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## FINANCIAL TIMES

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# Technology: Vanity or visionary?

By Richard Waters

Internet tycoons are backing futuristic ventures that may herald an era of scientific innovation, writes Richard Waters



Mining space: the Planetary Resources company wants to seek out and mine near-Earth asteroids

**G**rowing hamburgers in test tubes. Mining for precious metals on asteroids. Taking a supersonic, ground-level trip from Los Angeles to San Francisco in less than 30 minutes.

The futuristic ideas that have been pouring lately from the fertile imaginations of some of the wealthiest US technology entrepreneurs – and which, in a few cases, are being funded out of their own billions – have started to sound almost outlandish.

But that may be exactly the point. Testing their wits – and their fortunes – against the frontiers of technology has come to be seen as a mark of pride for the tech industry’s new super-wealthy, most of whom earned their money in the relatively low-tech environs of the consumer internet. Entrepreneurs such as Jeff Bezos of [Amazon](#); Elon Musk, who made his first fortune at PayPal; and Sergey Brin, co-founder of [Google](#), have come to embody a new and ambitious era of technological ambition.

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“The kind of people who are taking on the global grand challenges are interested in thinking big,” says Peter Diamandis, co-founder of Planetary Resources, the asteroid mining venture, and the creator of the X Prize for the first privately backed suborbital space flight.

Having disrupted entire industries, they have now become “interested in the world’s biggest problems”, Mr Diamandis says. “The world’s biggest challenges are also the world’s biggest market opportunities.”

It is ironic that this eruption of ambition has come at a time when many in Silicon Valley have begun to question whether the golden age of technological innovation is over.

The pessimism was summed up two years ago by Tyler Cowen, an American academic, who argued that the low-hanging fruit of the digital revolution had been picked and that too little effort was being put into making the next big breakthroughs.

The theme has been echoed by technocrats such as Peter Thiel, another early PayPal executive who was also the first outside investor in Facebook. He has hit a nerve in Silicon Valley with the complaint that venture capitalists have lost their appetite for world-changing ideas, preferring the safer ground of making small advances in mobile apps and social networks.

Yet recent headlines suggest this is too pessimistic.



Sergey Brin's first synthetic beef

Last week it was the turn of Google's Mr Brin to show off one of the products of this new marriage of advanced science, massive personal wealth and untamed ambition. It came with the first public tasting, in London, of laboratory-grown beef, a project funded largely by Mr Brin's own \$23bn fortune.

"If what we are doing is not seen by some people as science fiction, it's probably not transformative enough," he said in a video explaining the project – a statement that could sum up the ambition of the new scientific adventurers.

The upshot, according to supporters of this billionaire-fuelled quest for the next big technological breakthroughs, will be an age of discovery that creates the industries of the future: private space exploration, new forms of transport, robotics, new medicines and advanced materials. Yet it could end up instead as an era defined by the hubris of a generation of the ultra-wealthy.

"I think there will be some stupendous failures – but if you're not failing, you're not thinking big," says Mr Diamandis, who admits that the inevitable setbacks could provoke doubts about the effectiveness of this approach to problem-solving on a grand scale.

According to the technology elite, many of them based on the west coast of the US, there is no alternative to thinking very big. What may seem like hubris is seen as a necessary response to a dangerous lack of ambition that has settled on the rest of the political and business class.



Bell Labs build the Telstar satellite

Government funding has been withdrawn from some areas of advanced research. And the organisations that might once have filled the gap – the innovative old research groups such as Bell Labs, created by AT&T – have atrophied as heightened competition wrecked once-comfortable monopolies and weakened their ability to fund longer-term ideas.

Yet others argue that the incentives for groundbreaking innovation have not changed significantly, and that the history of technological breakthroughs such as the telephone and telegraph show that it has always been left to individual entrepreneurs to pull off the really big game-changers.

"Governments are concerned about congressional investigations, they're concerned about failure," Mr Diamandis says. "Big companies are concerned about stock prices."

Hubristic, idealistic or both, the technocrats see themselves as the ones to deliver large-scale breakthroughs to solve the world's social and economic ills. Mr Brin, for instance, was drawn to the idea of growing beef in test tubes by the environmental benefits of reducing the world's cattle population, as well as animal welfare concerns.

"We're moving into an era where talking about things that have seemed impossible has become dramatically important," says John Seely Brown, who once ran Xerox's famed Silicon Valley research centre, which was credited with many of the breakthroughs that led to personal computing.

As older industries are disrupted by the internet or global competition, the competitive advantage for an advanced nation such as America has become intimately tied with its ability to accomplish big technological advances, according to this view.

Yet while the wealth of nations may ultimately be at stake, the tendency to think big has come to seem like a personal mark of pride for the tech billionaire class.

This week Mr Musk, who has scored successes with electric cars and private space exploration, took a step further into the realm of science fiction with his proposal for a hyperloop: an elevated, sealed tube through which pods carrying passengers could shoot at 700mph. Such a transport system would be far cheaper to build and more attractive to travellers than a proposed high-speed rail link between San Francisco and Los Angeles, he claimed.

If there is a need for such grand personal ambition as this that stretches the imagination – and sometimes the credence – of the uninitiated, the time could be ripe.

Some experts say that a rare point in technological history has arrived when unimaginable breakthroughs will come to seem almost routine, giving the unbridled ambition and fortunes of today's super-rich technocrats a lasting impact on the world.

"It's an incredible moment in time," says Mr Seely Brown. "Things I would have thought were unthinkable five years ago" have seen the light of day, he adds, such as the driverless car developed by Google's advanced research and development arm, Google X.

New tools used in scientific research have accelerated the process of discovery, researchers say. The ability to analyse massive data sets

and use “deep learning” in computer systems that can adapt to experience, rather than depending on a human programmer, have led to breakthroughs. These range from drug discovery to the development of new materials to robots with a greater awareness of the world around them.

Nowhere has the ambition of the new entrepreneurs been more apparent than in the private space race, as some of the richest internet billionaires have moved to fill the gap left by the retreat of US government funding for space exploration.

Mr Bezos, who took an old-economy tack last week with his \$250m purchase of the Washington Post, has committed part of his billions to making space travel more affordable. He has been joined by Google billionaires Larry Page and Eric Schmidt, who are among the backers of Mr Diamandis’s venture to launch rockets to mine resources from passing asteroids.

For his part, Mr Musk has set his sights on Mars – having already built, through his company SpaceX, the first private rocket to reach orbit and dock with the International Space Station.

The space entrepreneurs have much in common with a much earlier generation of explorers, says Paul Saffo, a futurist based in San Francisco. “Commercial space is just like the great age of discovery around 1500,” he says. Once one ventures beyond the bounds of previous exploration and returns successful, others inevitably follow, producing a race for new riches that seemed out of reach before.



The hyperloop travel system

Even the most unlikely sounding breakthroughs are less out of reach than they might appear, according to their supporters. Mr Musk’s hyperloop idea, for instance, has been discussed in scientific circles for decades and is based on existing technology.

Mr Saffo, who carried out a study of the hyperloop concept in the early 1980s, says that “people just laughed” at the idea at the time. With the backing of a bold entrepreneur who can show success in other fields, though, the air of disbelief that surrounds an idea may dissipate.

“Often, hubris works,” says Jeffrey Pfeffer, a professor at Stanford University’s Graduate School of Business in Silicon Valley. “If you say it often enough, people will believe it.” That can lead to money and talent flowing to an idea that would once have seemed absurd. “The belief becomes reality,” he says.

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Mr Diamandis is hoping for a similar dynamic to take hold with his plan for mining asteroids. Like other ambitious tech dreamers, he claims that no big technological leaps need to be made to bring his idea to fruition, and that capital will flow once enough investors can see that the goal is achievable. Like Mr Musk’s hyperloop, all depends on ingenuity and execution.

As with the arrival of deepwater drilling in the early 1980s, says Mr Diamandis, the potential returns from asteroid mining will come to be seen as so great that the resources needed to overcome the technical challenges will inevitably be found. “Some of these asteroids are worth trillions of dollars in assets. Will it happen? Absolutely.”

The new internet tycoons are not the first billionaires to take on pressing global issues – though their methods and the scale of their ambition certainly set them apart. Microsoft co-founder Bill Gates, with the backing of Warren Buffett, has ploughed billions of dollars of his own money into fighting infant mortality, along with efforts to develop vaccines to conquer debilitating illnesses such as malaria.

Like the super-wealthy before them, Mr Gates and Mr Buffett have “used their money to do good works”, says Mr Saffo. Their tech industry successors, however, have a different plan: “This generation of hyper-entrepreneurs wants to launch new industries.”

Until the ambitious new tech dreams of the internet billionaires have run their course, it will be impossible to tell whose money has been better spent.

## Model evolves from the Beagle to Google

Charles Darwin would have felt at home in a world where breakthroughs in the advanced sciences are becoming increasingly dependent on the generosity of the super-rich.

As the son of an angel investor who had made his fortune during the industrial revolution, the younger Darwin was the beneficiary of a similar fount of personal patronage, says Bill Janeway, a veteran start-up investor and economic historian.

Yet even if it has a long history, some argue that dependence on personal generosity may not be the best way to organise important

scientific research. Such work is often better left to governments or established corporate research labs rather than individual benefactors, Mr Janeway says, since there is a risk that ambitious individuals will brush aside established scientific disciplines, such as peer review, in the race for high-profile achievements.

Others, however, argue that a breakout from the old forms of scientific research may be in order.

In periods of very rapid technological change, the biggest opportunities often lie on the fringes of science research where little work has been done before, making traditional approaches to peer review less useful, says Mr Seely Brown, a former head of Xerox's Palo Alto Research Center.

Whatever the source of funding, most agree that some form of institutionalisation of advanced research is in order – although new types of institutions may be needed to capitalise on the immense opportunities that some believe are now opening up.

The Bill and Melinda Gates Foundation, with an endowment of \$37bn, is a model for how to institutionalise personal support of science, taking traditional approaches to research to shape fields such as vaccine research, says Mr Janeway.

Mr Seely Brown, however, points to Google X, the search company's advanced projects lab, as an alternative model that is in keeping with the impatience and ambitions of Google's founders. The company has attracted some of the top brains from a range of disciplines, given them advanced research tools made possible by the company's massive computing resources, and primed them with the ambition and money to pursue world-changing ideas.

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**Letter in response to this article:**

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