Matéria

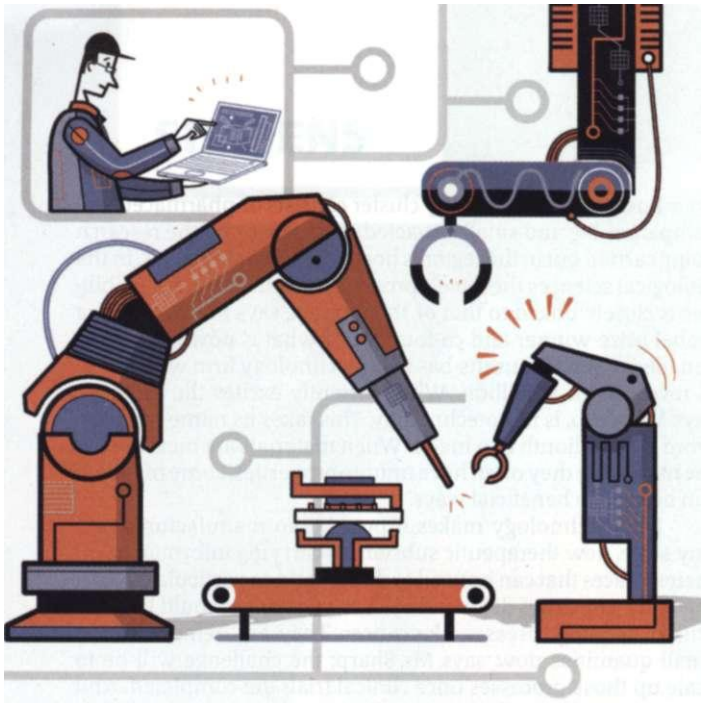
Factories and jobs

Back to making stuff

Manufacturing still matters, but the jobs are changing

FOR OVER 100 YEARS America was the world's leading manufacturer, but now it is neck-andneck with China (see chart 1, next page). In the decade to 2010 the number of manufacturing jobs in America fell by about a third. The rise of outsourcing and offshoring and the growth of sophisticated supply chains has enabled companies the world over to use China, India and other lower-wage countries as workshops. Prompted by the global financial crisis, some Western policymakers now reckon it is about time their countries returned to making stuff in order to create jobs and prevent more manufacturing skills from being exported. That supposes two things: that manufacturing is important to a nation and its economy, and that these new forms of manufacturing will create new jobs.

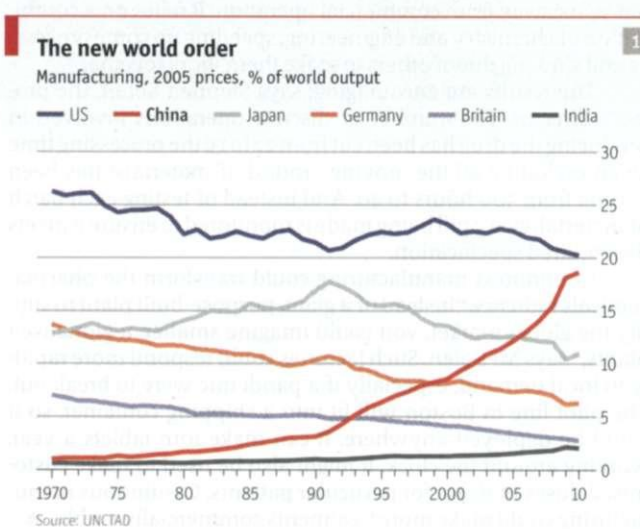
There has been plenty of research to show that manufac-



• turing is good for economies, but in recent years some economists have argued that there is nothing special about making things and that service industries can be just as productive and innovative. It is people and companies, not countries, that design, manufacture and sell products, and there are good and bad jobs in both manufacturing and services. But on average manufacturing workers do earn more, according to a report by Susan Helper of Case Western Reserve University, Cleveland, for the Brookings Institution, a think-tank in Washington, **DC** (see chart 2, right).

Manufacturing firms are also more likely than other companies to introduce new and innovative products. Manufacturing makes up only about 11% of America's **G D P** , but it is responsible for 68% of domestic spending on research and development. According to Ms Helper, it provides better-paid jobs, on average, than service industries, is a big source of innovation, helps to reduce trade deficits and creates opportunities in the growing "clean" economy, such as recycling and green energy. These are all good reasons for a country to engage in it.

Despite China's rapid rise, America remains a formidable production power. Its manufacturing output in dollar terms is now about the same as China's, but it achieves this with only 10% of the workforce deployed by China, says Susan Hockfield, president of the Massachusetts Institute of Technology **(M I T)** and co-chair of President Barack Obama's Advanced Manufacturing Partnership, an initiative recently set up with business and universities to create jobs and boost competitiveness.



The "Hammering Man" catches a nostalgia for the kind of manufacturing employment which in the developed world barely exists any more. Factory floors today often seem deserted, whereas the office blocks nearby are full of designers, **IT** specialists, accountants, logistics experts, marketing staff, customer-relations managers, cooks and cleaners, all of whom in various ways contribute to the factory. And outside the gates many more people are involved in different occupations that help to supply it. The definition of a manufacturing job is becoming increasingly blurred.

Yet America's productivity strides raise questions about how many manufacturing jobs, particularly of the white-collar variety, will be created. And some of the manufacturing breakthroughs now in the pipeline will bring down the number of people needed even further. "It is true that if you look at the array of manufacturing technologies that are coming out of **M I T** , many of them are jobs-free, or jobs-light," says Ms Hockfield. "But that is no reason not to want to do that type of manufacturing in America, because feeding into jobs-light processes is a huge supply chain in which there are lots of jobs and large economic benefits."

Companies are also optimistic about a manufacturing revival. "We are standing in front of a potential revolution in manufacturing," says Michael Idelchik, head of advanced technologies at **GE** Global Research, the **R & D** arm of one of the world's biggest manufacturers. The ideas that will make this happen can come from anywhere, which is why his laboratory, based in bucolic Niskayuna in upstate New York, also has research centres in Bangalore, Munich, Rio de Janeiro and Shanghai. As for the jobs likely to be created, Mr Idelchik thinks people have a myopic view of manufacturing employment: "If you look at everyone who contributes, it is a very large occupation."

Ghostin the machine

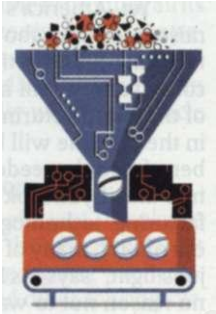
A lot of the jobs that remain on the factory floor will require a high level of skill, says Mr Smith, Rolls-Royce's manufacturing boss. "If manufacturing matters, then we need to make sure the necessary building blocks are there in the education system." His concern extends to the firm's suppliers, because companies in many countries have cut down on training in the economic downturn. To get the peo-

• ple it wants, Rolls-Royce has opened a new Apprentice Academy to double the number of people it can train each year, to 400.

In America firms have cut back on training so savagely that "apprenticeships may well be dead," reckons Suzanne Berger, one of the leaders of a new **MIT** research project, Production in the Innovation Economy, which is looking at how companies compete. Many firms feel that it is not worth training people if they are likely to leave to work for someone else. Ms Berger and her colleagues think one promising alternative to apprenticeships is a collaboration between community colleges and local firms to develop training programmes. Sometimes the firms donate manufacturing equipment to the colleges.

The digitisation of manufacturing will make training easier. Companies cannot justify halting production equipment which may be running 24 hours a day so that trainees can play around with it. But computers can simulate production systems in a virtual environment, and products too. At Warwick University in Britain, a room with giant high-resolution screens is used as a virtual-reality chamber to simulate products under development, such as cars, in three dimensions.

A new vehicle today is likely to be drawn up as a three-dimensional "digital prototype" long before it is actually built. It can be walked around, sat in, test-driven in a simulator, taken apart and placed in a virtual factory to work out how to build it. And the same software can be used by others in the company, including advertising staff who want to market the vehicle. The images generated from digital prototypes are now so good they are often used to produce brochures and television ads before a new car is built, says Grant Rochelle, a director of Autodesk, a Silicon Valley software company.



Many people working in factories are providing services that are crucial to manufacturing. "In the future more products will be sold on the basis of service," says Kumar Bhattacharyya, chairman of the Warwick Manufacturing Group at Warwick University. "If you sell a car with a ten-year warranty you need to make sure it will last for ten years and that you have the services in place to look after it." Despite high unemployment, some manufacturers say that too few people are choosing engineering and manufacturing careers, but new technologies like **3D** printing will help, predicts Lord Bhattacharyya. "If you can build something, people get excited about making things. Then they go and set up companies."

Come closer

One of the most successful incubators for new firms are industrial clusters, of which Silicon Valley is the best-known and most imitated example. Firms cluster together for a variety of reasons: the skills that are available in a particular area, the concentration of specialist services and the venture capital from investors with a close understanding of their market. Usually there are universities and research laboratories nearby, so the process of coming up with new ideas and the means of turning those ideas into products are closely linked. This relationship is set to become even more intimate with new manufacturing technologies. "We have technologies now we are only able to exploit if we have manufacturing capabilities in some proximity to those innovations," says Ms Berger. You do not have to move far from her office to find examples.

Boston's biotechnology cluster consists of pharmaceutical companies big and small, attracted in large part by the research being carried out in the region's hospitals and universities. In the biological sciences the development of manufacturing capabilities is closely linked to that of the product, says Phillip sharp, a Nobel prize-winner and co-founder of what is now called Biogen Idec, a Massachusetts-based biotechnology firm with annual revenues of $5 billion. What currently excites the industry, says Mr Sharp, is nanotechnology. This takes its name from the word for a billionth of a metre. When materials are measured at the nanoscale they often have unique properties, some of which can be used in beneficial ways.

Nanotechnology makes it possible to manufacture, on a tiny scale, new therapeutic substances carrying information on their surfaces that can be used to direct them to particular cells in the body. The drugs delivered by such substances could be valuable in treating diseases like cancer. They are being made in small quantities now, says Mr Sharp; the challenge will be to scale up those processes once clinical trials are completed. And that, too, he adds, will depend on both product and manufacturing innovation working together.

Making drugs for the most part remains an old-fashioned batch-manufacturing process. This involves assembling ingredients, often from different countries, processing them in a chemical plant into a batch of drug substance, then turning that substance into pills, liquids or creams in another factory, which might be in yet another country. All this involves a lot of moving around of drums and containers, and plenty of inventory sitting idle. It is time-consuming and expensive.

But in a laboratory in Boston another way of making drugs is being developed. Raw materials are put into one end of a machine full of tubes, cogs, belts and electronics, and pills pop out of the other end. This pilot production line, a joint venture between **MIT** and Novartis, a giant Swiss-based drugs company, is pioneering a continuous manufacturing process for the pharmaceuticals industry. It is producing a copy of a standard Novartis drug, although not for use yet because the system is still five to ten years away from commercial operation. It relies on a combination of chemistry and engineering, speeding up some processes and slowing down others to make them work together.

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The results are encouraging, says Stephen Sofen, the project's director. The number of discrete operations involved in producing the drug has been cut from 22 to 13; the processing time (even excluding all the moving around of materials) has been shrunk from 300 hours to 40. And instead of testing each batch of material, every pill being made is monitored to ensure it meets the required specification.

Continuous manufacturing could transform the pharmaceuticals industry. "Instead of a giant, purpose-built plant to supply the global market, you could imagine smaller, regionalised plants," says Mr Sofen. Such factories could respond more rapidly to local demand, especially if a pandemic were to break out. The pilot line in Boston will fit into a shipping container, so it could be deployed anywhere. It can make 10m tablets a year, working around the clock. It might also be used to make customised doses of drugs for particular patients. Continuous manufacturing could make more treatments commercially viable.

Fonte: The Economist, London, v. 403, n. 8781, p. 4-6, 21 a 27 Apr. 2012.