ManVis Report No.4

Overseas views: International perspectives on the future of manufacturing

Finbarr Livesey
Institute for Manufacturing
University of Cambridge

UNIVERSITY OF CAMBRIDGE
Institute for Manufacturing

Contents

1 Introduction

The purpose of this chapter is to provide an international context for the results of the pan-European Delphi that has been completed for the MANVIS project. It is based on discussions in three countries, China, USA and Japan, with further desk research on current thinking and future oriented work on manufacturing.

In looking outside the European Union three countries – the United States, Japan and China – were identified as benchmarks. The goal was to provide a comparator against which the European results could be tested. These countries were chosen as obvious competitors to the European Union in an economic sense, and as key countries in the evolution of manufacturing.

The common theme for manufacturing in each of the countries appears to be uncertainty. In the United States this is an uncertainty on whether manufacturing will remain a vibrant part of the economy. In Japan it is whether the manufacturing sector can be revitalised. In China it is whether the rapid growth of manufacturing can be managed effectively keeping the economy in balance.

Strong divergences in the way manufacturing is perceived are important to understanding the possible future trajectories in each country. While manufacturing has a strong place in the self image of the United States, the share of GDP and employment attributed to manufacturing continues to decline. Will this take its toll on the desire of the American government to support manufacturing? In Japan manufacturing is seen as a core element of the economy which is growing in strength again. Will this assist manufacturing in remaining a cornerstone of the Japanese economy in the future? And finally, manufacturing has been the recent engine of growth in the Chinese economy. However, concern that there is an imbalance in the growth of the economy make take the focus from manufacturing to services.

Each country has distinct top level issues for the further development of manufacturing. In the United States there is significant concern about the rising costs of doing business (especially healthcare costs) and the levels of outsourcing (both production and service outsourcing). China is struggling with the management of growth in terms of balancing the structure of the economy and ensuring power and infrastructure is in place to support that growth. Finally, Japan is attempting to revitalise its manufacturing sector as it is dealing with high and rising wage rates and changing demographics. The interplay of these issues with the perceptions in of manufacturing in each country means it is very difficult to develop impressions of what the manufacturing landscape will look like in the long run.

The rest of this chapter is organised to provide an overview of projections of future economic growth in key economies around the world, followed by individual sections on manufacturing in China, Japan and the USA, with a final section reflecting on relevant results from the MANVIS survey. In this way, we hope to provide another perspective on the future of manufacturing around the world and to assist in putting the MANVIS results into a broader context.

2 Projections of economic growth

Looking into the distant future and trying to predict which economies will be up and which will be down may be an impossible task. However, these kinds of projections are our best available indicator of future trends, such as the potential for lead market development.

A recent study by Goldman Sachs developed a model to contrast the potential for growth in the BRICs economies (Brazil, Russia, India, and China) to that of the G7 and other nations (Wilson & Purushothaman, 2003). The table below compares current purchasing power parity (PPP) adjusted GDP rankings for the top 10 nations in 2004 (CIA, 2005) to those for the Goldman Sachs modelling out to 2050.

Rank 2004	**Country**	**GDP (2004 US$bn PPP est.)**	**Rank 2050**	**Country**	**GDP (2003 US$bn)**
1	USA	11,750	1	China	44,453
2	China	7,262	2	USA	35,165
3	Japan	3,745	3	India	27,803
4	India	3,319	4	Japan	6,673
5	Germany	2,362	5	Brazil	6,074
6	UK	1,782	6	Russia	5,870
7	France	1,737	7	UK	3,782
8	Italy	1,609	8	Germany	3,603
9	Brazil	1,492	9	France	3,148
10	Russia	1,408	10	Italy	2,061

Obviously, these are projections and so small changes to some of the assumptions in the model could change this order. However, if these projections were to be realised, it would move the top European nations from 5th – 8th down to 7th – 10th. This shift indicates a possible weakening of overall economic influence in the long run no matter what happens with manufacturing.

However, there is one interesting point that should be noted especially in the context of lead market development. Those economies which are moving up in the rankings may not have the largest GDP per capita in the 2050 timeframe. This may make the arguments about lead market development more complicated, as those economies which are the largest in macro terms may not have the purchasing ability to support lead markets at the level of the individual.

The graph below shows the projected ten largest economies, shown in rank order, along with the projected GDP per capita.

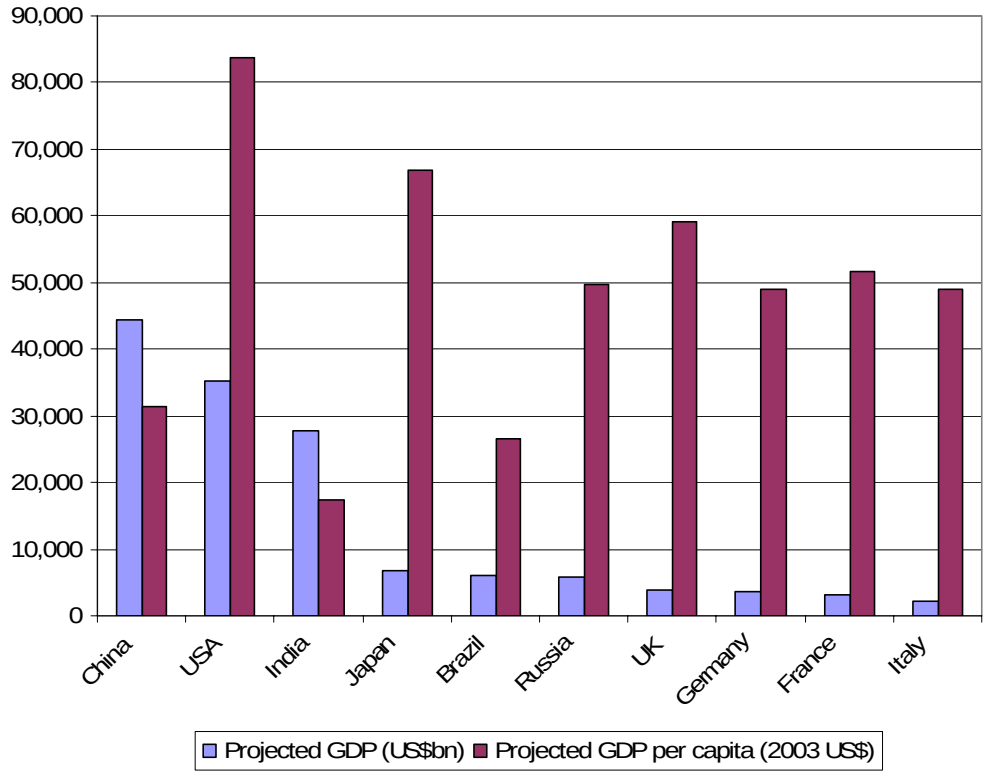


Figure 1: Projected GDP and GDP per capita of the ten largest economies

Of the BRICs economies, Russia is the only one to have come up to a comparable per capita GDP with Europe, the USA and Japan. China, Brazil and especially India are still far behind other nations on this measure in this long run model.

Again, these are broad projections which cannot take into account large disruptive events, such as wars or large natural disasters. However, these projections do indicate the emergence of a more complex economic geography surrounding the development of manufacturing.

3 Manufacturing in China

Commentators, academics and industrialists are all speaking of the significant growth of the Chinese economy and the impact it will have on the structure of global industry. It remains to be seen whether China will realise its phenomenal growth potential.

3.1 Structure of the economy

The structure of the Chinese economy has undergone a radical change in the past twenty years, with a significant shift away from agriculture towards manufacturing and services (World Bank, 2005).

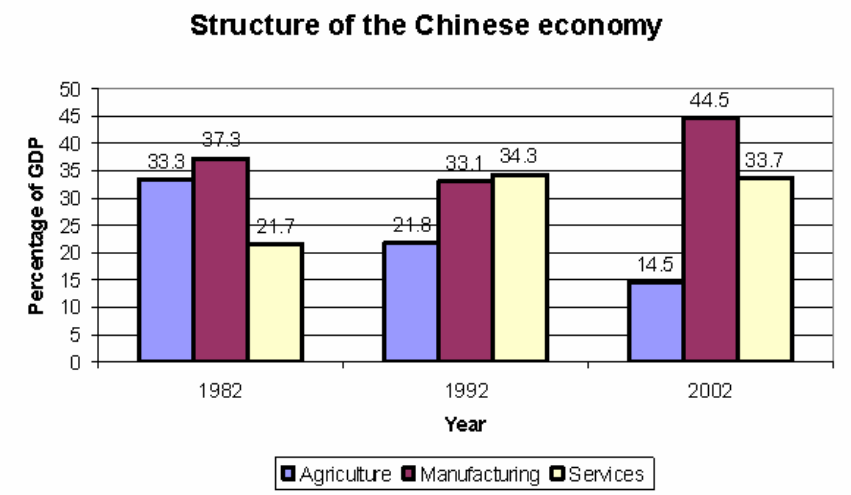


Figure 2: Structure of the Chinese economy

Within China, the growth of manufacturing has been uneven. The current pattern of industrialization has primary and heavy industries focused around Beijing, many multi-national companies (especially automotive manufacturers) locating around Shanghai. Shenzen is the centre of a large electronics and light engineering cluster, which extends through the Pearl River Delta, with Hong Kong providing a vital service and logistics hub.

This transition has led to a large increase in demand for raw materials and resources, and so has had major impacts both inside and outside of China. “The country’s enormous appetite for base metals, minerals and fuels has pushed their prices to new highs and created record profits for companies that extract and process them”(*Economist,* 2005). However, it looks as if expanding Chinese production, for example in steel, coupled with demand tapering will mean such increases should begin to flatten out. In terms of steel “China is estimated to produce about 330m tonnes of steel [in 2005], an increase of nearly 60m tonnes on [2004] and about triple the volume of 1997” (*Financial Times,* 2005). Overall, China is expected to begin having net exports of steel in 2006 which is compared to a net import of 15m tonnes in 2004.

3.1.1 A low cost economy?

When European commentators speak about manufacturing in China, most describe it as a low-cost location. While this is true on average, it does not reflect the great variation of wages across the country. A recent report for the Bureau of Labor Statistics (Bannister, 2004), estimates that average yearly earnings for Chinese manufacturing employees were less than $1,300 in 2002, with urban workers having the highest average of $2,100.

However, looking in more detail at individual locations highlights the differences that exist across the country. At present in Shanghai, it is reported that there is significant wage inflation, as the demand for specialised skills is very high. According to a Shanghai Labor and Social Security Bureau survey, average annual salary for a local worker was $5,363 in 2002, with foreign firms paying a little more, at $6,886 per year (McDaniels, 2004). This may have impacts on the future level of inward investment to specific areas, as it becomes less competitive to locate to these pockets of higher relative cost.

3.1.2 Employment in manufacturing

As with wages, good figures for employment in manufacturing are hard to find, as the official figures are still weak and the statistical practices of the government are being updated. From the Bannister report (Bannister, 2004), there appears to be a peaking of manufacturing employment in China in the mid 1990s, with a subsequent shedding of jobs to just over 90 million by the end of 2002.

Year	Estimated manufacturing employment (millions)
1992	91.06
1993	92.95
1994	96.13
1995	98.03
1996	97.63
2002	92.2

With so much commentary on movements of production to China, the possibility that China lost manufacturing jobs since the mid 1990s is not one that is commonly discussed. This may reinforce the analysis of chapter four, that while production output globally continues to rise this does not imply an increase in manufacturing employment as productivity improvements continue to lower the labour input required across manufacturing.

3.1.3 Innovation and R&D

With innovation as a key focus for long run economic growth R&D is increasingly important in China. Comparable statistics of R&D investment have been hard to collate, but the latest available statistics from the Ministry of Science and Technology (MOST) indicate a significant rise in R&D spending since 1998 (Chinese Ministry of Science, 2003).

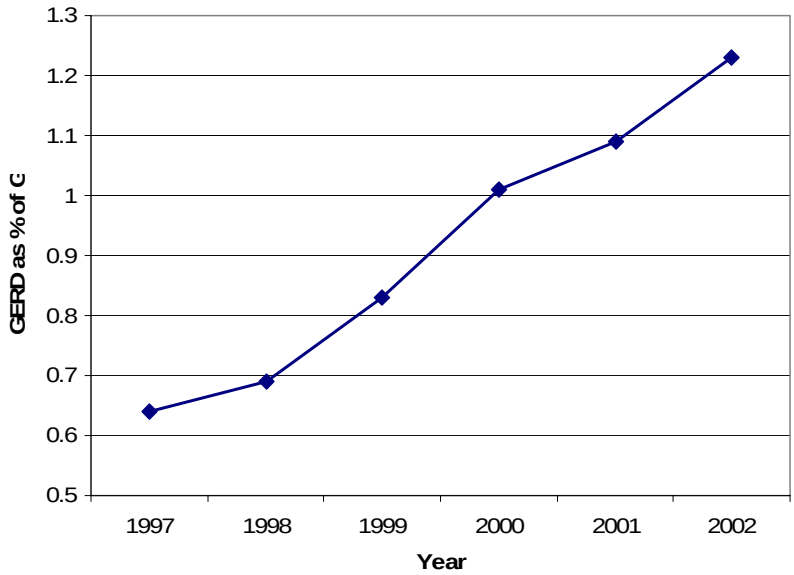


Figure 3: GERD as a percentage of GDP in China

This is an average increase of 14% in gross expenditure on R&D as a percentage of GDP from 1997 to 2002, with the 1998 to 2000 period having an even higher level of growth. At an average rate of increase of 10% per year, China would reach the Lisbon target of 3% of GDP spent on R&D by 2011, which would be a significant achievement (European Commission, 2003).

3.2 Major issues for Chinese manufacturing

As noted above, Chinese manufacturing faces a number of key challenges if it is to continue to grow. This section outlines those issues which were highlighted during our interviews, indicating potential barriers to the future success of manufacturing in the country.

3.2.1 Energy is a key constraint on further growth

With strong economic growth, there has been a significant rise in electricity consumption across the country. Currently, industrial usage accounts for about 75% of China's consumption, and in 2004 overall consumption rose 15% and has risen 13% in the first six months of 2005 (*Financial Times,* 2005). The rise in manufacturing output in China has demanded greater and greater amounts of electricity and throughout the summer of 2004 electricity restrictions were put in place, with manufacturers asked to stop producing on given days or at specific times. New plants are being built, but shortages will remain through 2007 at least.

The Chinese government is planning to bring 70,000 MW of capacity online this year, with similar amounts planned for 2006 and 2007. This is projected to ease shortages around Beijing and other areas, but Shanghai is predicted to suffer shortages through 2007. A continuing worry for the government is a cyclic state of feast and famine in electricity provision, as if industrial growth slows they will be left with significant overcapacity.

3.2.2 Current infrastructure cannot cope with current and future growth

The growth statistics for China are sometimes hard to fathom. For example, the population of the Pearl River Delta has grown from ~1 million to ~14 million in 15 years. The level of infrastructure development that is required to keep pace with such expansion is, to say the least, demanding.

3.2.3 Uneven growth may hamper further development

As shown by the Bannister work above, while broad labour rates are expected to remain flat, there are pockets of inflation, mainly around Shanghai, where there is a high demand for specialised skills. Some locations are likely to lose their cost advantage while other areas are not yet developed sufficiently (in infrastructure or skills terms) to be locations of interest to inward investment.

3.2.4 3.2.4 Chinese companies may not own the R&D carried out in China

Even as there is a reported rise in national spending on R&D, there are conflicting indications of where the funding is coming for that increase. A recent report from the Stimson Center commented that “The absolute number of foreign R&D centers or facilities in the PRC is unclear, and there is no definitive estimate. Recent Chinese articles put the number at anywhere between 120 and nearly 400 foreign-invested R&D centers through the PRC …” (Walsh, 2003). If the number of foreign companies owning R&D facilities continues to increase the headline number for R&D spend will improve, but the exploitation of that R&D may not directly benefit China.

3.2.5 3.2.5 Manufacturing may not receive continued focus from the national government

As the economy has moved from agriculture to manufacturing and services, concern has risen that it is overly dependent on manufacturing. This is leading to a push for the development of the service economy – both in terms of the internal service economy of China and the services based on products made in China. This may reduce the rate at which manufacturing expands within China as policy-makers attempt to achieve a balance.

3.3 Future vision of manufacturing in China

The Chinese government has been running a series of Foresights on a variety of sectors in the past five years. These give an early indication of the focus the government is likely to place on key sectors.

The most recent completed Foresight exercise ran from 2000 to 2003 and was carried out by the Ministry of Science (MOST). The exercise focused on three areas – Bioscience, Materials, and Information Technology. A number of key points emerged from this round of Foresight for manufacturing. These include:

- The emergence of distinct patterns of growth around the country e.g. South – electronics, textiles and light engineering; Shanghai – Automotive and 'high tech, Zheijang – SMEs, Beijing – HQs, North East – Traditional heavy and mechanical engineering
- The costs of professional staff in coastal areas are rising rapidly but apparently there is still a large pool of low cost labour in central and eastern China
- Government policies are moving towards thinking about the West but infrastructure is very weak in the West, hampering development
- Nervousness about overdependence on manufacturing
- Regions are increasingly being given local authority on industrial policy issues subject to central government oversight.

MOST is following this project with another Foresight which began in 2004 and again focusing on three technology areas. In this cycle, they are looking at Energy, Advanced Manufacturing Technologies, and Resources and Environment. The results of this project are expected in late 2005.

In parallel, the Chinese Academy of Sciences (CAS) has an ongoing project based in the Institute of Policy & Management which began in early 2005. This project is looking at the future of key sectors for the Chinese economy and includes automotive, aerospace, electronics, telecoms, and petrochemicals. The project will begin the Foresight part of its work in early 2006 and it is hoping to report in late 2007 or early 2008.

3.3.1 National Vision for Chinese manufacturing

At this stage there is no clear vision for Chinese manufacturing from the government. There appears to be a broad focus on high value-added production and innovation, but more specific focuses on modes of development or sectors is not apparent.

A growing concern is the balance of the economy between manufacturing and services. This may be detrimental to the continued expansion of manufacturing, as government focus and policy moves towards the development of the service sector.

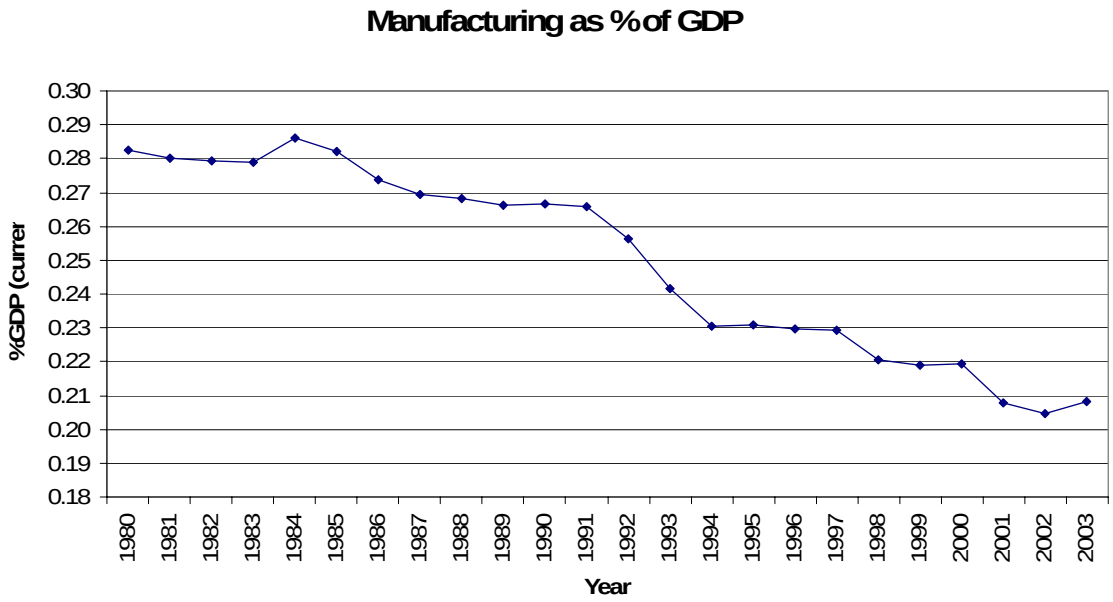
4 Manufacturing in Japan

Japan has been through turbulent economic times. In the 1990s real GDP growth varied significantly and was negative in 1998 and 1999. Now the country looks as if it is ready for growth, and some commentators are being bullish about its prospects. As the Economist claimed "Japan is back. It is being reformed. It is reviving" (*Economist,* 2005).

Manufacturing is seen as a key part of the Japanese economy in the future. An editorial in the Japan Times commented “Japan’s economic prosperity depends on its ability to produce and export quality products.” It appears that the success of Japanese manufacturing will dictate the overall success of the economy.

4.1 Structure of the economy

Japanese manufacturing has been through a significant recession in the 1990s falling from just under 27% of GDP in 1990 to approximately 22% of GDP in 2000. However, manufacturing is seen as a core element of the Japanese economy, and in terms of developed economies Japan has one of the highest proportions of GDP from manufacturing in the G8.



Source: Stat Japan

Figure 4: Manufacturing as a percentage of GDP in Japan

Since 2000, employment in manufacturing has fallen from just over 13 million to 11.5 million (Japanese Statistics Bureau, 2005). Manufacturing is currently 18.2% of total employment, down from its 2000 level of 20.5%.

It should be noted that the Japan Standard Industrial Classification (JSIC) were updated in 2002 to reflect changes in the economy. New categories such as ‘Information and Communications’ and ‘Medical, Healthcare and Welfare’ were established and the services categories were expanded. This means that strict comparisons cannot be made between figures for 2003 forward and those for 2002 and earlier.

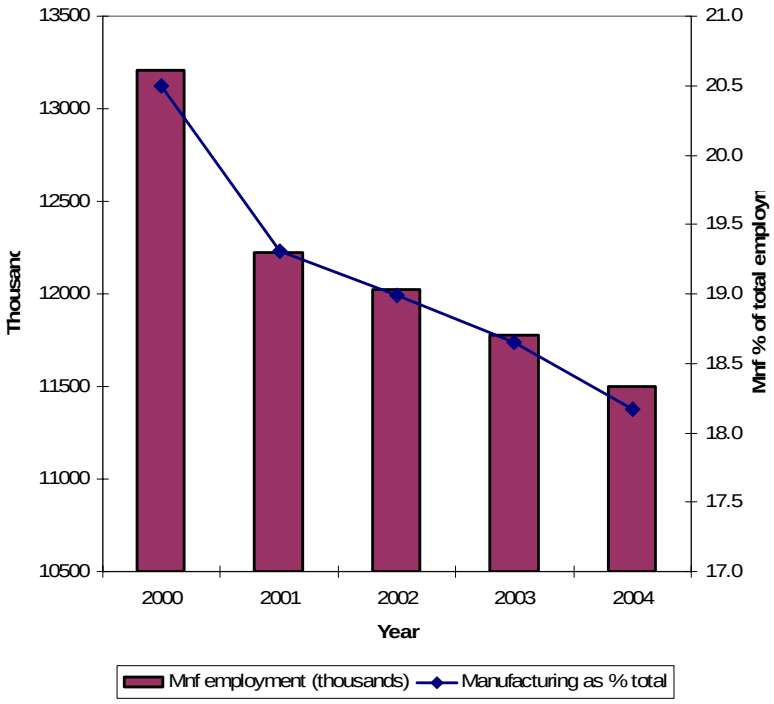


Figure 5: Manufacturing employment and percentage of total employees in manufacturing in Japan

Japan has had considerable success in using China as a low-cost base while keeping high-value activity in Japan. An example of this is the rise of EMS companies in Japan who have a significant production presence in China. This is reflected in the statistics for trade for Japan with other Asian countries. From approximately 30% of merchandise trade in 1990, Japan's trade with other Asian countries is now over 45% and continuing to rise. This trend is likely to continue and will form part of the landscape for Japanese manufacturing in the coming years.

4.2 Major issues for Japanese manufacturing

The Japanese manufacturing sector faces a range of problems, from the strength of the overall economy through to the changing demographics of the country.

4.2.1 Projected growth not strong enough

As the Japanese economy has struggled to recover, manufacturing is struggling to shed the external image of being expensive and troubled by the overall weakness in the economy. The latest projections from the OECD put the country's rate of GDP growth at 1.3% a year in the period to 2010, which is relatively low for a country trying to grow strongly (OECD, 2005). The OECD projections for the same time period for the

USA and the UK are 3.2% and 2.6% respectively. This low level of growth for Japan may hurt attempts to expand the manufacturing base of the country.

4.2.2 Highly concentrated industrial structure

Japan has a narrow industrial base, with a number of sectors that are very strong but few other sectors on which to build its future manufacturing strength. Currently Japan has a concentration of advanced component and materials industries, but few new industries have emerged in the past years as the economy has been in a slump.

4.2.3 High cost of labour

Japan remains one of the relatively costly locations in terms of compensation costs for production workers. As the graph below shows Japanese labour costs were much higher than those in the United States in the mid 1990s, but have fallen and are now lower in per hour terms than those of the USA (Bureau of Labor Statistics, 2004)

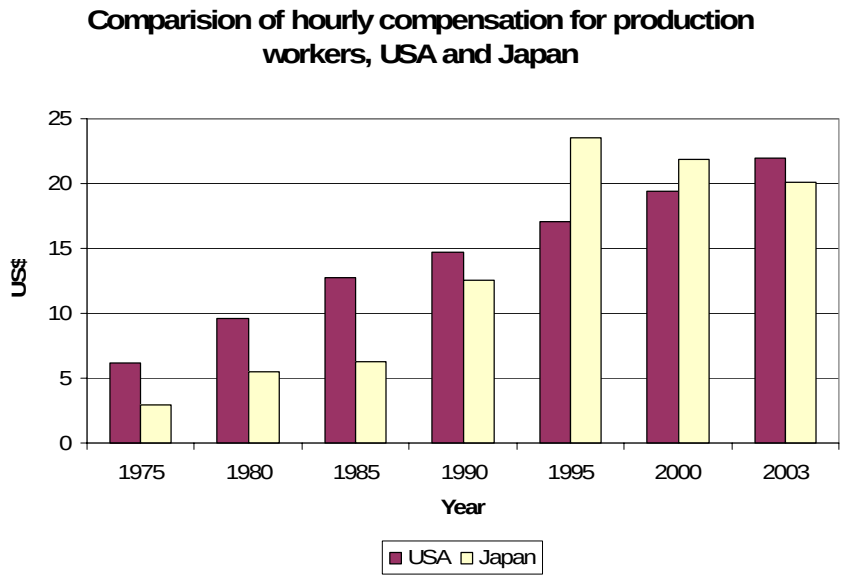


Figure 6: Hourly compensation for production workers, USA and Japan

4.2.4 Demographic changes

Projections of population for Japan show a significant reduction in the population, especially looking out to 2050. “The health ministry’s central projection suggests Japan’s population could fall from nearly 128 million now to about 100 million in 2050” (*Economist*, 2005). Possibly more worrying is that in the medium term “… the number of workers per elderly person is projected to fall from 2.6 in 2004 to 2.1 in 2010” (*OECD*,

2005). This will slow economic growth, and could bring it down from the base case of 1.3% to 1.1% in the period to 2010.

4.3 Future vision of manufacturing in Japan

The government of Japan has been very active in thinking about the future of the economy. It recently completed the eighth round of Foresight, the results of which are unfortunately not yet available. The seventh round of Foresight was completed in 2001 and involved over 4000 experts in a Delphi process looking at 1000 technology areas. From that report, the key technology areas in the 2005 to 2030 interval were thought to be genome science, regenerative medicine, brain science and bioinformatics. It is interesting to note that in the 7th Foresight manufacturing did not receive many survey responses, indicating a lack of perceived need for focus at that time.

A key statement of intent regarding the future of manufacturing in Japan is the Nakagawa Report on Industrial Structure released in mid 2004 by METI (JETRO, 2004). For this report, METI visited 300 companies and interviewed over 700 people. The report is intended to define industrial policy to create and accelerate growth. It outlines the current issues that face Japan and provides a framework for which industries should be the focus for Japan moving forward.

The Report lays out a number of basic principles on which the recommendations are based. These are to

- establish technologies and industries to ensure a leading position for Japan in global markets in the coming 20 to 30 years
- co-ordinate emerging technologies with traditional Japanese technologies
- fully utilize already developed technologies and to emphasize their preservation.

The diagram below shows the eleven areas (seven sectors and four industrial clusters) that came out of the study.

These ‘promising industry areas’ were selected against four criteria, the first of which was significant importance for the future of the Japanese economy. It is interesting to see how they have grouped these areas, into three ‘pillars’. These are

- cutting edge industry areas with global competitiveness;
- industry areas that meet needs arising from changes to society (e.g. changing demographics); and
- industrial clusters that support regional revival.

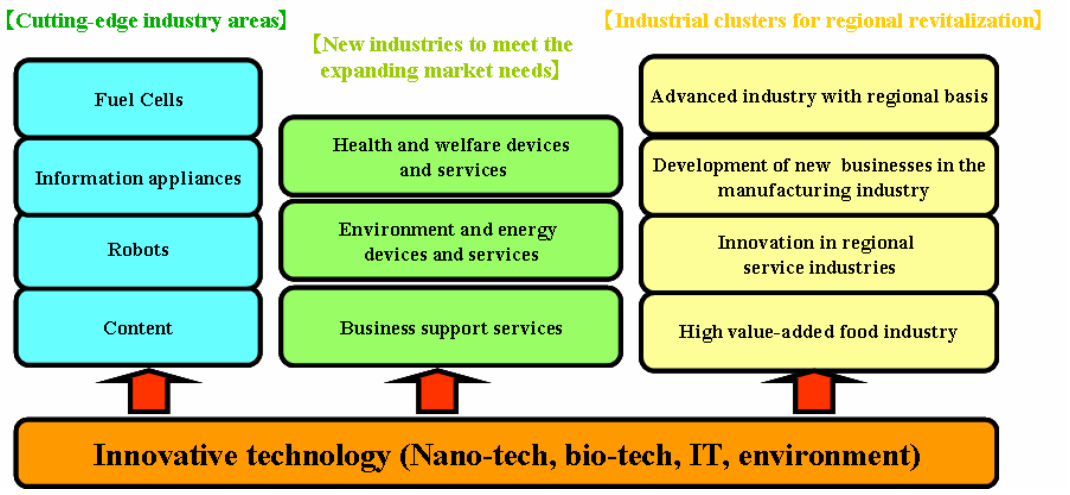


Figure 7: Eleven areas of focus from Nakagawa

While it is hoped that the industrial areas will provide growth individually, the Nakagawa Report highlights the hope that there will be spill-over and network effects. “It is estimated that the spill-over effect of market expansion in the seven sectors will be worth about 300 trillion yen by 2010. This is the equivalent of some 30% of domestic production in 2010 and is equivalent to the scale of the manufacturing sector in the current Japanese economy.”

Looking across the areas of focus, there is a significant component that is based on services (for example, business support services). While services will obviously play a strong role in the future of the economy “… manufacturing industry will continue to form the basis of the Japanese economy due to growth in advanced industries (electronics, transport equipment) and materials industries (chemical products)” (JETRO, 2005).

Overall, it appears that Japan is on its way to growth and “… will be a member of some sort of pan-Asian union, which will help it to keep China at bay” (*Economist,* 2005).

5 Manufacturing in the United States

Manufacturing has a strong place in the image of the strength of the country. As the introduction to *Manufacturing in America* states “American manufacturers are a cornerstone of the American economy and embody the best in American values” (Department of Commerce, 2004). However, manufacturing has been under pressure in recent years, with falling employment, relatively flat output, and a rising trade deficit.

5.1 Structure of the economy

The manufacturing sector in the United States "… was affected by the latest economic slowdown earlier, longer and harder then other sectors of the economy …" (Council of Economic Advisers, 2004). Between June 2000 and December 2001, manufacturing output dropped 6.8%. Employment in manufacturing declined 16% between mid 2000 and the end of 2003.

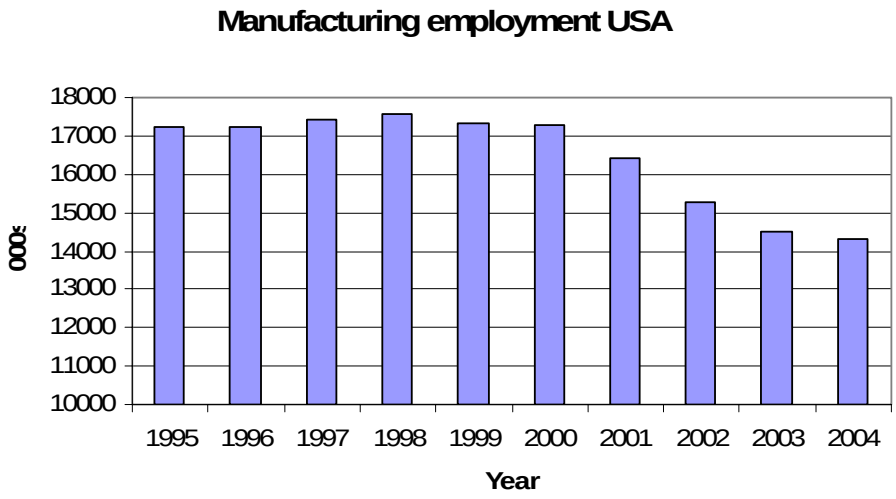


Figure 8: Manufacturing employment in the USA

More recently, job losses and other indicators have stabilised, with American manufacturing going through a comparatively stable period. Currently, manufacturing represents approximately 11.3% of total employment and is approximately 14% of the national economy (Bureau of Labor Statistics, 2005).

Hourly compensation costs for production workers in the United States are high compared to developing and emerging countries, such as China, but are lower than many European countries (for example Austria, Denmark, Finland, Germany and Norway) (Bureau of Labor Statistics, 2005). The graph below shows some comparisons in hourly costs expressed in US dollars.

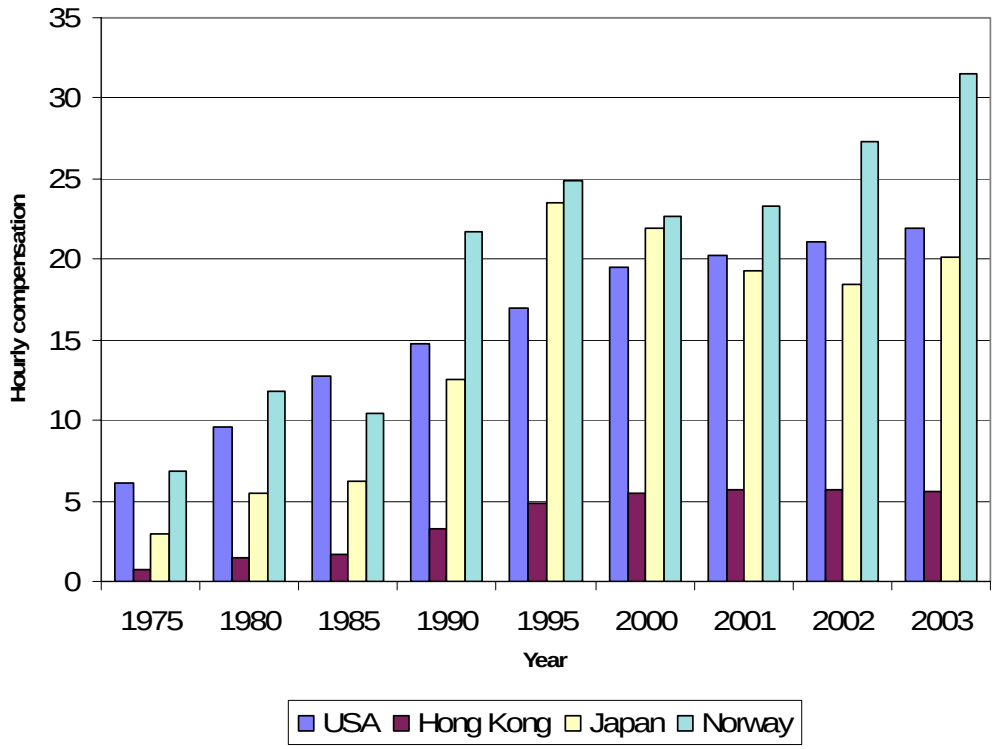


Figure 9: Hourly compensation for production workers (US$) in USA, Hong Kong, Japan and Norway

The long term structural changes in the US economy related to manufacturing appear to be driven by continuing improvements in productivity alongside the increasing market share of imported goods. In 1970, domestically produced goods were 91% of domestic goods purchases in the United States. However, by 2000 that number has fallen to 68%, with imported goods making up the difference.

5.2 Current issues for US manufacturing

US manufacturing is under significant pressure as global competition intensifies. This section summarises the issues that appear to be of greatest concern to US manufacturers.

5.2.1 Associated costs rising – especially healthcare

The proportion of US GDP that is spent on healthcare is continuing to rise. In 1980, healthcare accounted for 8% of the economy, compared to 13.2% in 2000, with a projected level of 16% by 2007 (PriceWaterhouseCoopers, 2003). The concern for manu-

facturers is that they will either have to carry these costs themselves or they will end up passing on the costs to employees in the form of reduced salaries.

At the same time, energy prices have continued to rise with manufacturers frustrated at a lack of a comprehensive and coherent energy plan for America. "… in the short run, rising energy prices and disruptions in energy supply reduce profits, production, investment, and employment for US businesses" (Department of Commerce, 2004).

5.2.2 A jobless recovery?

Following on from the recession in 2001, manufacturing output has not recovered in a similar fashion to other post-recession cycles. Whereas in previous expansions output has grown significantly, in this cycle manufacturing output has remained essentially flat. As Popkin commented in June 2003 "In the expansions during the 1960s, 1970s and 1980s, manufacturing output rose about 23 percent during the first 17 months of recovery. Manufacturing output is up less than 1.0 percent over the past seventeen months …" (Popkin, 2003). Generally this is leading to a concern about employment within manufacturing (which may again lead to a negative impression of manufacturing overall) and indeed about US manufacturing capability as well as capacity.

5.2.3 Outsourcing and offshoring

The United States has outsourced manufacturing to other countries for many years. For example the share of imports used in inputs in manufacturing rose from 10.5% to 16.2% between 1987 and 1997 (Bardhan & Kroll, 2003). Much of the discussion on outsourcing and offshoring is now around white collar jobs and many views on whether this is a positive or negative phenomenon for the country.

What is clear is that many of the activities that are part of manufacturing, from R&D through to production, and on to associated services, are now possible to outsource. This means that there are greater pressures across all of the value chain in manufacturing.

5.2.4 Trade balance

The United States has a significant trade deficit that has grown rapidly in the past decade. As the graph below shows, through the mid 1990s the trade deficit in goods and services was below 100,000 million but has grown to just over 600,000 million by 2004 (Bureau of Economic Analysis, 2004).

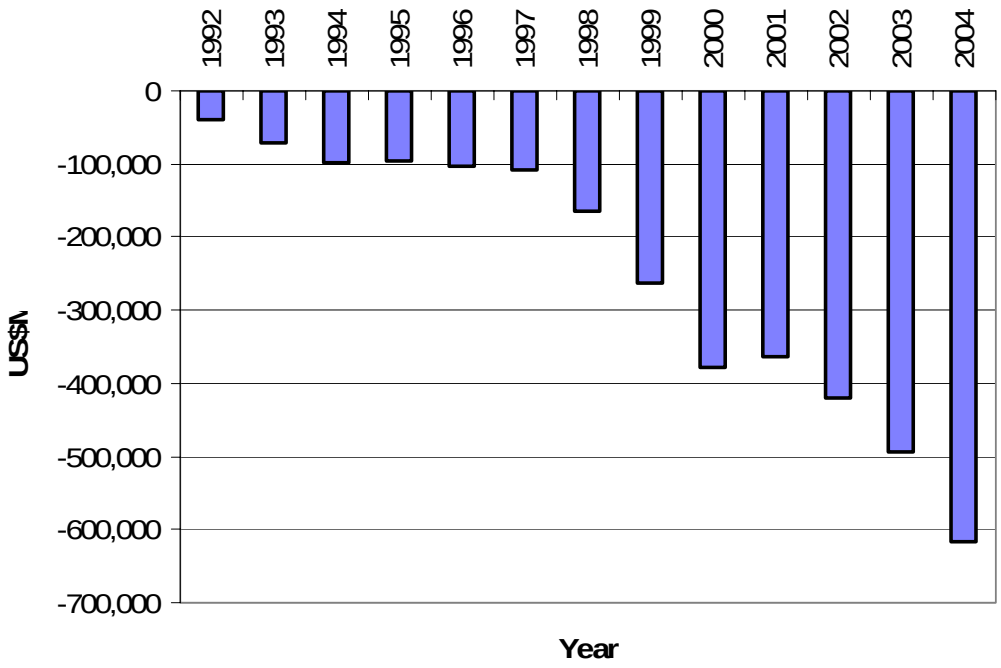


Figure 10: US trade deficit, 1992-2004

Specifically in relation to China, the US has a significant trade deficit of $124 billion at an annual rate through the end of 2003. This is the single largest bilateral goods and services trade deficit for the country, the next being Japan at $66 billion for the same period.

5.2.5 Challenges to US R&D leadership

Continued investment and strength in R&D is seen as key to the competitiveness of US manufacturers. The growth of R&D spending through the late 1990s has slowed significantly for the United States, and the percentage of GDP dedicated to R&D is relatively static at approximately 2.6% though this is significantly higher than the European average (National Science Foundation, 2004).

5.3 National Vision for US manufacturing

There is no one vision for manufacturing in the United States. The distributed nature of policy, between federal and state authorities, is one reason for this. Another is the evolution of the business-government relationship in the United States and the dominance of free market ideology. It is worth noting however that there are many examples of strong and supportive interventions and investments in manufacturing at state and county levels.

However, there are federal initiatives which give some indication of where the current administration sees the focus for moving forward. Through the last presidential election campaign, George W. Bush made many strong statements on manufacturing. A Manufacturing Initiative has now been established within the Department of Commerce and an Assistant Secretary for Manufacturing has been appointed.

The current position of the administration was set out in *Manufacturing in America* (Department of Commerce, 2004). In the opening summary, it is stated that “Strengthening American manufacturing is a top priority for the President … Manufacturing is the backbone of our economy and the muscle behind our national security.” However, the document does not provide a detailed vision of the future, rather it outlines the macro issues and initiatives that the federal government should pursue to support manufacturing broadly in the United States.

A number of industry led consortia are active in lobbying the government on manufacturing policy. The National Council for Advanced Manufacturing (NAFCAM) is one such body, and it recently released a response to the Department of Commerce’s strategy paper (NAFCAM, 2005). As for the Department of Commerce paper, this was structured around seven macro issues and so does not provide a clear vision of manufacturing in the future of the United States.

6 Commentary

The key MANVIS issues that this work focused on were the outsourcing and offshoring of manufacturing and the location of R&D in the future. Other issues obviously came to light in our conversations, and the key issues that reflect onto MANVIS results are presented here.

6.1 Relocation of industry (offshoring and outsourcing)

In the MANVIS Delphi, the experts responding contend that 80% of industry will relocate from Europe to other locations. It is interesting to compare this to the globalisation intentions of US manufacturers as reported by Deloitte (Deloitte, 2005). As can be seen from the graph below, the clear lead destination in the short term from the United States is China. Europe (both Western and Eastern) is an intended destination for just over 10% of respondents for manufacturing.

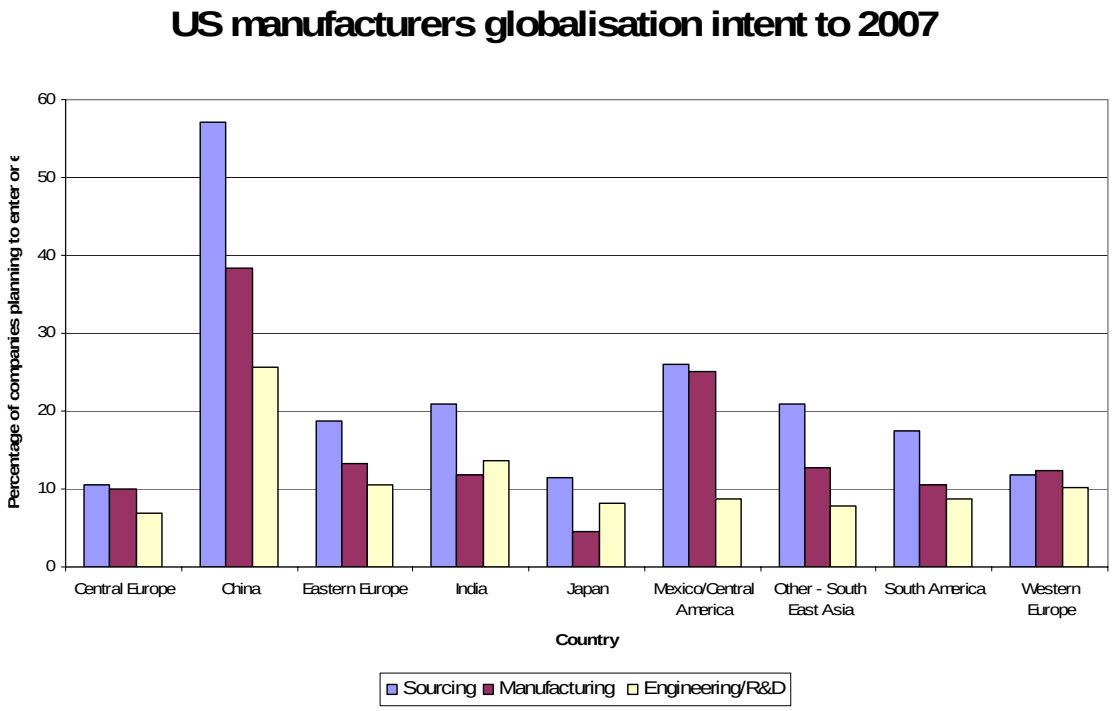


Figure 11: Globalisation intentions of US manufacturers

The continued pressure on US manufacturers to outsource and offshore their manufacturing activities is leading to an emerging sense of protectionism. It is possible that barriers to such movements will emerge, depending on how threatening the developments are perceived to be by the American public and the political establishment. The number of state legislatures who introduced bills attempting to restrict offshoring of software development is a possible lead indicator of this kind of activity (*Computer World,* 2003).

Japan appears to have managed the use of China as a low cost location by using 'mother' plants in Japan to develop new products and production technologies before establishing facilities overseas. However, there has been reluctance in the past to use electronic manufacturing services (EMS) companies to undertake production. There is evidence of moves in this direction but in contrast Sony have organised an 'internal EMS' model.

6.2 R&D location and practice

Whether R&D will follow manufacturing or not is a highly contentious issue. One fifth of the MANVIS experts do not believe that R&D will be performed close to manufacturing. While this does not say that R&D will remain in its current locations, it does imply in the opinion of the experts that there is no natural co-location pressure.

Data on the level of internationalisation of R&D is hard to collect, as different countries and companies define R&D in different ways and companies are reluctant to share information on R&D which they consider to be strategically sensitive. The most recent attempt to map the movements of R&D was recently released by UNCTAD. Their survey of transnational corporations and their global R&D intentions indicates that the movement of R&D around the world is a current and growing trend (UNCTAD, 2005).

Top 10 current foreign locations of R&D (percentage of respondents)	**Top 10 prospective R&D locations (percentage of respondents)**
United States (58.8)	China (61.8)
United Kingdom (47.1)	United States (41.2)
China (35.3)	India (29.4)
France (35.3)	Japan (14.7)
Japan (29.4)	United Kingdom (13.2)
India (25.0)	Russian Federation (10.3)
Canada (19.1)	France (8.8)
Germany (19.1)	Germany (5.9)
Singapore (17.6)	The Netherlands (4.4)
Italy (14.7)	Canada (4.4)

In the countries in which we carried out interviews, it was most apparent that Japan is trying to attract R&D into the country. There have been large investments in pure science from the government, aligned with recent moves to encourage entrepreneurship and spin outs and a move to give universities autonomy (moving from the earlier model of central government control).

Overall, it appears that competition for both the practice and location of R&D is only going to intensify in the coming years. The Lisbon Agenda will obviously drive much of this for Europe, but it may have to do more to attract multinationals, as in terms preferred prospective locations the highest ranked European country is the UK, and that is fifth behind the USA, China, India and Japan.

6.3 Lead market development

An interpretation of the MANVIS results is that the competition for development will be based on the strength of the lead market in each country. As we have seen, while the BRICs economies are taking the lead in the coming years in macro terms, in terms of GDP per capita it is a more complicated story. It remains to be seen whether countries

that lead at a national level but lag at the level of the individual represent strong lead markets.

6.4 Costs

A primary concern for many companies and nations is labour costs. The discussion on manufacturing offshoring is often cast as one of chasing low labour costs and so the headline wage rates for manufacturing is a key concern.

Looking at the possible evolution of hourly compensation for production workers it appears that while the gap in wage terms may close there will still be a large differential. The table below shows a simple model for three inflation scenarios across the USA, China, Japan and the UK. Assuming wage inflation (based on projected growth rates) and projecting those inflation rates on current wage levels, while there is a narrowing of the gap a significant difference still exists in each scenario.

		Inflation models			20 year projection of wages/hr		
Country	Current wage ($/hr)	Low	Medium	High	Low	Medium	High
USA	21.97	1.015	1.025	1.04	29.59	36.00	48.14
China (coast)	3	1.05	1.08	1.1	7.96	13.98	20.18
China (low)	1	1.05	1.08	1.1	2.65	4.66	6.73
Japan	20.09	1.015	1.025	1.04	27.06	32.92	44.02
UK	20.37	1.015	1.025	1.04	27.44	33.38	44.63

The key issue however will not be just labour costs, it will be total landed costs. As energy prices have risen, and appear to be remaining at their new levels, and as the labour content of production falls the relative importance of labour and transport costs may shift. While China may be a low cost labour location, in total landed cost terms it may actually be relatively similar to countries in the EU or even the United States. Examples of this are highlighted in a recent McKinsey study of why companies like Toyota are still manufacturing in California, which focuses on the lowering of labour content and the need to remain close to the customer to reduce lead times (Ritter & Sternfels, 2004).

6.5 Demographics

Japan is specifically using the shift in demographics in its industrial policy development, developing industries that will respond to the needs of an ageing population. This is a clear goal of the Nakagawa report, turning what has been seen as a negative trend into a positive.

The ageing of populations in the USA and Japan may also speed up the trends of offshoring of factories to countries such as China, which may still have an untapped labour pool, and lead to an even greater level of automation as the need to lower labour content becomes even sharper.

6.6 Servicisation

The rapid evolution of capital goods industries towards servicisation is challenging the images and models we have to interpret and analyse manufacturing around the world. While some companies have committed to a service agenda based on a product platform, it is unclear how this trend will develop across industries and what it will mean for multinational corporations to have their production and service activities in many locations.

While this was not a clear focus of the MANVIS Delphi, it is mentioned here, as it is likely to have a significant impact on the global pattern of manufacturing activities.

7 Summary

As can be seen there is significant uncertainty surrounding the development of manufacturing in the key economies of Japan, China and the United States in the coming decades. How those uncertainties will play out is almost impossible to say but European companies and governments will need to continue to monitor trends in labour costs, R&D investment and industrial policy quite closely. This will demand the development of new indicators, better data collection and semi-regular reviews of emerging government policy. Hopefully, these actions will be taken forward by the Commission and included in efforts such as ManuFuture.

Appendix – Current data on USA, Japan and China

Comparable trade statistics (World Trade Organisation, 2005)

Indicator	**China**	**Japan**	**USA**
Exports of goods and services ('95 prices, 1995 = 100)	342	134	131
Imports of goods and services ('95 prices, 1995 = 100)	327	123	175
Share in total world exports (2003)	5.8	6.3	9.6
Share in total world imports (2003)	5.3	4.9	16.7
Top 3 merchandise export destinations (2003, %)	USA (21.1) Hong Kong (17.4) **EU15** (16.5)	USA (24.9) **EU15** (15.3) China (12.2)	Canada (23.4) **EU15** (20.8) Mexico (13.5)
Top 3 merchandise import origins (2003, %)	Japan (18) **EU15** (12.8) Taipei (12)	China (19.7) USA (15.6) **EU15** (12.8)	**EU15** (19.3) Canada (17.4) China (12.5)

Figures

Bibliography

Bannister, J (2004): Manufacturing Employment and Compensation in China, Beijing Javelin Investment Consulting Company.

Bardhan, A. D. & Kroll, A. (2003): The new wave of outsourcing, Fischer Center for Real Estate and Urban Economics, UC Berkeley. Available <http://repositories.cdlib.org/cgi/viewcontent.cgi?article=1025&context=iber/fcreue>

Bureau of Economic Analysis (2005): Available <www.bea.gov>

Bureau of Labor Statistics (2005): Available <www.bls.gov>

Chinese Ministry of Science, (2003): China Science and Technology Statistics Data Book 2003. Available <http://www.most.gov.cn/eng/statistics/2003/index.htm>

CIA (2005): CIA World Fact Book.
Available <http://www.cia.gov/cia/publications/factbook/>

ComputerWorld (2003): US Lawmakers Pushing to Hinder Offshore Outsourcing. Available <http://www.computerworld.com/managementtopics/outsourcing/story/0,10801,88197,00.html>

Council of Economic Advisers (2004): Economic Report to the President of the United States.

Deloitte, (2005): Growing the Global Corporation: Global investment trends of US manufacturers.

Department of Commerce, (2004): Manufacturing in America: A comprehensive strategy to address the challenges to US manufacturers.

The Economist (2005): From accelerator to brake. The Economist, 8th October

The Economist (2005): The sun also rises: A survey of Japan. The Economist, 8th October.

European Commission (2003): Investing in Research: An action plan for Europe, Commission Communication, 4th June.

Financial Times (2005): Expanding fleets see shipping prices hit rock bottom. Financial Times, August 9th

Financial Times (2005): China heads for power glut in late 2006. Financial Times, August 10th.

The Japan Times (2004): Manufacturing still our lifeblood. The Japan Times, 1st December.

Japanese Statistics Bureau (2005): Statistical Handbook of Japan 2005. Available <http://www.stat.go.jp/english/data/handbook/c12cont.htm>

JETRO (2005): Nakagawa Report (English Summary), Toward a Sustainable and Competitive Industrial Structure. Available <http://www.jetro.de/d/nakagawareport.pdf>

McDaniels, I. (2004): A critical eye on Shanghai. China Business Review.

NAFCAM (2005): Future Policy Directions for American Manufacturing.

National Science Foundation (2004): Science and Engineering Indicators 2004.

OECD (2005): OECD Economic Survey of Japan, 2005.

Popkin, J. (2003): Securing America's Future: The case for a strong manufacturing base, Joel Popkin and Company, Washington D.C., prepared for the National Association of Manufacturers (NAM).

PricewaterhouseCoopers (2002): The Factors Fueling Rising Healthcare Costs.

Ritter, R. & Sternfels, R. (2004): When Offshore Manufacturing Doesn't Make Sense, The McKinsey Quarterly.

United Nations Conference on Trade and Development (UNCTAD) (2005): World Investment Report 2005: Transnational Corporations and the Internationalization of R&D.

Walsh, K. (2003): Foreign High Tech R&D in China: Risks, Rewards, and implications for US – China relations, The Henry L. Stimson Center.

Wilson, D. & Purushothaman, R. (2003): Dreaming with BRICs: The path to 2050, Goldman Sachs Global Economic Paper no.99.

World Bank (2005): World Development Indicators online database.