

12 Technologies that Can be Game Changers in 2014

From redefining the car to controlling disease, from making computers act like humans to discovering new materials, technology will keep changing lives and driving economic growth. Hari Pulakkat lists 12 technologies that, in the coming year, can cause short-term disruption and spur long-term growth in a few key industries

Most economists think that technological innovation is the most important driver of long-term economic growth. Social institutions and policies need to support such innovation, but long-term growth is unlikely in the absence of technological innovation. As we approach 2014, and growth still remains slow, it is a good time to look at technologies that can propel economies around the world. Such lists are always subjective and open to criticism. This list is no different. Our aim was to give a good mix in terms of probabilities and impact. Certain candidates would make any list. Some others would make most lists, but a few are technologies not yet proven but certain to cause enormous disruption if they succeed. Together, this list could tell you the story of a few key industries over the next decade: short-term disruption and long-term growth. They also tell you a story through implication: the connectedness of the world of technology.

THE CERTAINTIES

Technologies that have been knocking at our doors and are all ready to storm the market. Together, these four will disrupt industries worth \$10-20 trillion over the decade

IT and Computing: SMAC

AS THE most disruptive force ever in the history of the IT industry, the unique power of SMAC (social, mobile, analytics and cloud) comes from the way it combines different technologies. Individual SMAC technologies have developed well over the last few years, and the combination is now ripe for causing big shifts. Mobile phones are selling in large numbers, and mobile networks have matured. Cloud computing is more than just an idea, and analytics ties all these nicely to provide a combined package that is powerful.

- 2014 watch**
- HOSPITALS** begin to get connected to patients at home
- BANKS** offer a plethora of new mobile services
- RETAILERS** use SMAC to provide online experience in store
- CARS** develop intelligence, and remain in touch with the world

Life Sciences and healthcare: Whole Genome Sequencing

THE COMPLETE deconstruction of a human being's DNA is the most rapidly developing technology ever. It is now also ready for large-scale commercial use, as the cost has come down to a few thousand dollars per genome. A whole genome can now be sequenced in two weeks, and will soon be the basis of prevention and treatment of many diseases. It will be a life-saver for cancer patients, who can hope to get the correct drug based on the genetic basis of the tumour. At some point, whole genome sequencing will be as common as vaccinations for newborns.

- 2014 watch**
- A WHOLE** genome being sequenced in about a week
- WHOLE** genome sequencing arrives in India as a commercial service
- GENOME** sequencing becomes common for cancer treatment
- PEOPLE** begin sequencing their genomes to judge disease risk

Energy/transport: Electric Car

DRIVEN BY the Tesla Model S, electric cars had a good 2013 in the US. Next year, Tesla will expand to other countries, and other companies—Honda, BMW, GM, Volkswagen—are expected to launch new models. Electric cars are predicted to grow steadily till 2020, and dominate after that. In 2014, gear boxes will disappear in some cars, batteries will shrink and range on a single charge will increase. Charging time will shrink too, though still not to the ideal.

- 2014 watch**
- COMPETITORS** emerge to the lithium ion battery
- ELECTRIC** cars cross ranges of 500 km on a single charge
- NEW** electric cars launched in India
- ELECTRIC** cars cross 1% of the US market

Manufacturing: Internet of things

INTERNET OF Things, or M2M, is jargon for a network of machines. It is actually a set of sensors and motors connected to each other, one for feeding information and the other to act upon this information. Often a hyped technology, Internet of Things will begin to become real next year. Its impact will be felt most in the manufacturing sector, as it improves productivity by bringing an exquisite sense of timing to global supply chains. It is no wonder that Internet of Things is sometimes called Industry 4.0.

- 2014 watch**
- SMAC** seeps into the manufacturing sector
- CHEAP** microprocessors connects almost anything
- MANUFACTURED** components have sensors fitted into them
- VENDORS** move closer to a common communications protocol

THE STRONG POSSIBILITIES

Technologies that are nearly ready for the commercial market and are highly likely to descend on it in 2014

IT and computing: Cognitive computing

COGNITIVE COMPUTING is a process by which computers learn as they do their tasks—and engage with humans like humans. This term was coined by IBM to distinguish it from the more popular term 'artificial intelligence', and to stress the fact that there is nothing artificial about cognitive computing. IBM's Watson is the most advanced cognitive computing platform, but a few others are also being developed, mostly by startups. Some advances that have long-term significance are likely.

- 2014 watch**
- WATSON** starts being used more for cancer treatment
- PRIVATE** companies develop a few applications on the Watson platform
- COGNITIVE** analytics, a precursor to true cognitive computing develops more
- STARTUPS** launch some products, mostly around cognitive analytics

Life Sciences and healthcare: Wearable devices

PERSONAL HEALTH monitoring is growing in developed markets and even in India, as people monitor their sleep, exercise impact, heart health, progress of pregnancy...The next year will make a significant advance as these devices begin to be connected to hospitals. A wearable devices network can be considered an Internet of Things, and will be influenced by SMAC, and is thus a good illustration of how cutting-edge technologies reinforce each other. Wearable devices are not just for health monitoring. Watch out for Google Glass.

- 2014 watch**
- WEARABLE** devices market to be worth \$1.5 billion, according to Juniper Research
- NEW ERA** begins in healthcare, as devices are connected to hospitals
- GOOGLE,** Apple, Microsoft and Samsung launch non-medical wearable devices
- WEARABLE** devices begin to take away some smartphone functions

Energy and transport: New Batteries

BATTERY BREAKTHROUGHS are essential for renewable energy to take off, and the world has waited for long. We need better batteries in electric cars, in solar farms to provide power at night, in wind farms to provide steady power...Now, there are a few candidates that could make a difference to the world of renewables. Some are ready for commercialisation, some are early prototypes, some are just proof of concepts. There is a good chance now that one of them could prove to be a winner.

- 2014 watch**
- BREAKTHROUGHS** from 100-plus startups working on many types of batteries
- MIT STARTUP** Ambri will commercialise its liquid metal batteries (important for electricity grid)
- US STARTUP** Imprint Energy's non-toxic, flexible, rechargeable, printable zinc batteries
- ADVANCES ON** lithium air battery (for more range in electric cars)

Manufacturing: 3D Printing

3D PRINTING had an interesting year. As technology has advanced rapidly, gun models for printing were downloaded over 100,000 times. 3D printing is set to revolutionise manufacturing, as big players around the world announce their intention to switch to the technique in a big way. Companies doing 3D printing have good revenues and profits, and their stocks are riding high. It is even coming to life sciences, as biotech firms are working on printing body parts.

- 2014 watch**
- GARTNER** says market for sub-\$100,000 3D printers will grow 75%
- LOW-COST** printers taking off with key patents expiry
- GE** and Rolls Royce planning to make aircraft engine parts
- CALIFORNIA'S** Organov plans to print a human liver, but unlikely to have commercial value at the moment

THE DARK HORSES

They could have far-reaching impact but still remain unproven at commercial scale. Surprises are the norm in technology, and some of these four could surprise next year or in the near future

IT and computing: Graphene chip

GRAPHENE IS a single layer of carbon atoms. It was discovered only in 2004, but has since shown extraordinary properties in the lab. It is the thinnest and the strongest material that we know, and is also a very good conductor of heat and electricity. These properties make it great for computing. Computing needs a breakthrough soon: the copper wiring inside the chip cannot be shrunk for too long. An all-graphene chip would be a great development, as MIT and IBM have already shown that the idea can work, in photodetectors to begin with. Definitely in the wish list for 2014.

Life Sciences and healthcare: Nanomedicine

NANOMEDICINE IS the application of nanotechnology—manipulation of matter at the smallest scale—to medicine. As an area of research it is not new, but there have been no game-changing commercial applications yet for nanomedicine. Experts believe that there will be one soon, at some point in the next few years. Drug delivery using nanoparticles is one of the most promising areas of nanomedicine. Next year could see some important results in the clinical trials currently going on using nanoparticles for delivery. Watch out for some of them in India too.

Energy: Perovskites

PEROVSKITES ARE a kind of mineral made of calcium titanium oxide discovered in the 19th century. They have now become a hot research material for solar cells because they are cheap and abundant. Perovskites now work at 15% efficiency in the lab. Efficiencies of 25% are not impossible at some point, considering the pace at which research is advancing. It still has some barriers to cross. For example, perovskite cells contain lead, and are toxic to the environment if let loose. But it is certainly one of the materials to watch for in 2014.

Manufacturing: Printed Electronics

PRINTED ELECTRONICS is certain to rewrite our industries. The only question is when. A beginning could be made next year with printed solar cells, as several novel techniques have been shown to work in the labs this year. Soon, as costs drop, printed chips could be everywhere: on food packets, on newspapers and magazines, manufactured goods and so on. One day, this newspaper could have a video that could play when touched. Printed electronics could cut food waste, generate cheap electricity, power medical devices in our bodies, and so on. And that could spring a surprise next year.