distribution are becoming technology dependent for most sectors. Yet we still tend to operate in what Brian Small called 'islands of automation' with hardware separate from people and information poorly structured. We are not using information, people and technology in an optimum way. Current definitions of computer integrated manufacture seem a little dated and reflect this limited perspective in Figure 13.

FIGURE 13:
Computer Integrated Manufacture

FIGURE 13

MANUFACTURING PRESENT

COMPUTER INTEGRATED MANUFACTURE

- Management of change, flexibility of enterprise operations and efficient use of enterprise assets: people, capital investments and information

  CIMOSA: Open Systems Architecture for CIM

- A concept of linking and coordinating a broad array of activities in a manufacturing business through an integrated computer system

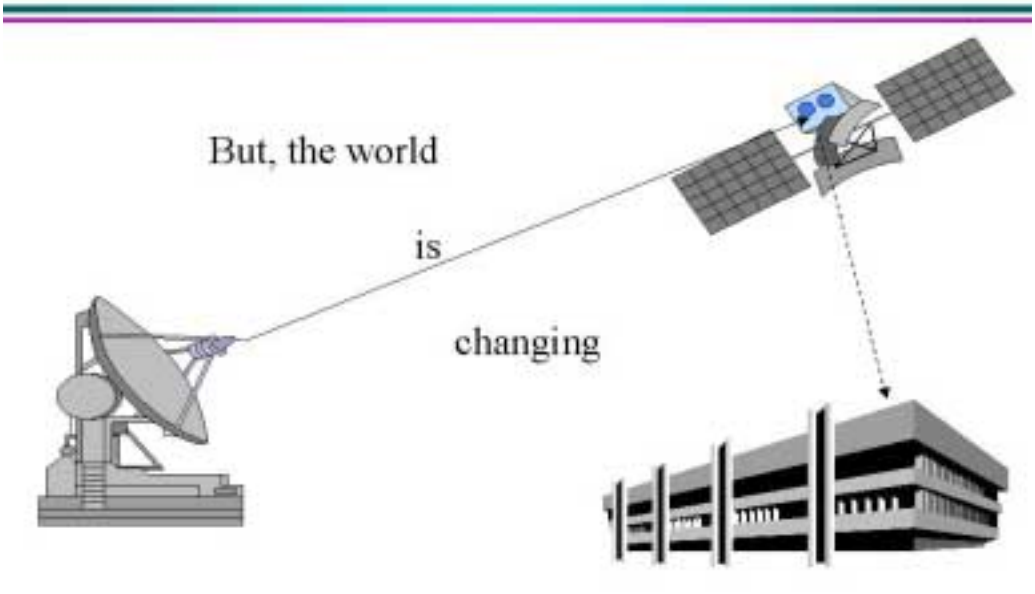
  Dilworth: Operations Management

The pace of change is accelerating. New technologies, for example the Internet with its implications of e-commerce, are emerging and challenging the status quo. We need a mindshift to compete in the future.

FIGURE 14:
The Changing Pace of Technology

FIGURE 14

THE CHANGING PACE OF TECHNOLOGY



We must extend our manufacturing systems to customers with direct access to their data and reach out to suppliers, who become responsible for component design as we outsource more and more and the supply chain becomes a network. We need an improved view of manufacturing. In Part 3, I shall attempt to provide this new perspective.

About the author

Professor David Little FIOM, worked in industry after graduating from Loughborough University with GEC, A Reyrolle and Molins, ending up as a senior manager in their Spares Division. He then moved into higher education at Huddersfield Polytechnic Business School, leaving to undertake research at Liverpool University where he became a senior lecturer and Sub-Dean. He recently returned to the University of Huddersfield as Professor of Manufacturing Systems. Currently Director of Research and Postgraduate Studies in the School of Engineering. He is a past president of The Institute of Operations Management.