The Japanese transformed the car industry. We are now in the midst of a new revolution. Surprisingly, it will make it easier for smaller firms like Austin Rover to survive.

THE RACE FOR POLE POSITION- Revolution in the Car Industry

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ALTHOUGH THE AVERAGE consumer may not yet have noticed, the car industry has recently been going through a quiet but very significant revolution. What is underway is both a technological and a social revolution, the consequences of which reach far beyond the car industry itself. The ideas of scientific management developed by Taylor, Henry Ford and Alfred Sloan, on which the era of mass production was built, have been made redundant by a new vision of production organisation developed by the Japanese. At the same time new electronics-based technologies are changing the car itself and opening up new possibilities for flexible production on a much reduced scale. As the slimmed down British car industry recovers from the short, sharp shock administered by Michael Edwardes and faces up to the arrival of Nissan later this year, an understanding of these developments is critical in assessing the choices and opportunities ahead for all the actors involved.

The likely impact of these developments can be fully appreciated by looking back at similar phases in the industry's 100-year history. A recent study identified four such transformations that set the industry off in a new direction.' As we shall see in each case the pattern of events that followed was surprisingly similar, leading ultimately to the rest of the industry catching up with those who pioneered the particular breakthrough in management, technology or both.

The first transformation

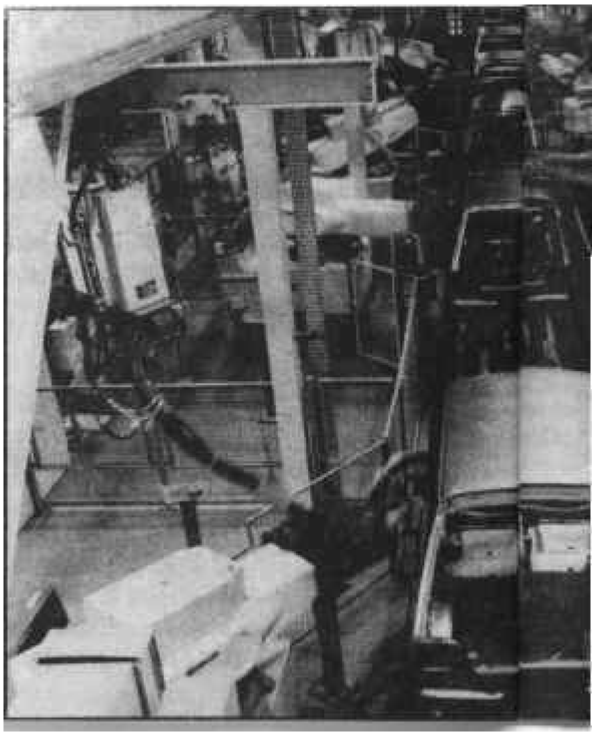
The first of these transformations was the breakthrough by American producers from around 1910 that turned this from a custom building to a mass volume industry. Henry Ford combined new production technology (the moving assembly line) with a new product (the standardised Model T) and a novel system of factory social organisation. Based on the ideas of Taylor, these scientific management principles, as they became known, took the division of labour to its logical extreme, breaking the work down into foolproof repetitive tasks. Ford balanced this with the introduction of the eight hour day and the doubling of wages.

Shortly afterwards Alfred Sloan, the early head of General Motors, developed the management superstructure to go with Taylorism on the shopfloor, extending the division of labour upwards into management functions and adding several tiers of management to control the operations of the company. This laid the basis for the multinational company of the postwar years. The adoption of scientific management led to a dramatic reduction in costs and an explosion in production to 4.8m cars by 1929. The industry quickly became concentrated in the hands of three companies, General Motors, Ford and Chrysler, which dominated the world industry throughout the interwar period.

In the 1920s the Europeans erected tarifi barriers to stem the flood of imports from the USA. Ford in turn responded by building modern integrated plants at Dagenham and Cologne in the early 1930s. The European producers began the process of catching up by copying what they learnt from visiting Detroit. However the demonstration of the full benefits of scientific management and mass production technology in Europe had to await the opening of the European market in more favourable circumstances after the second world war.

The second transformation began in Europe during the 1950s. The contribution of the European producers was to pioneer a diverse range of new product technologies, such as small transverse engine, front wheel drive hatchbacks. Because of national differences within Europe, in travel patterns, road conditions and customer tastes, car producers in each country went their own way, accumulating skills in designing different kinds of cars. When the European market opened up in the 1960s the European producers had an extraordinary range of models to offer consumers abroad, in contrast to the basic US built car which changed very little until the late 1970s. Trade within Europe grew quickly and European firms also captured 10% of the US market by 1959, in the process creating a new market there for small cars. The diversity of the European industry in fact turned out to be its strength, and not its weakness.

There were calls for the US government to halt this flow of small cars from Europe in the late 1960s, though these calls never came to anything. At that time wage costs rose in Europe and the devaluation of the dollar after 1971 led Volkswagen to open its first plant in the USA, while US producers responded with their own first small cars. Some European producers then

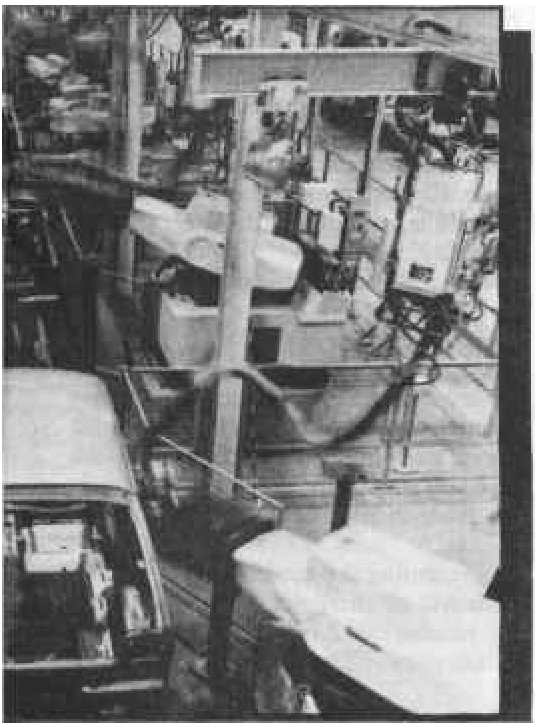


went 'up market' and created an entirely new, high priced luxury car market in the USA, which they now completely dominate.

The Japanese revolution

The third transformation was the work of the Japanese producers. In retrospect it is clear that the success of the Japanese car industry had little to do with lower wages, more robots or a particular addiction to work and discipline on the part of the Japanese worker. With a protected domestic market and a ban on foreign ownership Japanese firms licenced small car designs from Britain and France and introduced scientific management principles from the USA. Over time these management principles were turned upside down to suit Japanese priorities (such as limited space, materials and energy) and Japanese circumstances (a unique ability to work in groups coupled with the group structure of Japanese business). The result was that the Japanese developed a completely new system of social organisation as significantly different from what went before as scientific management was over previous techniques. As the system was refined it was able to deliver a much cheaper product of much higher quality.

There are three major elements to the Japanese breakthrough in social organisation. The first is a complete reorganisation of both the flow of work through the plant and the structure of management. The most well-known aspect of this is the 'just in time' system. In the West large stocks of parts were held throughout the plant in an effort to achieve the longest possible production runs and to ensure against equipment breakdown, defective parts and interruptions to the supply of components. The Japanese believed that these stocks hid rather than ameliorated problems and deliberately removed them. By doing so they revealed the bottlenecks in the plant in order of priority. Every effort was then devoted to removing these bottlenecks one at a time until they achieved a completely uninterrupted production flow.



In such a system defects become apparent very quickly, in contrast to the West where defects are only discovered later at great cost in terms of repair and waste. The Japanese therefore deliberately aimed at zero defects at each production step. To achieve this it was necessary to return the responsibility for diagnosing problems, repairing equipment and spotting defects to the line workers, eliminating in the process the need for armies of supervisors, inspectors and repairers. By moving knowledge, skills and decision-making down the system the Japanese were also able to eliminate many layers of middle management previously involved in collecting and transmitting information up the organisation and sending decisions down from the top. Whereas there are about 16 layers of management in General Motors there are only six in a Japanese firm.

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The smooth operation of such a system depends on the active cooperation of the workforce and a change from traditionally demarcated, job-specific skills to workers with firm-specific skills enabling them to perform many tasks within the company. The change from the principle of the rate for the job to a person-related wage, supplemented by large bonus payments, rewarding firm-specific knowledge and loyalty in return for job security was sufficient to change the behaviour of Japanese workers, even if it may not have altered the underlying antagonism between the workforce and management. This was reinforced by lifetime employment, company unions and a very much smaller pay differential between the shop-floor and top management.

The second element of the Japanese system is the extension of these ideas into the pyramid of companies supplying components. They also work on a 'just in time' system delivering components many times a day right to the assembly line. Many of the larger component suppliers started life as subsidiaries of the Japanese assemblers, and the assemblers also have minority shareholdings in many of the smaller components firms. These interdependent relations overcame many of the inefficiencies of traditional vertically integrated companies in the West, and on the other hand, do not rely on playing independent suppliers off against each other for short-term price advantage. The links between the companies exist on many levels. Company chairmen meet monthly to discuss long-term strategic issues and performance, while production and design engineers collaborate extensively.

Learning from Japan

The third element of the Japanese system is the role of the industrial groups, called Zaibatsu. Grouped around a major bank and a trading company are hundreds of companies producing all kinds of things, from steel and cars to electronics. Each of these companies owns a small proportion of the shares of the other companies, so collectively they all own each other. The stock market is hence irrelevant in Japan and these cross ownership relations can be seen as a web of mutual commitments to cooperate, rather than a means of control or a claim on profits. Most of the car producers, except Honda, belong to such a group. While there is a high degree of strategic cooperation within the group, so that they operate almost as mini-economies, competition between groups is intense. Should one company in a group get into trouble, other group companies will rally round to inject the necessary cash, management and technology. It would be a great loss of face for the group to be forced to leave a particular industry. Competition in Japan therefore focuses on improving performance rather than catching one's competitors out in a moment of weakness. This unique combination of cooperation within the group and intense competition between them has proved much more dynamic and innovative than Western-style competition.

The three elements of the Japanese

[1] A Altshuler, M Anderson, D Jones, D Roos and J Womack *The Future of the Automobile* Allen & Unwin 1984.

system when combined enabled the Japanese to reduce the number of hours needed to build a car from 250 to 140 between 1970 and 1981, with further reductions since then. This compared with an average of about 200 hours in the USA and West Germany in 1981, and slightly more in the UK. This competitive advantage allowed the Japanese to overtake the US in car production in 1980.

By 1981 all the major car-producing nations of the West had introduced some form of restraint to stem the rising flood of car imports from Japan. This finally convinced the Japanese to build plants in the West. By 1985 the five largest Japanese producers had announced plans to build one and a half million cars a year in North America by 1990. Japanese investment in Europe will not be far behind.

Meanwhile, European and American producers have begun to adopt many of the techniques pioneered by . the Japanese, either through direct copying of what they have seen in Japan, through collaboration with the Japanese (as Austin Rover is doing with Honda), or by observing the activities of Japanese owned plants in their own countries. A visit to the Honda plant in Marysville in the USA should be enough to convince even the most hardened sceptic that the Japanese system is fully transferable to the West, a lesson borne out by other Japanese owned plants. There is no doubt that the example of these plants will have a very powerful demonstration effect in diffusing these techniques to the West, breaking down the final reluctance or resistance of both middle management and the workforce. Western companies who either look for excuses because the task seems impossible or who think they can get round this challenge by introducing even more automation are in for a rude shock.

As the car market in the advanced countries approaches saturation the demand for new cars is mainly to replace existing cars rather than first-time buyers. Demand is expected to remain highly cyclical and to grow at only 1 or 2% a year. With increased affluence, at least for those in work, and the growth of two or three car households many new market segments have opened up. The Golf GTi began a new class of sporty hatchbacks while the Nissan Prairie and Honda Shuttle offer custom designed alternatives to the estate car. At the same time four wheel drive on such different cars as the Audi Quattro and Fiat Panda cater for high performance and basic off road utility. In addition to a fragmentation of the market, producers of more upmarket cars, such as BMW, Mercedes and Volvo, have been able to charge a premium for an image different to say Ford or Opel. With little sign of demand patterns converging within or between countries the era of the large volume 'world car', if it ever existed, may now be over.

The present, fourth transformation

We are now in the middle of a fourth transformation. After a long gestation period in the aircraft and computer industries, electronics began to have a pervasive influence on the car industry in the late 1970s. There is no doubt that after a period of modest, steady technical development the cars of the 1990s will incorporate a whole range of new technologies. While from the consumer perspective the car will evolve from current designs, every system in the car, including the body, will be quite different from those of today, offering significantly improved performance, fuel economy, safety and comfort with lower emissions.

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Changes in the process of making cars are at the core of the fourth transformation. In the last six years we have seen a major change of direction in important items of production equipment. The trend until then was towards ever more dedicated automation geared to high volume output of a standardised product. There was little flexibility and the equipment had to be completely replaced for a new model range or"engine. The new generation of production technology taking shape around computer aided design and engineering, robots for welding, painting and handling and flexible manufacturing systems have added a new element of flexibility and have dramatically reduced the economies of scale in this industry.

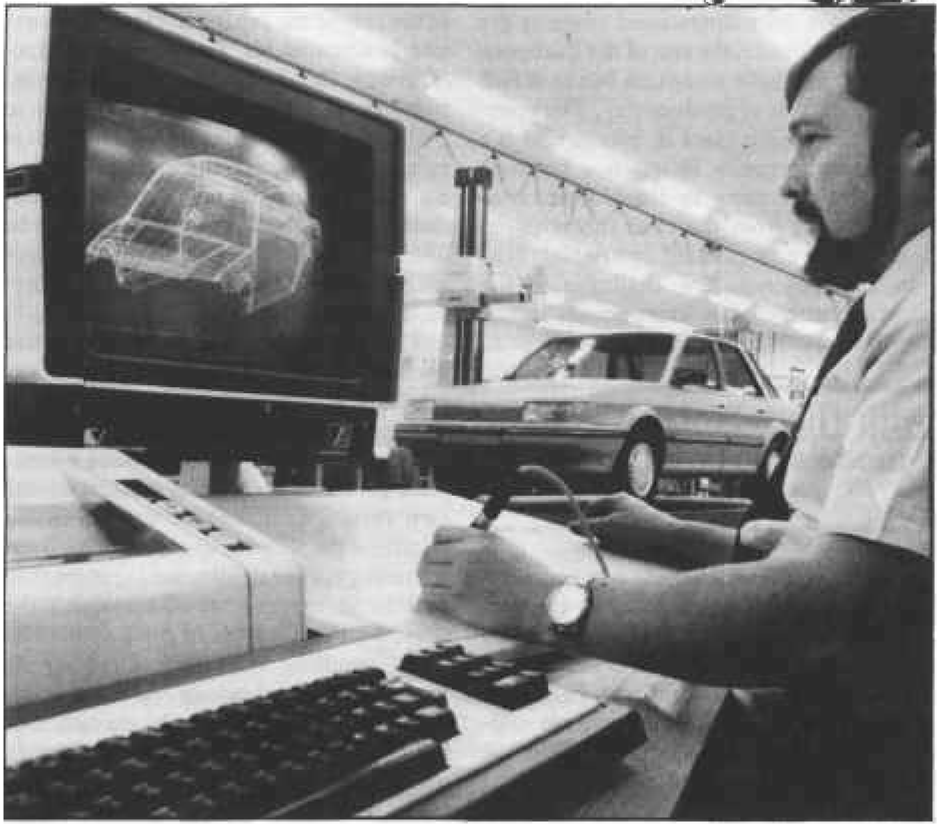
With a line of robots, a mix of models can be built on the same line and production can be changed quickly in response to changes in the market. New models can be introduced by reprogramming the robots rather than buying a new set of equipment. Once the initial investment has been made, a line of robots can be updated piecemeal by replacing them one at a time as new generations of equipment become available, instead of waiting for the next model change in several years' time. This is important when robotic technology is advancing rapidly, enabling them to do more things in a shorter time for more or less the same cost. While the industry is becoming more capital intensive this technology is also capital saving in that it significantly improves the utilisation of the capital equipment.

In addition to flexibility this new technology also brings substantial advances in product quality. Where so many parts have to fit together exactly, improvements in the quality, accuracy and consistency of each production operation add up to substantial cost savings, quite apart from eliminating many heavy, boring and dirty jobs. Grand attempts to automate with the sole aim of eliminating labour have been less successful than step by step automation of quality critical operations. It is becoming clear that exploiting the full benefits of this flexible technology depends on making the prior step towards 'just in time' and 'zero defects' mentioned earlier and is not a substitute for doing so.

Having substantially transformed the stamping, welding, painting and machining operations, flexible automation is now spreading into the trim shop and the assembly of components, sub-assemblies and final assembly. Computer aided design and engineering is also transforming the design process, reducing the cost and time taken to develop a new model and integrating the design process with manufacturing for the first time. As all these elements come together, it will be possible to produce a full model range in one or two plants, at much lower volume at a competitive cost, with much larger producers. There is little doubt that this is the biggest factor changing the fortunes of smaller and medium sized producers. Austin Rover and Saab are pioneering the development of smaller scale production tooling which will not be a priority for the larger producers, such as General Motors or Volkswagen. These new flexible production technologies are therefore opening up a much wider range of production possibilities at different volume levels. Moreover we are only halfway through this transformation, the switch from the steel car to the car made from plastics, composites and ceramics may again dramatically change the production process in the 1990s.

Restructuring the car industry

How will all these developments change the structure of this industry in the next decade or two? With the opening up of the



Austin Rover's computer aided engineering system. Car design at the touch of many buttons.

world market for cars, many observers expected a further rationalisation of the industry into a few, global mega-producers. This is now unlikely to happen. Falling economies of scale and increased scope for product differentiation create new opportunities for smaller and medium sized producers. To survive they will also have to seek collaborative ventures with other car producers to build some of their models and engines, to develop high risk new technologies and, in the future, to share distribution costs.

It is no longer correct to think of the car industry as a sunset industry, destined to follow textiles to the developing countries. Japanese management and new technology have pulled the rug from under the feet of the developing countries. It is still cheaper to build cars in Japan than in Korea, despite much lower wage costs in Korea. As the West catches up with the Japanese, strategies on the part of the developing countries to penetrate Western markets using their lower labour costs are less and less likely to succeed. The growth of the car industry in these countries will therefore be more closely linked to the growth of their own protected markets.

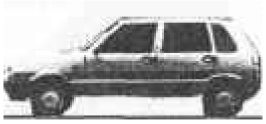
In the West the car industry is assuming a new significance, quite apart from its importance in terms of the balance of payments and employment. It is rapidly becoming a major consumer of electronic components and is the main first user outside the aircraft industry of robotics, computer aided design and flexible manufacturing systems. It also plays an important role in demonstrating the use of this equipment and in diffusing Japanese management techniques to the rest of the engineering industry.

Where does the UK car industry stand in all this? Before answering this it is perhaps worth remembering that British industry as a whole was for many decades shielded from the full force of international competition. After the first world war the British market and its main export markets in the Commonwealth were closed to its main industrial competitors, Germany and the USA. This protection lasted until tariffs were removed in the 1960s. During this half century the belief in the supremacy of British industry was never seriously tested, and when challenged for the first time in the 1960s was found to be far short of the truth. In industry after industry Britain's share of world trade fell and imports rose. In addition to coping with the opening up of her markets, Britain joined the EEC and within a few years switched its exports from Commonwealth markets to Europe. This all happened just when the postwar boom came to an end, the fixed exchange rate system collapsed and oil prices quadrupled. By the end of the 1970s it was clearly apparent to everyone that things simply could not continue as they had done and that some drastic changes were needed to become competitive again. However changing attitudes and institutions takes decades even under favourable circumstances, in tougher times they are accompanied by considerable hardship and disruption.

The underlying problem of the UK car industry was that it never developed an adequate response to the potential of Ford's best practice plant at Dagenham, opened in 1931. Successive mergers, from the Austin and Morris merger in 1952 to the final merger with Ley land in 1968, were never carried through. An efficient management superstructure was never added to Taylorism introduced on the shopfloor and weak management simply reacted to events. As in most other countries the unions sought above average wages for operating a Taylorist system. Management while agreeing to pay this premium, failed to demand the levels of productivity that would have enabled them to do so. Productivity stagnated and fell well behind the rest of Europe and imports began to enter the UK in large numbers after 1970. Between 1972 and 1979 car production in the UK collapsed from 1.9m to one million cars a year.

Austin Rover and the multinationals

It was not until 1978, three years after BL was rescued by nationalisation, that the task of welding together all the companies, their model ranges and plants, was begun by Michael Edwardes. By that time BL's market share had collapsed to 24% and the surgery required was more drastic than it would have been a decade or two earlier. Many of BL's plants were closed and break even output was reduced from lm to 430,000 cars a year. The remaining plants at Longbridge and Cowley were retooled and new manning levels were introduced to improve productivity to European levels. Employment in BL fell as a result by 67,000 between 1979 and 1984. A new model range was introduced, which will be completed with the launch of the new Rover this year. To offset its smaller size BL is pursuing an ambitious programme to exploit the full benefits of flexible manufacturing and design technologies throughout its operations. It is also continuing the successful collaboration with Honda beyond the Rover 200, built under licence from Honda, and the jointly designed new Rover, to other models in the future. With all the elements of its strategy



now in place Austin Rover, as the volume subsidiary of BL is now known, has to demonstrate that it can compete with companies such as Ford and General Motors.

The multinational producers, Ford, General Motors (Vauxhall) and Peugeot (who took over Chrysler UK in 1978) began to integrate their operations in Europe with the opening up of the European market. Their response to the poor levels of productivity in the UK was to increasingly rely on more profitable imports from their continental plants., while ceasing to export from the UK. Between 1973 and 1984 the multinationals switched from being net exporters of 200,000 cars to net importers of 350,000 cars a year. While Ford, with a 30% market share in the UK, continued to invest in the UK, Vauxhall and Peugeot reduced their operations in the UK to the assembly of imported kits containing very few components made in the UK?If the value of these imported kits is included then import penetration of the UK market continued to rise to a new record level of 66% in 1984, and the balance of trade in motor vehicles swung into the red to the tune of £2.7m.

Prospects

When the first of the Japanese plants in Europe are fully operational towards the end of the decade, the rest of the European industry will have no option but to match Japanese levels of productivity. The opening of the Nissan plant in Sunderland is a unique opportunity to watch a Japanese car plant operating in the UK environment. Apart from the clear threat to the market share of existing companies, Nissan also poses a new challenge to the already battered UK components industry. For its cars to be accepted as European

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products Nissan will have to buy considerable amounts of components in Europe. The UK components industry is currently undergoing a similar restructuring and rationalisation to Austin Rover. In the last decade the volume of components supplied to the UK car assemblers fell to one third of what it was. Austin Rover, Ford and now Nissan will continue to demand significantly improved productivity, delivery times, quality and new technology from the components industry. As we saw in the case of the Japanese, close collaboration is essential for 'just in time' production with the development of new technologies. However unlike in Italy, where Fiat dominates the industry, Austin Rover is not in a position to mastermind the restructuring of the UK components industry alone. New ways will have to be found to add a coherence to the pressures for restructuring coming from Austin Rover, Ford and Nissan.

There is no doubt that a great deal has been achieved in turning round the UK car industry, confounding the predictions of observers a decade ago. However there is still some way to go to introduce a complete Japanese production system, or our own version of it, and we are still in the middle of the fourth transformation of new technology. Meanwhile, the Japanese may well be in the process of surprising the West with a new wave of product innovations, resulting from their huge investment in new technology during the last decade. If this turns out to be the case then a lot of thought will have to be given to mobilising the technical and engineering talent in this country more effectively to meet this new challenge.

[2] Andrew Graves *Is Vauxhall British?* p4-5. *Marxism Today* Oct 1985.