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## Robotics and 3D printing are entering the mainstream

By Tanya Powley

From using 3D printing in reconstructive facial surgery to employing robots to look after the elderly, a new wave of advanced technologies has entered the mainstream.

3D printing, or additive manufacturing, may have been around since the 1980s, but it is only in recent years that advances in the technology have helped it play a bigger role in both industry and consumer markets.

The global products and services market for 3D printing, which is used to make everything from plastic figurines to complex parts for jet engines, rose 34.9 per cent to \$3.07bn in 2013, according to a report by Wohlers Associates, a 3D printing consultancy.

This was its highest growth in 17 years, adding to expectations that the technology could unleash a new industrial revolution.

“The industry is experiencing change that we have not seen in 20-plus years of tracking it,” says Tim Caffrey, senior consultant at Wohlers. “What’s most exciting is that we have barely scratched the surface of what’s possible.”

Medical businesses are using the technology to design highly personalised products, such as hearing aids and dental implants.

In March, surgeons at Morriston Hospital in Swansea used pioneering surgery, with a series of 3D printed parts, to reconstruct the face of man who had been in a serious motorbike accident.

While manufacturers have long used 3D printing to make plastic prototypes and products for testing, several of the world’s biggest companies are leading the way in moving the technology from design shop to factory floor.

New techniques, involving the use of lasers to melt metal powders, are enabling manufacturers to build complex shapes from metals such as titanium or aluminium.

Boeing currently prints 200 parts for 10 aircraft platforms, while GE is using 3D printing machines to make fuel nozzles for jet engines. Those fuel nozzles used to consist of 18 parts but now comprise a single piece, making it up to 25 per cent lighter. By 2020, it expects to have made 100,000 3D printed fuel nozzles.

If 3D printing is having something of a moment, then robotics is enjoying a bigger one.

Robots may have so far failed to take over the world – a vision put about by science fiction writers – but technology developments are now resulting in big advances.

For the past 50 years, robots have been a mainstay in manufacturing sectors such as automotive, where big caged-off machines are used to perform dangerous and dirty jobs such as welding and heavy lifting.

But, as smarter technology takes hold – with developments in machine vision, mobility and artificial intelligence – robots are starting to come out of the safety cage and work side-by-side with humans. This is opening up new robotic markets.

Robots are being used in healthcare to undertake delicate surgery, as well as to drive hospital trolleys used to transport medicines, samples for the lab, meals, laundry, heavy loads and hazardous waste.

A report by McKinsey Global Institute, the consultancy’s research arm, has estimated that the application of advanced robotics across



Support services: robotics is moving from industry to everyday life

healthcare, manufacturing and services could generate a potential economic boost of \$1.7tn to \$4.5tn a year by 2025, including more than \$800bn to \$2.6tn in value from healthcare uses.

“The big explosive market for robotics is in services,” says Robert Richardson, director of the Leeds EPSRC National Facility for Innovative Robotic Systems.

“Robotics is finally moving from industry into everyday life and that’s a big challenge,” he adds.

Governments around the world are committing more money to robotics. The EU is disbursing some €1bn, while the UK government has made robotics and autonomous systems part of its eight great technologies initiative.

“It’s a lot clearer that there is support for robotics than it was even five years ago,” says Rich Walker, managing director of Shadow Robots, a UK-based robotics research company.

But while the potential of both 3D printing and robotics is huge, they are unlikely to cause a massive disruption to industry or everyday life in the immediate future.

3D printing is still being held back by the costs involved – both the machines themselves and the metal and other materials they use remain expensive.

Another problem is machine capability, which limits the use of the technology for mass production.

Meanwhile, advanced robotics also comes with safety concerns. Regulators are still catching up with what are the legal liabilities of robots being let out of their safety cages, which could see regulations being introduced that slow down their development.

The threat these technologies pose to jobs could also hamper progress.

According to McKinsey, policies discouraging adoption of advanced robots – by protecting manual jobs or levying taxes on robots – could limit their economic impact.

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