

Profiting from technical progress

AT A GLANCE

- Technical change is the process by which we can get more productive output from our economic endeavours via the same number of inputs
- It includes technological invention and innovation but also more effective organisation of existing resources
- Commercially viable new technologies range from mobile connectivity to empower the individual to smart cities to improve the efficiency of the population at large
- Emerging markets may be key innovators in the future as they by-pass the sunk costs of what is now largely legacy technology
- We are undoubtedly likely to underestimate the impact that technical change may have on our environment but investors should not forget that from the simple light bulb, General Electric was built. What might today's light bulb be?

Humans are terrible at predicting the future. Our tendency to simply extrapolate forward from our current state invariably underestimates the real extent of change. This is particularly true when it comes to technical progress. Mankind's ability to be more productive with resources and labour has grown exponentially, consistently exceeding expectations and allowing unimaginable growth in populations and living standards.

We need only look at history to know tomorrow's world is going to be very different. Technological development is accelerating as the lines blur between academic research and commercial enterprise. Themes such as mobile connectivity, cloud computing, 'smart city' development and, most recently, the creation of synthetic life in a laboratory, are just a few strands in a multiplying web of developments that have wide-ranging commercial benefits. Identifying the most interesting and investible 'tech' themes offers considerable growth potential to investors.

"If we have learned one thing from the history of invention and discovery, it is that, in the long run - and often in the short one - the most daring prophecies seem laughably conservative."

Arthur C. Clarke, *The Exploration of Space*, 1951

THE DRIVERS OF TECHNICAL CHANGE

The bulk of economic growth over time – around 87.5% according to Nobel prize winner Robert Solow's estimates – ultimately stems from technical change. Technical progress can arise not just from technological advances, but also organisational changes (such as the introduction of global free markets), or from changes in market constraints (such as subsidies and quota systems).

Technological change is driven by the cycle of *invention*, *innovation* and *diffusion*. Invention is the initial discovery of a new technology; innovation encompasses how that invention is improved upon; and diffusion is the spread of a technology through industry or society.

When a new technology is born it often replaces something else, in a process that the economist Joseph Schumpeter christened *'creative destruction'*; technological change not only provides the underlying tailwind to sustainable economic growth, it also destroys the power of some companies as their products became obsolete. Think vinyl and CDs!

INVENTION IS GREAT, INNOVATION AND DIFFUSION ARE BETTER

In business terms, the distinction between invention, innovation and diffusion is critical. Even the most useful inventions can offer little commercial benefit if they are not innovated and diffused appropriately. Take the development of the light bulb, for instance. It may be synonymous with Thomas Edison but Edison did not invent it. He improved Humphry Davy's original design and brought it to the mass market. His innovation of the light bulb led him to form the Edison Electric Light Company, which later became General Electric.

TOP TEN GLOBAL INNOVATION LEADERS

Rank	Country	Innovation score	Rank	Country	Innovation score
1	South Korea	2.26	6	Canada	1.42
2	US	1.80	7	UK	1.42
3	Japan	1.79	8	Germany	1.12
4	Sweden	1.64	9	France	1.12
5	Netherlands	1.55	10	Australia	1.02

Source: The Boston Consulting Group (BCG), the National Association of Manufacturers, and the Manufacturing Institute. March 2009. The index measures innovation inputs (government & education policy and innovation environment) and outputs (patents, technology transfer, business performance, labour productivity, and the impact of innovation on economic growth).

IDENTIFYING INNOVATION

Innovation leaders tend to be concentrated in highly capitalised, developed stock markets, such as the Anglo-Saxon markets of the UK, US, Canada, Australia, the tiger economies of Japan and South Korea and the European leaders of the Netherlands, Sweden, Germany and France.

We should watch out for emerging markets such as China and India who recognise the need to invest in the innovation economy in the same way that Japan and South Korea did. In some ways, emerging economies like China benefit from 'late mover' advantages. In newly developing industries, they have the ability to invest in the very latest technology rather than having to deal with ageing installed infrastructure, as is the case in developed countries.

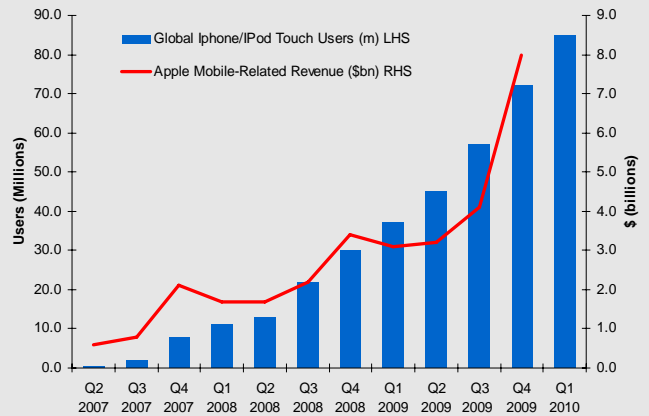
A CASE STUDY IN INNOVATION: APPLE

When Apple released its iPhone in 2007, the mobile phone market was saturated. Smart-phone technology had been available for years. Apple was very late to the mobile telecoms party.

What Apple brought to market was not new - but it would prove to be an exceptional innovation on what was already available. Its 'uniqueness' lay in the combination of its touch-screen design simplicity and the ease with which consumers could browse the web, 'sync' music with their existing iTunes collections and download new content via its 'App Store'.

Fast forward a few years and the iPhone has become one of the most successful product launches of all time. Apple recently overtook Microsoft to become the largest technology company in the world by market value. Their new product, the iPad, has made a strong debut and could open up new and interesting technological avenues - it is being mooted as an excellent device for interactive learning.

IPHONE: THE FASTEST NEW DEVICE GROWTH RAMP IN HISTORY...



Source: Apple and Morgan Stanley. Apple revenue includes iPhone, iPod Touch and iTunes revenues.

THE AGE OF MOBILE CONNECTIVITY & SOCIAL NETWORKING

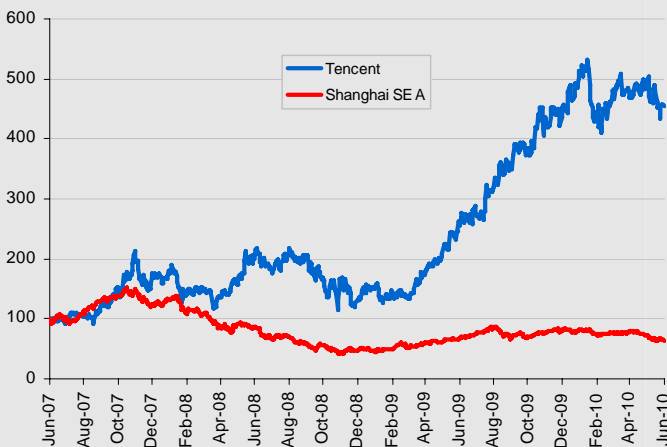
We have entered a new phase in computing that has much further to run: mobile connectivity. Over the last 50 years, we have seen distinct phases of development in computing, each providing new winners in the stock market. In the 70s, the development of mainframe computing saw IBM rise to prominence. In the 1980s, the move to personal computing unleashed Microsoft, Dell and Intel. In the 1990s, the explosive growth of desktop internet computing unveiled Google, Amazon and eBay.

Now, we are seeing a mass move to mobile internet and social networking. The numbers are already quite large but the scope for further growth and commercialisation is huge. Morgan Stanley analysts believe that mobile internet usage is ramping up substantially faster than desktop internet usage did, with mobile usage predicted to exceed desktop within five years. Significantly, Apple has proven that consumers are prepared to pay for content on the mobile internet. This is an important move away from the desktop model, where there was greater expectation of free content.

There will be winners across the value chain as this trend grows: device makers, such as Apple, have already been huge beneficiaries, but component makers and content-rich social networking sites also stand to benefit. The average cell-phone usage pattern is mostly voice, while the average smart-phone is mostly data. Mobile data traffic is therefore expected to increase by almost 4,000% by 2014, for a cumulative annual growth rate of more than 100%. Infrastructure specialists like Cisco Systems stand to benefit from this huge growth of demand on network architecture.

PLAY THE CONTENT PROVIDERS...

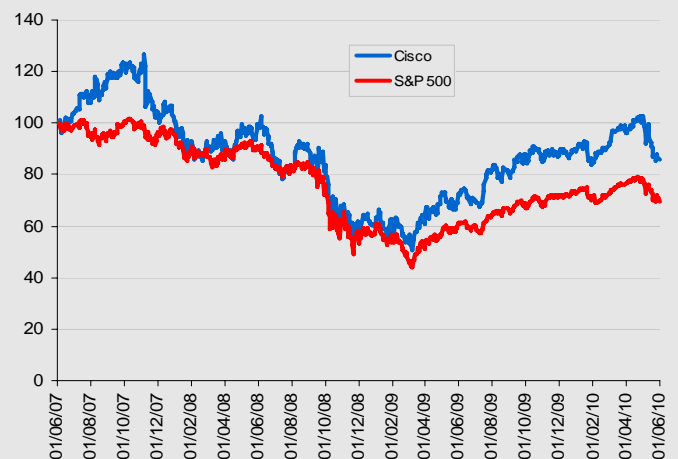
Tencent is China's leading social networking site. It generates strong advertising and gaming revenues in a market where consumers have a greater willingness to pay to create online avatars and buy virtual goods looks.



Source: DataStream, 30.04.10. Share price total return in USD

...AND THE INFRASTRUCTURE SUPPLIERS

Cisco will benefit from installing infrastructure to cope with increased traffic (also driven by a general move towards video content). Media and gaming companies with the right business models will benefit.



Source: DataStream, 30.04.10. Share price total return in USD

PLAYING THE SUPPLY CHAIN IN MOBILE DEVICES

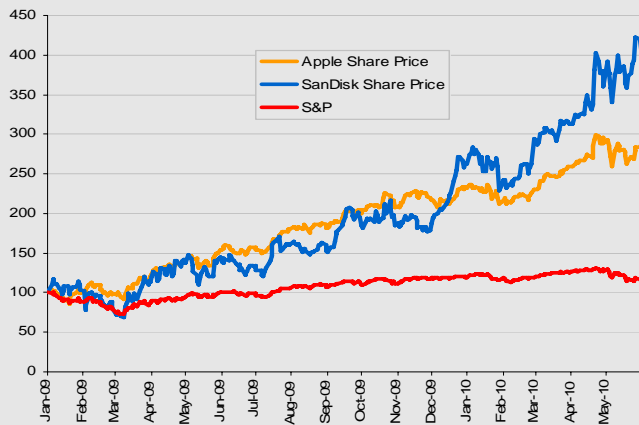
Investing successfully in technology takes innovative thinking. Apple has been a great success story and is now rated accordingly by the stock market, so much so that any disappointment in its aggressive sales target would see its share price punished. A better way to fully benefit from the incredible market growth in mobile connectivity is by investing in companies that make components for all smart-phones. This is what makes SanDisk such an attractive stock.

SanDisk makes the memory for smart-phones and a range of other mobile devices such as the iPad, allowing investors to benefit from the growth in the industry without tying their colours to a particular smart-phone brand, whose valuation may not be attractive. In the words of their chief executive Eli Harari "There is a war going on and we sell the bullets".

"The rapid growth in mobile devices and increased use of video will result in much greater network traffic that will play into the hands of infrastructure network specialists such as Cisco Systems. The growth in smart-phones can be accessed via component manufacturers like SanDisk, which benefits from supplying all of the leading brands, including Apple. Meanwhile, the trend towards cloud computing has begun but has considerable scope to grow. This theme can be played through desktop virtualisation stocks such as Citrix Systems and BMC Software."

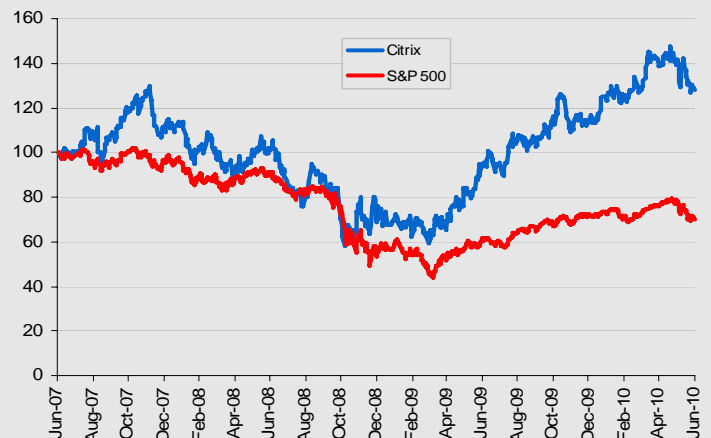
Dmitry Solomakhin, Portfolio Manager, Technology

THE MOBILE CONNECTIVITY SUPPLY CHAIN



Source: DataStream, 30.04.10. Share price total return in USD

INVESTING IN THE CLOUDS



Source: DataStream, 30.04.10. Share price total return in USD

COMPUTING IN THE CLOUDS

The first general purpose electronic computer, the US-built ENIAC (Electronic Numerical Integrator and Computer) was completed in 1945, weighed 30 tonnes and had approximately 80 bytes of memory. Since then, computers have become smaller and smaller. Next, they may be about to disappear completely!

We refer to a theme already underway, one that is set to get much bigger - the move towards dematerialised, on-demand data, or 'cloud computing'. Rather than saving data locally to hard storage, businesses and individuals can save data to the cloud (external data centres) and access it on demand via the internet from a range of devices. As increasing bandwidth from the likes of Cisco begin to make cloud computing more economically viable, IT hardware will begin to adapt. Without needing large amounts of storage locally, business computers will become smaller, and the proliferation of wireless internet will aid their portability. As devices become more portable, technologies such as enhanced reality (the process of augmenting reality with additional information as you experience it via portable devices) will become increasingly viable, potentially changing the way in which we interact with the world and one another. Video conferencing could become quite an interactive, content rich affair.

The business implications of this shift are huge. One way to access the emergent trend is to invest in companies who specialise in desktop virtualisation, such as Citrix and enterprise software developers who can integrate corporate process, such as Software AG.

"I find a lot of high-quality growth opportunities in the technology sector. One company that should be a beneficiary of the trend towards cloud computing is Software AG - a leading software vendor based in Germany. It has a large share of the global enterprise service business (ESB) and business process management (BPM) markets."

Fabio Ricelli, Portfolio Manager, European equities

FROM SMART-PHONES TO SMART CITIES

In an increasingly digital world, the competitiveness of a city or country is increasingly a function of its digital as much as its physical infrastructure. Some governments have already recognised this and are meeting the challenge head-on. South Korea, for example, is investing heavily in cutting-edge technology. Unable to compete with lower-priced Chinese labour, South Korea wants to move away from labour-intensive industries, towards knowledge-based enterprise. Scheduled for completion in 2015, the futuristic city of Songdo is intended to be a technologically advanced business hub for North-East Asia.

Songdo is an integrated, 'smart' city, with wireless networks and radio-frequency identification linking all major information systems - residential, business, medical and governmental. Residents will have smart-phones they can use to pay their bills, access medical records or just open doors.

Songdo is ahead of the curve and has the advantage of being purpose built, whereas existing cities must undertake significant restructuring upgrades. It is difficult to know which businesses stand to gain most from digitally integrated cities, but some winners are more immediately apparent. Microsoft is already involved in software programming, while companies like Cisco look set to benefit from the expansion of the concept in coming decades.

Many technology and utility companies will also benefit from the move towards smart energy. The first steps towards a new generation of 'smart grids' that can both send information and receive instructions have already been taken. The Electric Power Research Institute estimates the cost of upgrading US utilities alone to be \$165bn over two decades.

Smart grids are actually based on a host of applications that serve the generation, transmission and distribution networks but also reach into households to cut waste, enhance reliability and facilitate applications such as plug-in vehicles or rooftop solar panels. Smart grids will help to curb power demand by limiting transmission losses and managing demand at peak times thanks to 'smart meters' in homes.

A key beneficiary of this broad move to a digitally integrated world with smart energy grids will be semiconductor equipment manufacturers such as Applied Materials, who produce the equipment necessary for semiconductor chip manufacture. The world is going to need a lot more semiconductor foundries to produce an ever greater number of chips.

TECHNOLOGY AND EMERGING MARKET GROWTH

Technology will be both a massive beneficiary of growth and contributor to growth within emerging markets. The usage of personal computers in emerging markets is expected to double between now and 2013. We can expect a mixture of developed market players and local stocks to benefit. Where the barriers to entry are higher, and knowledge is protected by intellectual property rights, developed market stocks can expect to do well as emerging markets play catch-up.

China, as a centrally planned economy, is very much one to watch on the innovation front. The government can channel funds very effectively to strategically important sectors. For instance, recognising their dependence on oil imports, China has invested very heavily in the development of electric cars and renewable technologies. Notably, the sunk cost of infrastructure investment in fossil fuel technologies is nowhere near as great as it is in the west so the incentive to develop and benefit from technological advances that also help the current account is plain.

"Technology is a fast-growing area within emerging economies and many companies are well-positioned to benefit from healthy growth in demand in under-penetrated markets. I like market-leading companies such as Samsung and Hon Hai Precision, which will benefit from rising consumer demand for affordable computers. I also like Tencent, China's leading social networking site. Tencent has an 80% market share and generates strong advertising revenues from increased internet usage in a market with just 20% penetration."

Nick Price, Portfolio Manager, global emerging markets

TECHNOLOGY AND UNMET MEDICAL NEEDS

Technological advances in healthcare can be commercially lucrative. It's why the major pharmaceutical companies spend billions on their Research & Development programmes.

Chronic disease areas present the greatest growth potential for healthcare companies in developed markets. The WHO predicts that the incidence of death from diseases such as chronic obstructive pulmonary disease (COPD), cancers and diabetes/metabolic conditions will increase from less than 20% in 2005 to almost 30% in 2030. In terms of their R&D spending, pharmaceutical companies are increasingly focusing on chronic diseases. Half of the US population is set to be classified as obese (a body mass index in excess of 30) by the end of this decade and the prevalence of diabetes has more than doubled over the last 25 years.

Companies like Genentech, recently acquired by Roche, are leading the search for cancer solutions. Myriad Genetics looks at genes to identify the likelihood of getting cancer so preventative action can be taken before the disease takes hold. Its clinical tests also evaluate patients in advance of treatment to identify the most effective chemotherapy and reduce the risk of severe side effects.

In the fields of biotechnology (and nanotechnology), investing is more binary and speculative. Most companies spend years burning through cash, and only one or two make the breakthroughs that see their share prices jump. Gilead Sciences in the US became a US\$45 billion market cap company on the back of its innovative AIDS drugs. That was not even a market that even existed a few decades ago.

At Fidelity, we research such companies thoroughly but tend to favour investment in those innovative healthcare stocks with more predictable earnings streams, such as Ossur. The company is a global leader in the development of orthopaedics and advanced mechanical prosthetics, which enable patients who have lost limbs to walk again.

SOME OTHER INTERESTING TECHNICAL THEMES

No article on technical change can hope to offer anything more than a taste of such a huge topic. We have concentrated mostly on technological advances in this issue. We will be considering fertilisers and their capacity to make farming more productive in emerging markets in a future issue on the economics of food.

While we have already considered the future of energy in a previous issue, it is an area where technical progress could have a significant impact. In addition to efficiency gains in the extraction of marginal fossil fuel deposits in shale and deepwater areas and the advance of renewable technologies, more embryonic studies suggest many other technologies that could be made more commercially viable in time.

Craig Ventner, of Synthetic Genomics Inc, recently developed a living organism – a self-replicating cell – from four bottles of chemicals. One of the potential commercial benefits of this work is that we could ultimately create highly effective synthetic bio-fuels. In fact, the accompanying patent claims envisaged many long-term benefits, including bio-fuels, vaccines and drugs, organisms that can effectively consume oil slicks and new ways of producing food and clean drinking water.

CONCLUSION

We have provided a taste of some of the areas where real value could be found. Cloud computing, mobile internet and the development of digital smart city living are interesting and investible themes right now, but have significant growth potential still to come.

Few things are certain about our future. One of them is that we are almost bound to sharply underestimate the extent of the changes in store for us. The business world has changed dramatically in the last thirty years and there is every reason to believe it will do so again in the next thirty. It is difficult to look too far ahead, particularly from an investment standpoint, as the companies that benefit from the latest academic breakthroughs may not have even been formed yet. But it's worthwhile to try to.

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