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Department of Trade and Industry

THE JAPANESE SECRET – ARE THEY WINNING?

DR W R GILLAN FIRST SECRETARY (SCIENCE AND TECHNOLOGY) 1983-85

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Addenda

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Note:- Differences in accounting practice between Japan and the UK can confuse the profit picture. The declared income (4.3 per cent of sales before tax in NEC's case) is shown in company annual reports and is liable to corporation tax at an effective rate of about 54 per cent. Internally the companies are often highly profitable, with rates of return of 20 per cent or more, particu larly in product areas where trade restraint agreements inhibit price competition (see page 37). This money is used to repay bank loans or for capital expenditure.

Footnote 2 - Page 21

Note:- The high proportion of overseas students in UK degree courses and the different range of opportunities open to graduates complicates comparison of the numbers of engineering graduates in Japan and the UK. The IT Skills Shortages Committee has estimated that in the UK 2,400 new electrical/electronic engineering graduates enter employment directly related to their degree discipline each year. This compares with about 20,000 in these disciplines in Japan.

The Japanese Secret

- are they Winning?

Dr W. J. Gillan

This report is issued by the Overseas Technical Information Unit of the Department of Industry. It reflects the personal views of Dr W. J. Gillan which are not necessarily those of the Department or H.M. Government.

January 1986

THE JAPANESE SECRET - ARE THEY WINNING?

PROLOGUE

Japan has a booming economy founded on manufacturing industry. Inflation is negligible, the unemployment rate is under 5 per cent and the balance of payment surplus (1984) is over $35 billion (Notes 1,2). Average real annual growth in GNP over the last 10 years is 4 per cent.

Japan also has few natural resources and a population of 120 million living on half of the flat land area that supports 57 million in the UK. Despite these disadvantages its key economic indicators reveal a national performance which is the envy of the rest of the world, (Figure 1). This is having an impact; a visitor to Japan sees an affluent, well dressed, populace. New cars throng the streets of Tokyo. Per capita income is already 50 per cent higher than the UK and seems on course to approach US levels by the end of the century.

Japan is an example to the UK. It shows how an industrialised country can thrive even if it has few natural resources or energy supplies, the position the UK will be in in the next century. But even though Japanese industrial success depends on science and technology expert visitors from the UK are often disappointed by what they see. The common reaction is "There is nothing here we couldn't do at home".

This report examines the intriguing differences between Japan and the UK and attempts to identify the factors which have led to Japans strong industrial performance. It concentrates on the electrical and electronic industry, a sector of rapid progress. It is a personal view based on a two year stay in Japan which included numerous visits to laboratories and factories and discussions with industrialists, research workers, Government officials and visitors from the UK. All deserve thanks.

Technology and industry are two of the main pillars of the Japanese economy. Their impact on other areas of the economy, including employment and living standards is also discussed in this report.

Note 1: Most financial figures in this report have been converted from Yen to £, at the rate of Yen 300 = £1. Some trade figures have been given in dollars since they are often quoted in this way by the Japanese Government. Dollar values have been converted at the rate of £1 = $1.40.

Note 2: Growth continues: Japan's trade surplus for 1985 is expected to be about $54 billion, 50 per cent higher than in 1984.

FIGURE 1

Economic Indicators

	Japan	UK
Unemployment	< 5%	14%
Av. Salary(84)	£14,600	£9,100
Inflation	2.5%	5%
GNP(83)	£928 bn	£259 bn

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The Japanese Secret - Are They Winning

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TRADE

Japan had a surplus of $35 billion in external trade in 1984. At first sight the reason is obvious. It is the worlds largest manufacturer of cars, ships, hi-fi, video recorders, cameras, watches, calculators, compact disc players and microwave ovens. It is within the top three in products ranging from integrated circuits to tractors, lawn mowers to machine tools and typewriters to washing machines. Few consumers anywhere in the developed world do not passes a selection of Japanese products. Even if he choses an ostensibly British high technology product it is likely to have a strong Japanese component; his British made home computer will have Japanese Integrated circuits and keyboard, his British made TV will contain numerous Japanese components and have been assembled by Japanese production machinery and his British car may have an Japanese made engine or gearbox.

Despite Japan's dominance in these products overall exports per head of population are less than those of the UK. Its eminence in manufactured goods is not matched by export success in areas such as chemicals, rubber and leather products, garments, food or tobacco, all areas where the UK does well. However with the exception of food Japan is self sufficient in such products; exports are low but imports are negligible. The result is that Japan is much more self sufficient in manufactured products than other OECD countries; the UK is much less self sufficient. (Figure 2).

Hence the rules of the Japanese economy are:

High exports and negligible imports of high added value manufactured goods.

Low exports in other areas, but even lower imports.

Import raw materials and energy.

The flow of funds into Japan produced by an enormous and growing trade surplus is now of the same order as the flow into the OPEC countries in the 1970s during the 'oil shock'. This income is being used to finance overseas investments which are now worth $80 billion, surpassing those of the UK.

This paper is written from the UK viewpoint but the main Japanese preoccupation is its trade relationship with the US. Almost one third of Japanese exports go to

the US and totalled $60 billion in 1984. The bilateral balance of payments surplus is now almost $40 billion, and growing. It is no coincidence that as Japan has become the worlds leading creditor the US has become a debtor for the first time in 100 years.

Trade Comparisons

	Japan (84)	UK (83)
Exports/head	£1012	£1064
Exports of manufactures (as % of total)	97%	66%
Imports/head	£812	£1072
Imports of manufactures (as % of total)	27%	68%

FIGURE 2

JAPANESE INDUSTRIAL STRUCTURE

Japan has a three tier industrial structure, with each layer satisfying particular national objectives. The layers are:

High Technology Industry

This produces the goods responsible for export success. The firms are efficient, with outputs often worth about £100,000 pa for each employee, twice the figure for comparable UK companies. The workers are well paid, typically earning 50 to 100 per cent more than their equivalent in the UK. In some cases, such as laser disc players, the products themselves depend on advanced technology. In other cases, such as cars, pocket calculators or watches, the products themselves do not depend on advanced technology but their efficient production does. Japan is the worlds leading producer of these products and shows no sign of losing its lead despite the fact that its workers are paid several times as much as those in the factories of neighbouring competitors. The moral is that export success depends more on good engineering, particularly production engineering than on low industrial wages.

Low Technology Industry

This satisfies Japans internal demands and keeps out exports. It makes the simpler components for the high technology industry plus the products essential for daily life including clothing, footware, toys, hardware, cutlery, china and luggage. The UK industries making these products have been severly damaged in recent years by imports from low cost producers including Hong Kong, Taiwan, Korea, Spain and Italy. Despite the geographical proximity of some of these countries their products are rarely, if ever, seen in the shops in Japan. The Japanese workers making these products recieve lower wages than workers in high technology companies (although they still equate with the wages of comparable UK workers) and they work long hours, often over a 5½ or 6 day week. Although they still cannot match the production costs of their oriental neighbours Japans complex distribution system provides plenty of opportunity for national chauvinism to filter out potential imports.

Service Industry

Japans enormous service sector creates employment. It also acts as a filter to help screen out imports. The operation of this sector is discussed in this report.

JAPANESE INDUSTRY 1

BIG IS BEAUTIFUL

Japanese export success is due to the efforts of about 30 large companies, with annual sales ranging from about £500 million to about £20 billion. Thirty years ago most people in the UK would be hard put to think of a single Japanese name: today HONDA, SONY, TOSHIBA, NISSAN and many others are household words.

In the 1960's in the UK merger and amalgamation were fashionable. The theory was that large groups would benefit from the sharing of research, development, production and marketing overheads. It is probably fair to say that the major groups formed have not lived up to expectations; Austin Rover has a much smaller market share than the constituents of the original British Leyland Motors, ICL has had its financial hiccups and GEC has withdrawn from market areas such as consumer electronics, one of the major money earners of Japanese industry. Today the current fashion in the UK is to look to small industry for business growth.

Yet the example of Japan shows that the ideas of the 60's were not wrong. Indeed it is illogical to expect a small firm, however good its technology, to compete in the long term on a world scale with companies such as MATSUSHITA which have sales offices in 90 countries, R & D laboratories with six thousand scientists and engineers and large production engineering companies, again with over one thousand engineers.

The Semiconductor process equipment market illustrates the problem. Semiconductor production has now replaced the steel industry as the largest user of capital. Worldwide investment in the non-communist world in 1984 was about $7 billion. The UK's expertise in semiconductors is widely recognised and it has several small, well regarded high technology companies making specialised instruments and production equipment. In 1984 Japan was the worlds largest purchaser of such equipment and its companies bought about $2 billion worth. Only about 1.5 per cent of this, worth about $30 million, came from the UK. It was excellent news for the companies concerned but as a national effort in a high technology growth market is insignificant. Moreover the sales rely almost exclusively on superior technology and are vulnerable to technical 'leapfrogging'; they are as likely to decrease as to increase.

Electrical Engineering Companies

	Sales (bn)	Employees (000)
Hitachi	£13.4	155
Matsushita	£10.0	124
Toshiba	£ 8.3	103
NEC	£ 5.4	73
Mitsubishi Electric	£ 5.4	64
GEC	£ 4.8	171

JAPANESE INDUSTRY 2

GROWTH BEFORE PROFIT

There is a fundamental difference in the question a Japanese manager asks himself when confronted by a new idea and the question a British manager asks.

The British question is:

Can this produce an adequate return on capital?

The Japanese is:

Will it make my company grow?

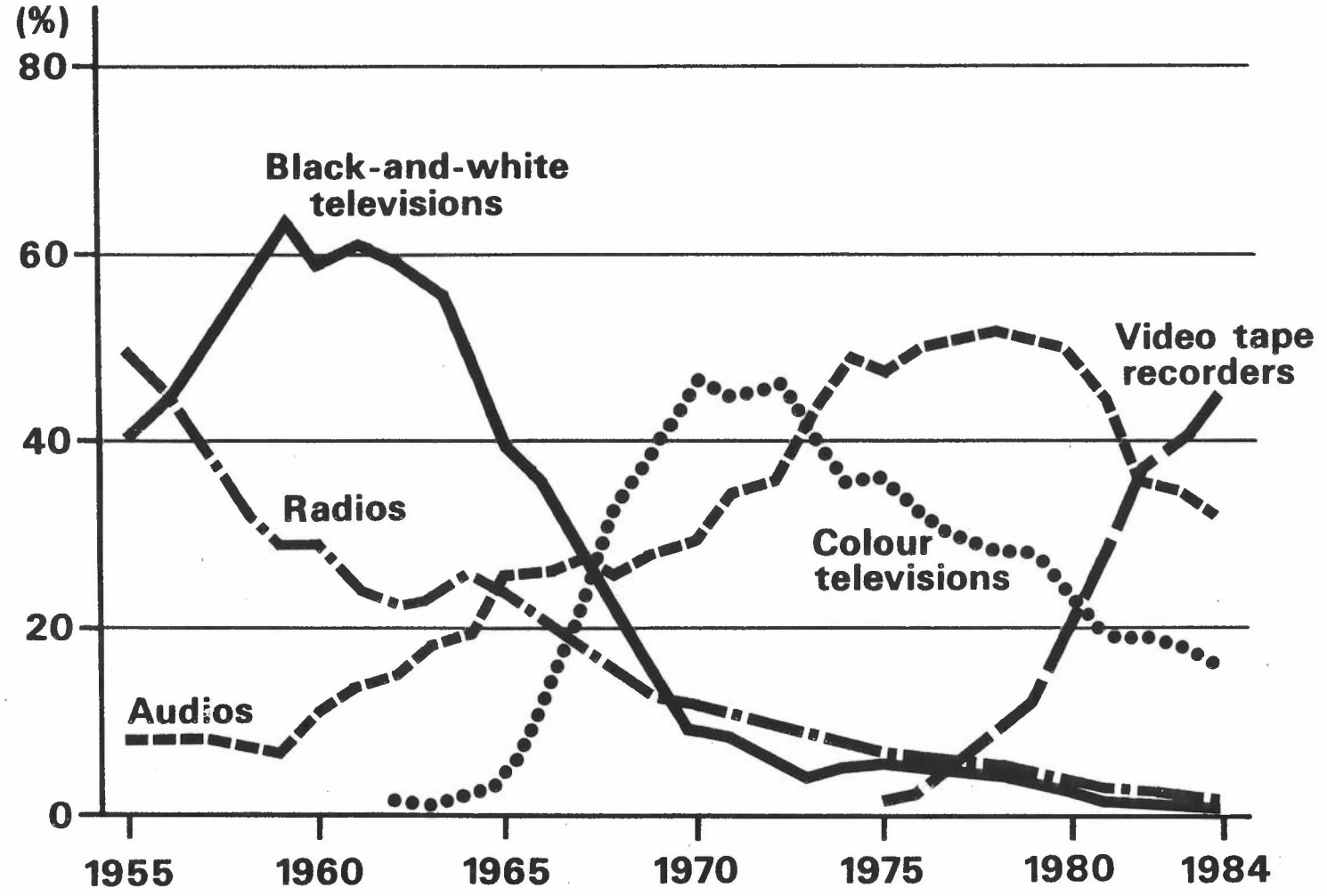
At first sight these questions are not dissimilar but the impact of the difference is profound.

Since the war Japanese manufacturers have shown themselves to be adept at capitalising on the products made possible be advancing technology. Colour TV's, Hi-Fi and VTR's have all dominated their efforts in turn and now they are looking for the next growth markets (Figure 3). This time it is not a single product which will produce growth but a mixture of consumer and office automation products. They are:

APPLICATION	PRODUCT
Domestic	Compact Disc Players
	Integrated Video Camera Recorders
Small Business	Electronic Typewriters
	Portable Word Processers
Large Business	Personal Photocopiers/Laser printers
	Office Facsimile Machines
	Optical Disc Document Stores

The Japanese approach has made it inconceivable that any Japanese electronic company of consequence should not make these products. TOSHIBA, HITACHI, MATSUSHITA and MITSUBISHI make all of them while slightly smaller

Production Composition of Principal Consumer Electronic Equipment



Source: Ministry of International Trade and Industry, Japan

firms such as SONY, NEC or CANON make most of them. The British approach has made it inconceivable that any British Company should develop any of these products.

This Japanese business philosophy produces a vigorous and dynamic industry. Whenever advancing technology makes any new product possible a dozen companies will rush to make it. They are also continually questing around for new areas of business in established products.

This approach also creates vigorous competition. For example Japanese cameras have seized a large part of the world market which is now nearing saturation. Most Japanese camera companies are operating at little more than half capacity and 1984 saw the bankrupcy of one well known name, MAMIYA. Nevertheless two companies, MATSUSHITA (National) and Casio, entered the camera market for the first time in 1984. Both are expert at mass producing other equipment and feel they can take on the established camera companies. The market for the established makers is likely to shrink further.

The Japanese approach also produces companies with diverse ranges of interests to add to their strength. The Japanese invasion of the world motorcycle markets in the 1950's and 60's saw the demise of the British industry and names such as Norton, James and Triumph are no longer seen. Over the last three years there has been a major collapse in the world motorcycle market and Japanese production in 1984 was less than half of the 1981 figure. Many production lines are idle but even if the market vanished the main Japanese manufacturers would survive. HONDA is now a major car manufacturer and also makes pumps and lawn mowers. SUZUKI is a successful car manufacturer and YAMAHA is involved in a variety of products including musical instruments, ski equipment, computers, boats and hi-fi.

The push for growth and market share almost regardless of profits has two further consequences. They are:

i) Japanese companies may act in ways in overseas markets which lead to dumping accusations. The usual defence is that it is impossible to set a production cost for items where capital cost is high but labour and material costs are very low. This is partly true but conceals the feeling that it is acceptable practice.

ii) Japanese manufacturers price their products to sell in overseas markets with little regard for exchange rates. Competitors who depend on favourable rates for profitability can be frozen out of markets.

Figure 3 Growth Products

Camera-recorders

7 Manufacturers
Present capacity 100,000 pa approx

Laser Disc Players

20 Manufacturers
1984 Production £150 million
70% annual growth

Electronic Typewriters and
Portable Word Processors

10 Manufacturers
Output (1984) £700 million
150% growth

Personal Photocopiers

8 Manufacturers
Output (1984) £1 billion
Annual growth 40%

Office Facsimile

17 Manufacturers
Output (1984) £1 billion
Annual growth 45%

Optical Disc Document Stores

7 Manufacturers
Output (1984) £40 million (est)
Potential world market $\approx$ £10 billion pa

JAPANESE INDUSTRY 3

INVESTMENT AND PROFITS

Japan has a high trade surplus in high technology products; it has a higher trade deficit in technology itself than any other developed country (figure 4).

This illustrates another facet of the Japanese business attitude. Technology is fundamental to the success of manufacturing industry. It can be bought cheaply and Japanese companies invest heavily in seeking it out worldwide. When it is not available they are prepared to spend heavily on R & D to develop their own. Typical expenditures range from about 3 per cent of sales to 12 per cent of sales. The lower figures are for companies which have large sectors, such as heavy engineering or domestic appliances, which do not demand much R & D. For these companies the expenditure in the leading edge technology areas is about 10 per cent of sales. What is more the Japanese are strict about the definition; much detail development and production engineering is not included in these figures.

These R & D figures translate into an impressive R & D effort. One major example, HITACHI, has 11,000 professional R & D technologists and an annual budget of £750 million. The top dozen companies in Japan all have R & D budgets in excess of £250 million and several thousand R & D staff. Total R & D expenditure by industry was £15.2 billion (1983). All of this is for civil research.

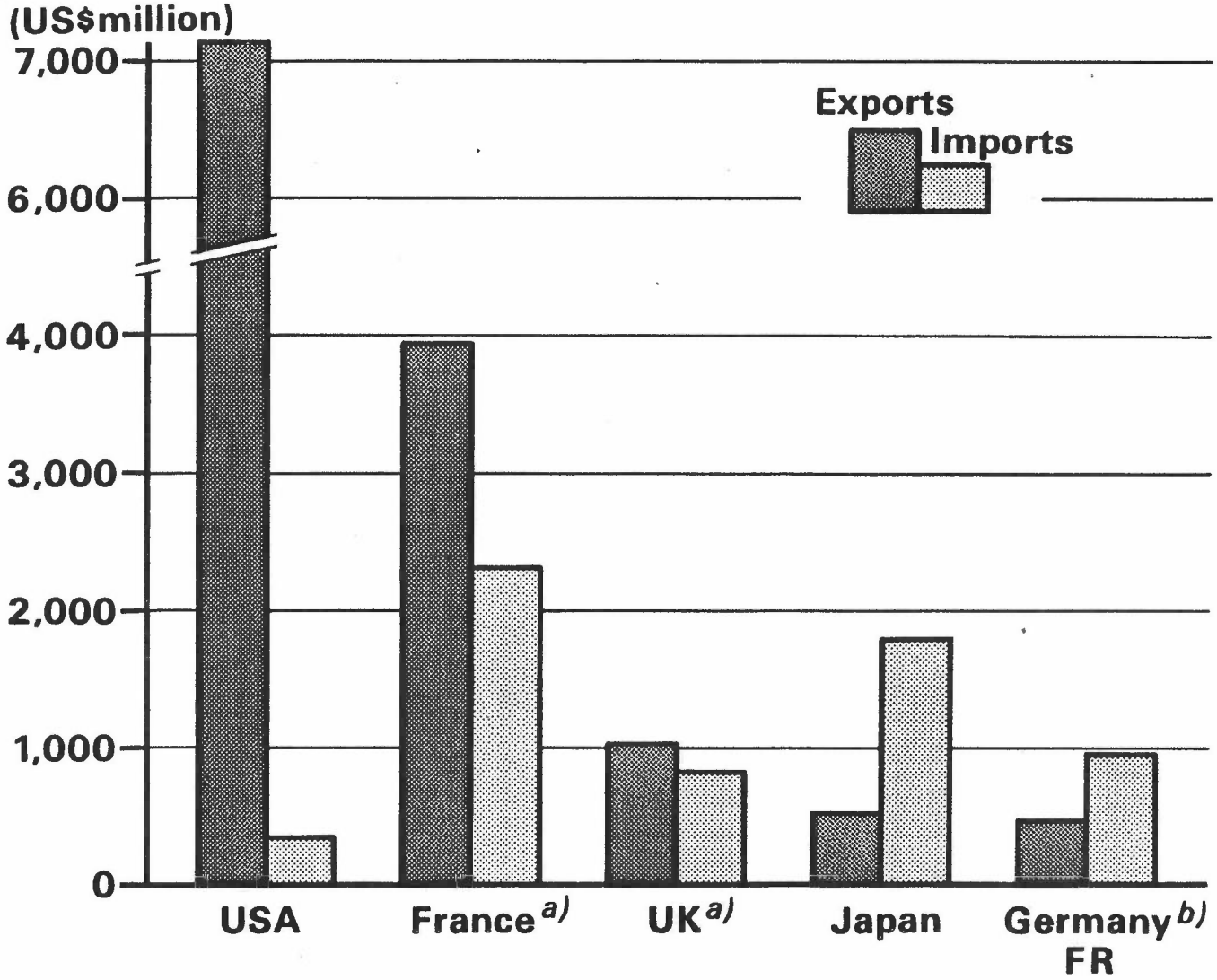
Hence Japanese industry believes that it is vital to maintain R & D spending. They also invest heavily in new plant. A typical new VLSI or office automation equipment plant costs between £200 million and £400 million. At present most of the large electronic companies are building at least one such plant each year.

The Japanese companies are willing to spend considerable sums of money to promote company advancement and growth. They are much less enthusiastic about distributing income as profits and many companies operate with net incomes of only 2-3% of turnover. Perhaps the extreme example of this is NEC, the semiconductor and computer firm, with 1984 sales of £6 billion. In the years from 1973 to 1983 net profits never exceeded 3.5 per cent of sales yet R & D spending was maintained at over 10 per cent of sales throughout the decade. Annual growth over the decade averaged 13 per cent (compound).

It is doubtful if a company such as NEC could have survived if transplanted to the UK business environment. The pressure to boost profits by cutting R & D costs

FIGURE 4

Exports and Imports of Technology in Selected Countries (1982)



a) 1980 b) 1981

Source: Science and Technology Agency, Japan

would have been intense. Compare the figures above with what happened in Thorn EMI when profits were unexpectedly low earlier this year (Figure 5).

What of the bankers and shareholders of these companies? It seems that they accept that the high investment is required if companies are to maintain growth, and they take a long term view. Twenty years ago HITACHI was much the same size as the companies which now make up GEC in the UK. Now its sales are over three times those of GEC. Profits based on 3 per cent of those sales are much better than from a higher percentage of the sales of a company which had failed to achieve its spectacular growth. Certainly there is no shortage of finance in Japan. Long term loans at interest rates of about 5 per cent are readily available although many large companies are able to find investment from income. High corporate taxes on profits are an incentive for companies not to rely on the stock market for funds and to rely on straightforward loans, where interest is paid out of pre-tax income.

Business Philosophy 2

NEC (1983)

R&D expenditure = 10.3% of sales

Pre-tax profit = 4.3% of sales

Average Pre-tax profit (73-83) = 3.1% of sales

Result - Success, 10 year growth = 14% pa

Thorn-EMI adopts growth policies

pre-tax profit (84-85) falls to 5.7% of sales

Result - Chairman resigns

FIGURE 5

JAPANESE INDUSTRY 4

PRODUCTION AND AUTOMATION

In Japan a manufacturer will always find himself with several competitors within months of the launch of a new product. While advanced technology and unique features go some way towards building market share there is no hope for a manufacturer whose production costs are out of line. Efficient production is vital for survival.

Efficient production does not always mean the use of robots. Indeed, assembly is often the last process to be automated in a factory and warehousing/material transport the first. Increasingly a computer system control the operation of the factory and component ordering in response to inputs from the marketing department.

In low and moderate volume factories producing quantities in the range up to about 500,000 units per year manual assembly is still common. These factories make the products in the list in Figure 3 and factory output is normally worth from about £200,000 to £500,000 each year per worker employed. Labour costs are only a minor part of the factory operating costs and cost saving is not an important factor in a decision about automating the manned production jobs. The main reasons are to improve quality or increase output.

In the true mass production industries, such as VTRs or calculators, full automation of assembly is more common. Outputs of a single factory in these industries are measured in millions of units per year, or even in tens of millions in the case of calculators. But even here complex robots with multiple degrees of freedom are not particularly common. Simple two or three axis pick and place machines are used, although considerable ingenuity goes into the design of the actuators and grippers for picking up and manipulating the components. Many UK "experts" would deny that these are robots.

Although the above description applies mainly for light electronic and/or electromechanical equipment, the general principles apply for mechanical engineering, such as machine tool production and the car industry. Essentially the approach is to automate the jobs that can be easily automated; use human skills where they are still essential; make sure that nothing disrupts production. In these other plants dirty and dangerous jobs are also a strong candidate for automation.

JAPANESE INDUSTRY 5

PRODUCTION ENGINEERING

In the UK when a company wants to install a new advanced production system it usually approaches a specialist system house. After the system is installed it runs until it is superceded.

Japanese manufacturers appreciate that advanced production systems are a vital component of their success and prefer to develop them by themselves. They maintain large production engineering teams of graduate engineers and most have special production engineering research laboratories. If automated production of a new product is envisaged the production engineering team is often larger than the team developing the product. In the UK production engineers are often less well qualified and paid than R & D engineers. In Japan production engineering is on a level with all other engineering activities.

Once a production system has been installed it is not neglected. Typically a team of graduate production engineers in the factory will maintain and continually update it.

The efforts of these production teams can produce spectacular results for high volume items. For example, the lines at SHARP which assemble 60 million calculators per year are solely manned by 3 production engineers. Another impressive example is the video recorder tape deck assembly lines at MATSUSHITA. Each has about 120 robots and once again is manned by about 3 production engineers. These lines assemble 7 million complex decks, each with about 140 components, each year. Last year VTRs accounted for almost £2 billion worth of MATSUSHITA'S turnover.

Hence the production engineering effort is significant and can lead, in itself, to new products and areas of business. For example, MATSUSHITA has set up its production engineering group as a separate company with 1,000 employees, mainly graduates. This company is now Japan's largest robot producer (projected 1985 output value £150 million) and sells its electronic production machinery for PCB and mechanical assembly worldwide.

JAPANESE INDUSTRY 6

THE WORKFORCE

In the UK we accept that professional footballers retire in their mid-thirties. Yet in the Summer of 1984 when HITACHI suggested that its production workforce in its Welsh TV factory was too old, with an average age of 35, it raised a storm of protest, including scores of letters to the Times. Nevertheless, effective production depends on quickness, physical fitness and good hand and eye co-ordination in production workers. These are the attributes of sportsmen.

In Japan a typical light assembly line in an electronics plant is manned by women in their early twenties. Heavier production lines in the car and mechanical engineering industries are manned by men in their twenties or early thirties. The average age of workers on the assembly line at HONDA Sayama car plant is 27. At NISSAN'S Zama factory, an older plant, it is 29. The average age of a production worker at Ford's plant at Halewood is about 40.

How do Japanese companies manage this young workforce when operating a lifetime employment system? For women workers it is easy. They are recruited straight from school at 18, given one or two weeks on the job training and put to work. When they marry five or six years later, as almost all do, they resign. They often return to work later in life but then usually to a lower paid job in a component factory or low technology industry.

Male production workers are usually also recruited from school at 18, although it is not unusual to find graduates manning production lines. They receive on-the-job training, often backed up by courses in a technical college, but within a few weeks they will also be working. They then work in production until their late thirties. A variety of options are then possible. Some will move to the factories of component suppliers, usually as a foreman. Their experience in the main production plant is an asset and helps strengthen the links between supplier and customer. Others will move into administrative jobs in production control, component procurement or marketing back-up. In all cases appropriate training is given. They will remain in such jobs until they retire between 55 and 60.

It says much for the innate intelligence and ability of the Japanese worker that they can cope with such changes. However industry is highly regarded in Japan and has the pick of the 18 year old school leavers. Industrial jobs in the top companies are well paid: a typical 23 year old woman worker can earn over £7,000 a

year including biannual bonuses, while a male worker in his mid thirties can receive about £14,000 per year. Salary increases steadily with age. In the large firms they will often work a 5 day week for about half the year with 5½ or 6 days for the remainder. Overtime working seems less common than in the UK; the companies believe that it is not possible to work flat out for longer than about eight or nine hours each day.

Hence Japanese companies provide their male workforce with a progressive career within the company. While they do not do this for women workers they pay them well. In both cases single status canteens, staff uniforms for all and an absence of visible status markers such as company cars make all workers feel that their interests and the interests of the company are synonymous. This helps explain why workers participate enthusiastically in quality circles and suggestion schemes.

There may be lessons for UK companies. When UK car workers, newly recruited by NISSAN, visited Japan recently they were amazed by the absence of strikes or sabotage in car plants. Could it be that in the UK both of these are due at least in part to the frustrations of older workers trying to keep up with a fast moving assembly lines? Creating a system which limits the high pressure assembly line work to young, fit workers could be a positive step in industrial relations.

All of this sounds idyllic for a Japanese production worker; he must work very hard but is well rewarded and looked after. But it is important to remember that these conditions only apply in the large blue-chip companies. Workers in the other companies, have less job security, work longer hours, often for 5½ or 6 days a week, and pay levels, including bonus, are only about two-thirds of the large company levels.

JAPANESE INDUSTRY 7

COMPONENT SUPPLIERS

Reliable component supplies are vital for mass production industries. The component supplier in Japan must provide high quality parts on time. If items are found to be faulty or supplied late he faces considerable cash penalties. All of this poses considerable problems, particularly in the mass production industries where kan-ban (just-in-time) part supply systems are used. Components are usually brought in by lorry on Japan's crowded road network and hourly deliveries are common in, for example, the car industry. Hence the component supplier must keep a floating stock on the lorries on the road. There may only be a short term store under the factory eaves and early deliveries are not allowed.

All of this sounds onerous for the supplier. However, he receives considerable technical and financial back-up from the customer, which will often have a direct financial stake. There is also little chopping and changing between suppliers. If an alternative supplier, either from Japan or overseas, offers lower cost components the Japanese customer's first reaction is not to place an order. Instead he will try to find out why the components are cheaper and ask himself how he can cut the cost from his existing supplier. He may then provide soft loans to buy new equipment or send a team of production engineers to improve the production technology.

This makes selling components into Japan a frustrating business. Unless it depends on technology which cannot be copied or is tightly protected it is difficult to make anything other than token sales of components. In recent months MITI has been urging companies to look overseas for purchases; if they do it will be a major shift in current practice.

The absence of suitable component suppliers is sometimes offered as an excuse for the failure of British companies to enter mass production industries. Yet not all Japanese companies rely on external suppliers. BROTHER, a medium sized company, which makes, inter alia, typewriters and printers, manufactures most of its components itself including keyboards, pressed and die cast metal parts, plastic mouldings and small electric motors. Other companies, such as TOSHIBA, MATSUSHITA, HITACHI and CANON buy in some parts but manufacture critical items such as photocopier drums, dot-matrix printer heads, disc drive parts and video recorder heads in house. Hence the success of the Japanese companies does not seem to depend critically on the existence of component suppliers.

JAPANESE INDUSTRY 8

GOVERNMENT LABS, UNIVERSITIES AND TECHNOLOGY TRANSFER

In the UK we are accustomed to the idea that Universities, and to some extend Government laboratories, are pools of technical expertise which ought to be tapped by industry. It is considered vital for high technology programmes such as Alvey to have a strong University and Government component. The problems of transferring technology from these institutions to industry are the subject of considerable debate.

Japanese industry sidesteps the problems of technology transfer by doing its research itself. Consider a typical high technology product, amorphous silicon photocells used in solar energy applications and as power supplies for pocket calculators. One of the main companies, SANYO, makes solar cells with a total output of 3MW each year. It has 30 high quality researchers in this area and well equipped research laboratories. Japanese companies see it as illogical to expect one or two individuals in a University or Government laboratory to make a contribution to this effort.

This does not mean that companies ignore the Universities and Government labs. Their research staff will regularly visit such institutions for discussions. Often a public sector researcher may be better briefed on developments overseas and acts as a "listening post" for new ideas. University staff can offer advice and provide post-graduate training. And if there is a gifted researcher, either from Japan or overseas, the company is keen to hear and discuss his work. It is unusual for a Japanese company to give a research contract to a University but it may supply equipment.

Even within the companies technology transfer from laboratory to production is seen as a problem and considerable steps are taken to ease the path. TOSHIBA'S development of the Tosfile optical disc document image store is a typical example. It was first mooted in 1978 and the TOSHIBA R & D labs were asked to do necessary work on lasers, electro optics, disc materials and precision servo machanisms. After the labs had developed the essential technology the design engineers from the production factory moved to the laboratories and worked alongside the research workers for a full year before returning to the factory to complete development. This produced a smooth transfer of the technology and Tosfile was introduced in 1982, a full two years ahead of the competition. It

would have been impossible to achieve the same level of contact with a university. Perhaps this is a reason why the undoubted excellence of UK universities is rarely converted to a major industrial success.

Hence Universities and Government labs play a relatively minor part in industry's R & D effort. Often they will indulge in parallel research topics or tackle subjects not of interest to industry. However they do provide a pool of expertise for use by MITI and other Government agencies in planning and running Government sponsored industrial research programmes.

JAPANESE INDUSTRY 9

SALES, MARKETING AND DISTRIBUTION

Japanese firms achieve high outputs with limited numbers of production workers. In contrast they maintain large well manned sales forces. Some of the large Japanese companies export to over 100 different countries as well as Japan and teams of people must monitor the different requirements for these markets and make sure that appropriate products are supplied. There is no substitute for manpower in these activities; the result is that the production workforce is usually outnumbered by the worldwide sales force.

Marketing high value industrial goods, such as machine tools, in Japan is much the same as in the UK. Exhibitions and trade shows take place in the main cities, particularly in Osaka and Tokyo. Manufactures will also maintain demonstration, service and training centres in the large cities. The Japanese customers expect such back-up and if a product goes wrong it must be repaired within hours. This makes it difficult for importers to test the market in Japan; selling demands a high commitment from the start.

Consumer goods in Japan must wend their way through a tortuous distribution system before reaching the customer. There are 430 thousand wholesale outlets and goods are bought and sold 4.2 times before they reach one of the 1.72 million shops; the UK figure is 1.9 times.

The final retail outlet is often a small shop franchised to sell the products of only one manufacturer, particularly in the electrical sector. This gives the supply companies great marketing power; for example when JVC introduced the VHS video tape standard in 1976 its product appeared exclusively on display and sale in 46,000 small electrical shops all over Japan. It was able to seize a dominant market share even though the Sony β-max system was already established. Philips, with no tied outlets, had no hope of establishing its V series formats in Japan. The same would be true for any other manufacturer trying to establish itself in the electrical/electronic consumer goods sector.

It is not only overseas companies which face this problem. Coney Onkyo, which produces about £40 million worth of radio and hi-fi equipment each year in Japan, sells 90 per cent of its output overseas because it is unable to penetrate the Japanese marketing system.

In addition to the numerous small shops in every town and village Japan also has department stores, rather like those in the UK. The department stores are widely distributed in the large towns and have considerable buying power and are able to short circuit the distribution system to some extent. However they do not use their lower buying in prices to cut sales prices and undercut the small local shops. Instead they use high margins to offer a high standard of service; they are very well manned and well decorated. The number of large outlets are controlled and they do not seem to have reached the density necessary to promote price competition.

Finally, there are discount outlets. These are concentrated in small areas in Tokyo and Osaka; only part of the population has easy access to them. These account for about 15% of retail sales in the electrical sector and offer discounts of 10 to 30% off the manufacturer's list price. They use their buying power to force very low prices when buying directly from manufacturers, but only pass on part of the saving; the remainder is channelled off for other, sometimes dubious, purposes. They deny that they operate cartels but it is noticeable that the discount prices of adjacent shops are usually within a few yen of each other; there is no downward price ratcheting.

Hence an importer bringing a consumer product in Japan is faced with a difficult job in getting his product in front of the eyes of a customer. The simplest approach is to deal directly with the large department store chains as many importers do, including the producers of fine china. However, this neglects over two thirds of the potential market. Marketing through other outlets is usually impossible. A UK manufacturer trying to launch an electronic mass market consumer product in Japan would face an impossible task; in contrast Japanese manufacturers such as TOSHIBA claim they can reach 70 per cent of the UK market by dealing with only 6 retailers. As discussed previously the Japanese marketing system is particularly effective at keeping the inexpensive electrical and electronic products from Hong Kong, Taiwan and South Korea off the market, despite their geographic proximity.

This complex, and expensive, distribution and retail system means that the Japanese consumer does not benefit from Japanese manufacturing efficiency. The prices of Japanese made goods in the shops in Tokyo on products with no tariff or other barriers are usually higher than in London. But the inefficiency creates employment.

Finally the size of the Japanese market, based on an economy over twice the size of the UK's, is sometimes given as an explanation of Japans industrial success. But does it, for example, explain why Japan can support 17 companies making office facsimile machines while the UK supports none.

JAPANESE INDUSTRY 10

AN ENGINEERS CAREER

Education

The Japanese education system is based on a mixture of state and private schools. Education is free to age 15 at state schools but fees can exceed £1000 year at a private school. From age 15 fees of about £600 per year are also charged at state schools, but grants covering about half of the cost are available to the poorest families. There is intense pressure to succeed and many children spend several evenings a week at 'juku' (cram schools). Competition to enter university is fierce.

About 35 per cent of pupils enter university (comparable UK figure 14 per cent). Once there the pressure is less severe than in the schools and it is unusual for students to fail.

The Universities concentrate on providing a broad education with a good grounding in maths, physics and chemistry for engineers. There is some specialisation, but less than in a UK undergraduate course. About 10 per cent of engineers stay on for some specialised two years masters degree after the four year degree course. A PhD would take a further 3 years. The student must fund his own university career by summer jobs, support from parents or state loans.

Japan produces about 10 times as many engineering graduates as the UK although it only has just over twice the population. It produces over 20,000 graduates on electrical and electronic engineering. The UK figure is 3,000. Yet Japanese companies say they are being held back by a shortage of electronic engineers. (Table).

Recruitment and Training

The large Japanese companies recruit large numbers of engineering graduates with Ordinary and Masters Degrees. Jobs in these companies are highly sought after; only a relatively small number of banks and finance houses offer better long term prospects for a young graduate. The initial salary for an ambitious engineer entering a company may be lower but he is taking the only path which will lead to board membership.

Graduates in Electrical/Electronic Eng. Engineering 1984

	Male	Female
1st Degree	18,527	266
Masters	1,901	12
Doctorates	116	1
	20,544	279

Figures-Monbusho

On joining the company the new graduate will undergo a period of induction training, which may last for over a year. In CANON'S case this includes 3 months on a production line and 3 months door to door selling of photocopiers. He will also receive training in topics such as etiquette, English and company history and ideals as well as technical training for his first work assignment.

At Work

The boundaries between production, production engineering, marketing support and R and D are less clearly defined in Japanese companies than elsewhere. Company policy dictates that a graduate engineer may work in any of them and move every two or three years although a successful research engineer may stay put for a longer time.

By the age of 30 a good engineer will be earning over £20,000 per year, including bonuses and overtime. In advancing areas such as electronics this is often a time for extensive in house retraining, with the aim of bringing his technical education back up to the current first degree or MSc level. He will then continue to work as an engineer for another few years. He works long hours, often until 9 pm every night, for which he usually receives overtime pay. He will usually be entitled to 3 weeks holiday every year but may take only 2.

Over the first 15 years of the career the salary difference between mundane and outstanding engineers is small. The main difference will be that in a company paying a 4 month per year salary bonus, i.e. giving an average of 3 months pay at the winter and summer bonus months, the good engineer will receive 5 months bonus per year while the poor performer only 3 months. The difference is not consolidated into basic salary and must be earned anew each year.

The first major change occurs in the late thirties. Unexceptional engineers will often then be transferred to associate or supplier subsidiary companies. Others may be retrained and remain in engineering functions while others move into sales and marketing. The top third will receive concentrated management training and will become factory managers, department heads and senior managers. Those successful in these roles will ultimately be appointed to the board of directors; in the high technology companies this is almost entirely composed of engineers who have come up through the company structure. The classic route to company President is via R and D Director.

Final retirement at present usually occurs between 55 and 60, although talented people are invited to stay on as consultants or are appointed to manage associate companies.

Hence the main differences between Japan and the UK are:

1) in the UK it is widely held that engineers can't run successful companies; in Japan they believe no-one else can and the board is manned by people with an intimate knowledge of the company's technology.

2) in Japan engineering is the natural route to the top of a major company; engineering as a career attracts people who are both ambitious and talented. In the UK a management qualification, accountancy or legal training is probably a faster, less hotly contested route;

3) a good engineer is better paid in a large company than he would be anywhere else. Staff turnover, in the past, has been very low. An engineer at a particular age is better paid than any other member of staff.

One major problem faced by the companies is that as growth slows they are less able to offer good career prospects to the over 40s. This seems to be lowering morale throughout the system and engineers are becoming more mobile. The large companies are still unlikely to recruit at other than new graduate level unless they desperately need a specialist; there is still a strong distrust of 'paratroopers', or late entrants. The other major problem is a national shortage of engineers in some disciplines, particularly software and electronics. Small companies in particular say that they can not take on work because of this.

JAPANESE INDUSTRY 11

THE ROLE OF MITI

In the past the overseas perspective of MITI has often been that it acts as a "puppet master", controlling and co-ordinating the activities of companies to seize new export markets. This overestimates the influence of MITI; Japanese companies are fiercely independent and would resent anything other than indirect guidance.

In practice the growth centred philosophies of companies have meant that little urging from MITI has been needed. Another factor is that MITI is generally prepared to shape its policies in line with the needs expressed by industry, through consultative committees, usually containing a high proportion of industralists. Industry also provides a management career for senior MITI officials retiring in their fifties.

Over the last 30 years Japan's stable Government has had every reason to be satisfied with this relationship and has felt little need to interfere. The result has been a situation where it has been difficult to say whether MITI leads Japanese industry or vice versa.

Japan's massive trade surplus seem likely to disturb this relationship. The reaction from overseas Governments has prompted MITI to invite 60 major companies to prepare plans to boost their imports. For the first time MITI is trying to persuade firms to act in a way which many think is against their own best interests.

GOVERNMENT SPONSORED RESEARCH

THE NATIONAL PROJECTS

Most Japanese Ministries, such as Environment and Transport, have their own research laboratories serving the specific requirements of their Ministry. They have much in common with their UK counterparts and exist to provide research and advice for their Ministries.

Thirty one, about one-third of the total, Government laboratories are at Tsukuba, sometimes known as "Science City", about 40 miles north-east of Tokyo. The intention in moving there to this new University town was to generate an atmosphere where there would be a cross-fertilization of ideas and technologies. It is probably fair to say that this has yet to be achieved. There is little communication between laboratories. A scientist is more likely to have visited an institute in the US than the one 100 yards from his front gate.

The laboratories controlled by the Agency of Industry, Science and Technology (a part of MITI), have a greater impact outside Government than those of other Ministries. Much of their research work is speculative and long term and has little obvious direct impact in industry but they do provide technical management and advice for the national projects. Typically one or two such projects start each year. They normally run for 5 to 10 years and total budgets are in the range from £20 million to £100 million. Their broad aim is to equip Japanese industry with expertise either in areas where it is seen to be lagging other countries or in areas where it is on a par, but where a co-ordinated national effort seems likely to make significant progress. The topics are identified by advisory committees with representation from Industry, University and Government.

Some national projects are successful, some less so. One relative failure was CACS (Comprehensive Automobile Control Scheme) aimed at developing advanced urban road traffic control equipment. It ran from 1972-1977 and the total budget was £20 million. Little of the advanced route guidance and variable signing hardware and systems developed for the scheme have found practical application. On the other hand it gave companies such as HITACHI, NEC and SUMITOMO expertise in traffic control technology; there is now little hope of any overseas company selling traffic control systems in Japan.

There have also been outstanding successes. In the early 1970's it seemed that the US had an unassailable lead in the production of integrated circuits and the

Japanese industry was little bigger than that of the UK. In 1976 MITI started the VLSI project, with a total budget over 6 years of £100 million. Japan now holds 35% of the world market in ICs. The Japan-US IC trade figures illustrate Japans progress (Figure 6). Japan expects to have a £2 billion trade surplus in ICs in 1985; the UK deficit is expected to be about £400 million.

In 1985 the world IC market has slumped as a result of over capacity and reduced demand. Prices have collapsed and a 256 k DRAM is now available in volume for £3. Nevertheless investment continues in Japan. This year SHARP, SANYO, SONY and NMB will all start making 256 k DRAMS. Meanwhile US companies are laying off staff and some, such as National Semiconductor, are withdrawing from the memory market. Japanese companies are also making a major effort in microprocessors and support chips and are busy establishing custom design centres in developed countries, including four in the UK. This, couplied with the fact that 8 out of 10 of the 1M bit DRAM designs announced so far are Japanese suggests that they may reach a 50 per cent world market share as demand peaks again. The roots of Japan's progress to a world supplier of VLSI lie in the well targetted national project.

Figure 7 shows some of the current national projects and expenditures.

FIGURE 6

Japans IC Trade with U.S.

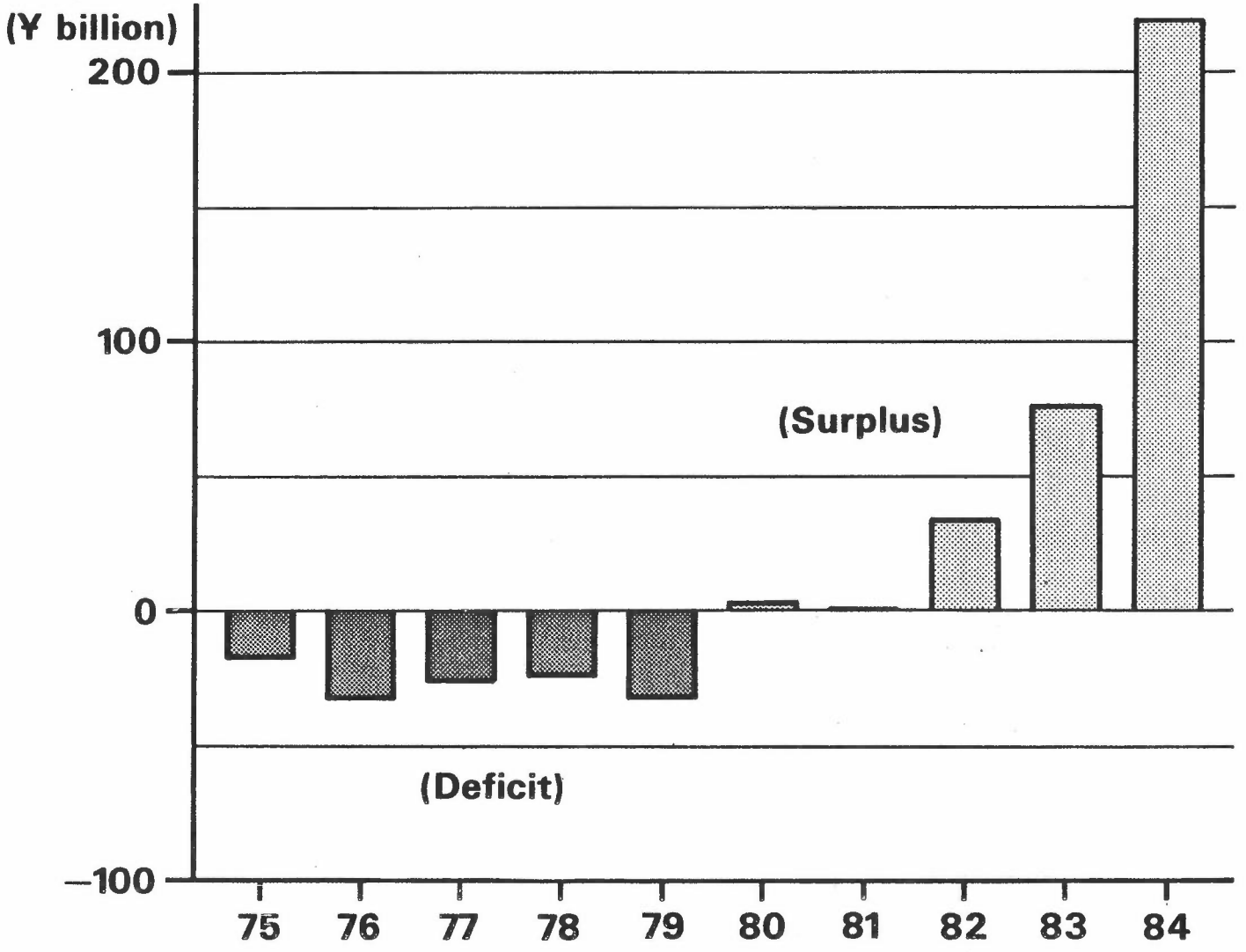


FIGURE 7

National Projects

	Total Budget
Manganese Nodule Mining	£66m
10 Gigaflop Supercomputer	£75m
Automated Sewing System	£43m
Advanced Robotics	£65m
Earth Observation Systems	£75m

UNEMPLOYMENT

A NATION OF SHOPKEEPERS

The UK has an unemployment rate of 14 per cent. Japan's official rate is now 2.7 per cent. However Japan excludes the short term unemployed and people who manage to find occasional short term work from the statistics. It has been suggested that this would give a still enviable rate of about 5 per cent by UK standards. How does Japan achieve this?

At first sight industry is a major factor. As discussed in Section 1 Japanese companies manufacture a variety of products which are no longer produced in the UK. However Japan's higher productivity more than outweighs the difference and only 25per cent of the Japanese workforce is employed in manufacturing industry. The UK figure is 26.7 per cent.

In the industries responsible for the trade surplus output per employee averages about £80,000 p.a., almost twice the UK average. In some firms, such as BROTHER, it exceeds £100,000 p.a. At that rate Japan's £24 billion trade surplus is directly responsible for about 300 thousand jobs. While there must be multiplier due to the impact of suppliers it seems unlikely that the work involved in producing the trade surplus is responsible for more than about 1 million jobs. If the UK emulated Japan's relative industrial success it would produce under 500,000 jobs, taking account of the relative population or GNP's. These would be welcome but are no solution to the UK's unemployment problem. In practice the overall employment ratios suggest that increase in efficiency needed throughout British industry if emulating the Japanese model could well result in a net loss of jobs.

The answers lie elsewhere and can be considered in age-related and non-age related factors. For simplicity the unemployment figures in the following sections have been translated to a UK base.

Age Related Unemployment

a. Education 1: In Japan 95 per cent of pupils remain at school until they are 18. In the UK the corresponding figure (School + FE) is 40 per cent. Adoption of the Japanese system would remove about 700,000 potential job seekers in the UK from the employment market (although not all of these appear in the UK statistics);

b. Education 2: In Japan 35 per cent of the population attends University. The UK figure (University + FE colleges) is 14 per cent. Adoption of the Japanese system would remove about 350,000 potential job seekers in the 18-21 age range from the UK job market;

c. Retirement: In Japan retirement for people in employment is normally between 55 and 60 while in the UK it is in the 60 to 65 range. Many Japanese retirees find part time jobs and do not disappear from the labour market. It is difficult to identify the true impact of this earlier retirement but assume that the average Japanese retires 5 years earlier than his UK counterpart and one third of these permanently cease work. This would remove 2 million people from the Japanese workforce, or 1 million in UK terms.

Hence adoption of Japanese education and retirement patterns might cut UK employment by 2 million. They would add to public spending, although there would be a saving on benefits and youth employment programmes. The Japanese education and retirement plans also add to public spending, although a greater part of the provision burden is borne by individual citizens. Finally the Japanese pattern satisfies industry; it needs well educated young people as a workforce and likes them to retire before they are too far past their physical and mental peak.

Non Age Related Unemployment

A study of Japan reveals much about the UK. It shows that it has failed to match the Japanese drive to efficient mass production. It also shows that the UK has had a massive efficiency drive in the service industries in the last 20 years, totally unmatched by Japan. Unfortunately efficient service industries, particularly in the wholesale and retail trades, generate unemployment.

Japan is still a country of small shops for all products (see Marketing). There are large supermarkets but they are relatively few and far between, and most are compact with 1,000 to 2,000 square feet of selling area. There are hardly any equivalents of superstores and hypermarkets and none of the warehouse electrical and furniture retail outlets which are found in the UK. Government policy protects the small shopkeepers and hinders the growth of large efficient outlets.

It achieves this by supporting planning controls and by tacitly supporting retail price maintenance. The multitude of small shops also creates employment in the wholesale sectors. There are other knock-on effects; in the UK supplies to a

supermarket may be delivered on a single 30 ton articulated lorry; in Japan they are delivered to the large number of smaller shops in 10 million small vans, creating employment for drivers and in the vehicle industries.

The absence of a drive for 'efficiency', expressed by low manning levels, is evident everywhere in the service industries. Department stores, restaurants and shops are all overstaffed by UK standards while traffic congestion and a 20 ton weight limit on the expressways, half of the UK limit, ensures that the efficiency of road transport, responsible for 50 per cent of Japanese internal freight movement, does not match UK levels. Japanese petrol stations are not self service; they are all well manned and the staff clean windscreens and serve fuel. Japanese restaurants, offering good quality food at reasonable prices, abound and all need several staff. They will deliver food to a home for a nominal fee; the UK equivalent would be the labour efficient take-away. Similarly cheap modern hotels are less expensive and more readily available than in the UK. Low rates and a relaxed planning environment seem to be factors in the existance of many of these marginal high service businesses.

The basic philosophy is the same in the service sector as the manufacturing sector. Short term profits take second place to long term survival. In the UK efficient service means low cost service. In Japan efficient service means good service with plenty of people employed.

These service activities are major contributors of employment. Consider only one, the wholesale and retail sector (Figure 8). In theory if the UK instituted policies which led to a Japanese style wholesale and retail system it would create 3.5 million new jobs. As discussed in Trade and Marketing this might also have a beneficial impact on import penetration. Costs would increase but there would be a saving on benefits.

Summary

Hence efficient industry does not create employment even if it dominates world markets. Japan achieves low unemployment by keeping its young people in education longer than in the UK, by retiring them earlier and by having a large effective service sector. In theory similar policies in the UK could more than eliminate unemployment.

The major question is how far the Japanese population's willingness to fund a large service sector depends on industrial success. Over the last 30 years real incomes have been growing and the pressure to minimize costs has been low. If the

Figure 8 Retail Sector Employment

Employment in	Japan	Japan/2	UK
Retail outlets	8.7m	4.3m	2.3m
Wholesalers	4.4m	2.2m	0.84m
Total in Sector	13.1m	6.5m	3.1m

Note: The Japan/2 figures are shown to permit direct comparison with UK figures.

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LIFE IN JAPAN

INCOME TAX, HOUSING AND LIVING STANDARDS

In 1984 the average gross annual income of a Japanese household with one or more workers exceeded £16,000. In Japan low income taxes allow workers to keep about 85 per cent of this as disposable income. In the UK the figure for a typical family would be only 70 per cent. As in the UK there are major differences in salary levels depending on the employer and job.

Hence at first sight Japanese workers appear to be better off than their UK counterparts. This is deceptive. The family lives in a high cost economy. Typical outgoings include:

Medical Expenses: Medical insurance costs about £20 per month for a family. In addition if anyone needs medical treatment they may need to pay up to one-third of the cost, often a substantial sum.

Education: Private schools, national schools from age 15 and Universities all charge fees. A son or daughter at University can cost several thousand pounds each year. The average family expenditure on education, over all households, is £390 per year.

Housing: Average family expenditure on housing, at £42 per month, conceals a wide range of expenditure. Japan has a long tradition of property ownership and the ownership ratio, at 60%, is close to that in the UK. Many families live with parents to minimise costs but a family which has the misfortune to depend on the property market faces a difficult time. Prices are two to three times their UK equivalent and a family can pay half their income on a mortgage. A small rented flat in outer Tokyo might cost about £200 per month, expensive for low income families and retired people.

Food: Government measures to support agriculture add to food costs. Some items, such as fish and chicken cost much the same as in the UK but fruit and vegetables all cost about 3 times the UK price. Rice, the main staple, costs £1.10 a pound, about four times the UK price while a can of Japanese canned tuna which costs 51 pence in Sainsburys costs £1 in a Tokyo supermarket. In the UK food accounts for 15 per cent of household expenditure. In Japan 25 per cent.

Savings: A Japanese family can expect to have to find large sums of money from time to time if a member of the family is hospitalised or needs educating. In many cases there is also an income gap between retirement in the mid or late fifties until pensions are payable at age 60 or 65, depending on the scheme the breadwinner belongs to. As a result, Japanese families save about 20 per cent of income, twice the UK figure. The tendency of companies to pay part of the salary twice yearly as a lump sum "bonus" aids the family to save. The high savings ratio makes the banks cash rich and able to offer moderate interest loans to industry.

These high costs reduce the standard of living. It is difficult to compare that of different countries. However, a typical Japanese family is slightly less likely to own a video recorder than a UK family and only one quarter as likely to have a holiday abroad. They live in a home about 80 per cent of the size of a modern British semi-detached while car ownership is almost identical. The construction standards of Japanese houses are poor and they are often cold in winter and oppresively hot in summer. Under one half are connected to main drainage. In the large cities there is little open space and in the 1970s there was a major air pollution problem, although this has now been solved.

Hence in practical terms living standards in Japan are no better than in the UK; in many respects they are worse. Despite this the use of small local shops and facilities creates a village atmosphere, even in the large cities, producing a pleasant living environment. People seem content with their lot. There is little crime or vandalism and there is no parallel of the enduring feuds between UK employers and employees over pay levels.

JAPAN 25 YEARS ON

In 25 years time when North Sea Oil supplies run down the UK and Japan will be in a similar position: both will be forced to import much of their energy and raw materials and will need to make a living by adding value to imports. How successful will they be?

Japan is already the world's largest manufacturer of cars, watches, cameras, VTRs, photocopiers and is at or near the top in a host of other products. The large companies have found the knack of manufacturing for the world market; they will attempt to continue their growth. Other industries which so far have concentrated on Japan's internal market will increasingly turn to exports to boost growth. The energy of Japanese industry makes it difficult to predict where all the growth will occur; it will respond to all opportunities but the present openings are obvious.

Office Automation

OA is the main hope for extending the growth of the electronic industry. OA equipment production is expected to increase from £9.5 billion (1983) to £27 billion by 1994. At least two thirds of this will be exported.

Semiconductors

Japan already holds over one third of the world semiconductor market. Japanese companies such as HITACHI, TOSHIBA, and NEC are particularly aggressive in this market; it has been reported that in the US memory market HITACHI has adopted a policy of always being 10% lower in price than any competitor, whatever the cost. There seems little to stop the Japanese industry taking half the world market within a few years (see National Projects).

Computers

FUJITSU and NEC already sell more machines in Japan than IBM and HITACHI is in the process of pushing it into fourth place. Japanese computer exports have grown at 60 per cent per annum (compound) over the last six years and now exceed £3.5 billion. Seimens and Amdahl now supply Fujitsu computers and the UK computer industry depends on Japanese technology. The Japanese manufacturers can supply a broad range of machines, from desk top micros to supercomputers.

The strong growth should continue although there are two potential hiccups. They are:

i) Computers demand more back up and sales support than almost any other product. The companies believe that this has limited sales in overseas markets and hope to overcome the problem by designing machines with standard interfaces compatible with others on the market.

ii) The US disquiet about the trade imbalance has focussed on the computer industry. This may do little to suppress exports but will help US penetration within Japan. Recent decisions where this may have been a factor were NISSAN'S decision to purchase a CRAY supercomputer and IBM Technology agreements with MITI and NTT.

Nuclear Power

MITSUBISHI Heavy Industries (MHI) can build a Pressurised Water Reactor Station (PWR) in under 5 years in Japan, less than half the time it takes to build a comparable UK power station. MHI is just completing a new privately owned 'hot laboratory' and a large fabrication shop for volume production of nuclear power station components. Neither facility is justified by the size of the Japanese market. A strong push into exports is likely. Initially this would be in Asian markets but an effort to sell in the US or Europe is not impossible.

Defence Equipment

Official Government policy is not to export defence equipment. However US and European Defence manufacturers now rely heavily on Japanese components and are starting to purchase sub-systems. The irony of being able to sell items in support of overseas industry but not having direct access to the market themselves is not lost on the manufacturers. Japan already makes about £3 billion worth of military missile systems, aircraft, radars and avionics equipment for its own use. Much of it is built under licence, mainly from the US, but Japanese engineers have mastered the technology. Japan's success in exporting manufactured goods rests on its ability to produce reliable, effective products at a reasonable price, just what is needed for a defence supplier. It already enjoys good trading relations with potential customers, particularly its suppliers of raw materials and oil.

Aircraft

The high passenger loadings on domestic routes force Japanese airlines to use Jumbos, often the Boeing 747 although TDA now operates A300 airbuses. The main internal carrier, ANA, is claimed to be the world's 7th largest airline in terms of passenger km. The main international carrier, JAL, claims to be the world's largest, in terms of international passenger-km flown, although this claim is also made by BA. Japan's booming industry is producing annual growth of 20% in air cargo. In all the two main Japanese carriers have 150 large jets (Tristars, DC10s, 727s, 737, 747, 767 amd A300).

All of this suggests that Japan could support a civil aircraft industry. At present it is building components for Fokker and Boeing and three companies are constructing the body and wings of the Boeing 767 and the forthcoming 7J7. Three Japanese companies are also involved in the V2500 civil airline engine product, jointly with Rolls-Royce, Pratt and Witney and other companies. Hence within a few years the Japanese aerospace industry will have mastered the technology necessary to build large commercial aircraft.

Space

At present Japan has its own launcher and satellite industry, capable of putting a 200 kg satellite into geosynchronous orbit. The industry depends heavily on US technology, and is reckoned to lag the US and European industry by several years in technical capability. Nevertheless within 10 years Japan will have a launcher capable of launching a 2 ton communications satellite and the industry will have gained experience in constructing such satellites through joint ventures with US companies. On the ground station side NEC already holds a major share of the professional world market while 8 Japanese companies have developed and marketed receivers for the experimental direct broadcast satellite launched in 1984.

Hence over the next twenty years Japanese industry could move to a position of supplying a satellite, a launch and all ground equipment for professional communications and Direct Broadcasting satellites. Asian neighbours could be the first customers.

Civil Engineering

Japan has recently completed the 34 mile long Seikan Tunnel and a number of large suspension bridges linking islands in the Inland Sea. Japanese construction companies now have considerable expertise. The Bosphorous Bridge project shows that they will compete, with strong government support, for contracts anywhere in the World.

Pharmaceuticals

The Japanese pharmaceutical market is worth about £13 billion each year. The present export ratio is very low, at only 3% of production. Reductions in internal drug prices by the health and welfare ministry have forced the companies to look to exports and they have boosted R and D expenditure to above 10 per cent of turnover. Once again the drug companies seem to lag the US and Europe in expertise but they are conscious that they are behind and are determined to catch up.

New Markets

The other possibility for Japanese companies is to expand their exports to the developing world in products where they are already strong. In 1984 exports of colour TV sets rose by over 30 per cent to 6 million units, with most of the increase accounted for by exports to China. Japan is looking to the expanding markets in Asia, including China, Indonesia and India, to absorb exports of basic products such as cars, trucks, cameras and TVs.

Conclusion

Hence Japan will build on its strong base in high technology industries. The message for the future is expansion of markets and products and further growth in exports. Trade friction may well develop into a trade war and fear of recriminations is likely to be the main brake on growth. The message for UK industry is that competition from Japan will intensify over a broad front.

Informal Trade Restraint

When Japanese Industry first mounted its onslaught in the 1950's and 60's it caused numerous casualties elsewhere in the world. The British motorcycle industry, the US home based TV and radio industry and the German camera industry have all virtually disappeared.

Once overseas industry awoke to the challenge pressure for protection grew. Various mechanisms have been tried but only one has proved to be compatible with the spirit of free trade. It is for Japanese companies to sell their goods at artificially inflated prices in overseas markets to hold market penetration at an acceptable level. Agreements may be formal or informal and on an industry to industry or Government to Government basis.

The Japanese companies have been happy to go along with such procedures since they gain high profits without having to invest in production capacity. The car makers are happy to earn 50 per cent profit on every car sold in the US or UK, they can sell machine tools in the UK at twice the Japanese price and the ¥ 50,000 minimum f.o.b price set on Video tape recorders for export to Europe has boosted the profits of the electronic companies.

It is doubtful whether such measures provide anything other than the illusion of protection. In Japan it is noticeable that the car companies have used the high profits from exporting to the US and Europe to invest in R & D, construct new factories, some exclusively for export models, to build modern dock facilities and large efficient roll-on roll-off car transporters for shipping their products. In the UK they have used the high margins to build modern import facilities and build up dealer chains. These improvements will make them even more competitive in future and are all funded by overseas consumers. Similarly in other sectors such as domestic electronics the Japanese manufacturers are using high profits to build up their R & D effort in Japan and marketing and distribution systems in the UK and elsewhere.

The damage can be insidious away from the consumer goods sector. If, for example, UK industry has to pay twice the Japanese price for a machine tool it is more difficult to modernise production and produce competitive products.

Niche Markets

An alternative approach is to avoid competing in areas where the Japanese are strong and concentrate on areas where Japan does not compete. Once again the protection this gives may be illusory. The large UK electronic firms have largely pulled out of consumer electronics to concentrate on defence and industrial products. As discussed previously neither is likely to excape Japanese competition permanently. Similarly the UK's integrated circuit industry has avoided competing in the standard large volume areas, such as memories, and concentrated on high value custom IC's. But by the end of 1986 there will be four Japanese specialist IC design centres in the UK, linked by satellite to diffusion facilities in Japan.

Hence Japanese industry expands to fill market niches. Once again the car industry provides an excellent example. The first Japanese cars imported to the UK and US were small, inexpensive family saloons. Since import numbers were limited the Japanese manufacturers have attacked the high profit niche markets with four-wheel drive trucks, directly competing with Land Rover, and specialist sports cars, competing with Lotus and Reliant.

Hence a niche market approach is of little value as an industrial strategy. It may be effective over a period for small UK companies prepared to operate at the pinnacle of advancing technology but as a national strategy for large companies it offers little hope of long term industrial success.

Market Opening Measures

If the global trade figures are examined it seems that the major problem at present is not Japans exports. Low import figures are the cause of the imbalance. At present the UK imports about £4 billion worth of Japanese goods and exports about £1 billion worth of UK products to Japan in return. The UK, the US and many other countries might be happy to see imports from Japan at their present high level if they could encourage Japan to buy more in exchange.

The major problem with this approach is that Japan is largely self-sufficient in many products, with the exception of food and raw materials. It is relatively easy to market unique consumer products or high technology products with no local opposition but most manufactured goods face strong competion. The Japanese government is reacting to overseas pressure but there is a danger that this will produce only token purchases. And even when the Japanese market is ostensibly open hidden barriers limit imports. Two examples are:

i) In 1984 the USA negotiated the famous 'beef and oranges' agreement with Japan to allow the US surpluses of these products easy access to the Japanese market. A good quality US orange in the UK costs about 20 pence; despite the presence of the agreement a US orange in Japan costs at least 70 pence, and usually looks as if it has been in store for a few weeks. They have not swamped the market for home grown oranges, as was expected.

ii) Unlike the UK Japan is not a signatory of the MFA (Multi-Fibre Agreement) which limits the sales of garments from developing countries much as South Korea, Hong-Kong, India and Bangladesh. In theory the Japanese market is much more open than the UK's. In practice clothes from these counties are rarely, if ever, seen in Japanese shops.

Hence even when the Japanese market is theoretically open imports remain low. But even if pressure opened up the markets the danger must be that the main beneficiaries would be the major food exporters and the newly industrialised countries, with little benefit to UK or European manufacturers.

Another related suggestion sometimes made is that Japan should increase internal investment in areas such as housing or mains drainage. There is certainly scope for such investment but it seems unlikely to act as much of a damper on the export industries.

Competing with Japan

Ultimately the only real way of coping with the Japanese onslaught is head on competion. Firms must produce goods which match those from Japan in both price and quality and market them just a intensively. A joint effort would be needed; government would need to create a supportive micro-economic climate for industry similar to that which exists in Japan and industry would have to make growth and exports it first priority.

WHAT COULD THE UK DO?

Japan has negligible inflation, low unemployment and a healthy balance of payments surplus founded on a strong industrial base. Could the UK copy its example? It would demand numerous radical changes by Government and Industry.Some of the possibilities are outlined below.

Government Actions

i) Create an environment where long term moderate interest finance is readily available to industry.

ii) If UK companies acted like Japanese companies their share price would collapse and they would be vulnerable to takeover; Government action to provide protection would be needed.

iii) Ensure that education system produces plenty of well educated school leavers and technology graduates. The Japanese experience suggests that an output of 10,000 electronic/electrical graduates and technicians each year would not be too many.

iv) Minimise the taxes which penalise home industry more than importers. These include rates, income taxes and national insurance. The Japanese experience suggests that sales taxes would be less damaging.

v) The Japanese regard the UK as an easy market. Study how other countries complicate importing.

vi) Create an environment where workers are happy to leave companies in their late fifties to make way for freshly educated young people.

Company Actions

i) Aim for growth and diversification of activities even at the expense of profits.

ii) Invest in R & D. Ten per cent of sales is a good target for a high technology company.

iii) Invest in people. In house training relevant to the company's needs is the most valuable. The in house trained person is worth more to a company than to any other employer. He should be paid accordingly.

iv) Invest in Production Engineering. A company should no more think of buying in production expertise than buying in product designs.

v) Concentrate on Exports. In particular think about exporting to Japan. It is not easy but a company which ignores Japan ignores the worlds second largest market for high technology products; if you gear yourself to sell in Japan you can sell anywhere.

vi) Involve the workforce: eliminate anything which creates visible status differences.

vii) Know what the Japanese companies in your industry are doing. Even if you are not competing with them at present you are likely to be in future. Two recommended inexpensive sources are:

a) OTIS - Overseas Technical Information Service;

b) The Japan Economic Journal - the weekly English language Japanese business newspaper.

Unemployment

Japan's example suggests that a strong export performance would create a healthy balance of payments surplus and help control inflation. The example also suggests that productive high technology industry offers no solution to unemployment. It does show that unemployment can be controlled, but the solution means a high price economy. The UK could possibly reduce unemployment by measures similar to those used in Japan or by related measures. For example a VAT rate of 50 per cent, on all goods, including food, would emulate the Japanese social tax of an inefficient distribution system and the revenue could be used for job creating public works. The major question is whether those already in work would accept the drop in living standards that this action would entail. Perhaps this approach would only be tolerable in a high growth economy.

Conclusion - Is Japan Winning?

Every visitor to Japan tries to identify the secret of its success. Just-in-time component supply, quality circles, the number of engineers and investment in robots have all been in fashion. In reality they are no more than symptoms of the fact that Japan provides a particularly fertile environment for industry. It is noticeable when talking to Japanese industrialists that they seem able to concern themselves wholeheartedly with the design, engineering, manufacture and marketing of their products; their main concern is technical feasibility and not financial viability.

In the UK perhaps we expect too much of industry. It is expected to generate exports, to create profits for investors, to provide revenue for national and local government whatever the state of its internal finance and to provide employment for its workers at an age when they are no longer suited to high pressure production work. The Japanese system allows its companies to concentrate on production and exports to a much greater extent.

Industrialists from the less successful arms of Japanese industry are now imitating the extremely successful electrical and mechanical engineering companies and the Japanese challenge is likely to spread to areas where they have little world market share at present. The brakes on growth will be external pressure and competition. It seems that the British electronics industry is unwilling or unable to compete in the growth products identified in Figure 3; will companies from other sectors of UK industry find themselves in a similar position in 20 years time?

Talk to a Japanese industrialist and he will display considerable admiration for the technical and scientific achievements of the West. He may even mention the number of Nobel Prizes; scientists working in the UK have won 26 over the last 30 years while the Japanese have won 4. But if he is in a growth industry and you ask which country he fears most as a competitor then he is more likely to say South Korea than a European nation. There is a danger that the industrialised countries of Europe will end up squeezed between Japan, which couples advanced technology and efficient production, and countries like South Korea, with advancing technology and low labour costs.

For many years Japan has had the reputation of being a copier of western technology; now the race is on to see which countries can copy the Japanese approach and participate in the race to share world markets. The title of this

paper asks if the Japanese are winning; if winning is defined as having an industrial structure which is surviving and growing then there is no doubt that Japan will win. The question is which countries will be alongside?