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1 – WHY THE FUTURE WILL BE MUCH BETTER THAN YOU THINK

Pessimism is pandemic, but it's unwarranted. Our present state of existence is infinitely better than the past, and the future will be infinitely better than the present. And as always, the drivers of improving conditions are economic freedom and technological development. Such is the case made by authors Peter Diamandis and Steven Kotler in their new book, [Abundance](#).

They make a strong argument. After all, violence is at an all-time low, personal freedom at a historic high. During the past century child mortality decreased by 90%, while average human life span increased by 100%. Food is cheaper and more plentiful than ever (groceries cost 13 times less today than in 1870). Poverty has declined more in the past 50 years than in the previous 500. In fact, adjusted for inflation, incomes have tripled in the past 50 years. Even Americans living under the poverty line today have access to a telephone, toilet, television, running water, air-conditioning and a car. Go back 150 years and the richest robber barons could have never dreamed of such wealth.

As for the future, we are now entering a period of radical transformation. Progress in breakthrough technologies will let us make greater gains in the next two decades than we have made in the previous 200 years. A list of these technologies would include:

- artificial intelligence
- robotics
- infinite computing
- ubiquitous broadband networks
- digital manufacturing

- nanomaterials
- synthetic biology

As a result we will soon have the ability to meet and exceed the basic needs of every man, woman, and child on the planet. Abundance for all is within our grasp.

Nor are these changes restricted to the developed world, write the authors. In Africa today a Masai warrior on a cellphone has better mobile communications than the President did 25 years ago; if he's on a smartphone with Google, he has access to more information than the President did just 15 years ago, with a feast of standard features: watch, stereo, camera, video camera, voice recorder, GPS tracker, video conferencing equipment, a vast library of books, films, games, music. Just 20 years ago these same goods and services would have cost over \$1 million.

Four powerful forces are starting to emerge, each with enormous world-changing potential:

1. **The accelerating rate of technological progress.** Right now all information-based technologies are on exponential growth curves: They're doubling in power for the same price every 12 to 24 months. This is why an \$8 million supercomputer from two decades ago now sits in your pocket and costs less than \$200. This same rate of change is also showing up in networks, sensors, cloud computing, 3-D printing, genetics, AI, robotics and dozens more industries. Biotechnology has been on such a wild, exponential ride that a state-of-the-art lab,

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complete with automation – what would have cost millions of dollars just ten years ago – can now be had for under \$10,000.

2. **The Do-It-Yourself revolution.** Individual tinkerers and inventors have always been an underappreciated force for technological breakthroughs, but today they are equipped with cheap, accessible technology that can leverage their inventions exponentially. As a result they have moved into once esoteric fields like neuroscience, biology, genetics and robotics. Today small teams of motivated DIYers can accomplish what was once the sole province of large corporations and governments. For example, Burt Rutan flew into space. Craig Venter sequenced the human genome. Dean Kamen has invented a purifier that can turn anything wet into pure water. (Imagine the impact around the world!) Right now high school and college students are using the tools of synthetic biology to complete real-world projects that rival the output of major biopharmaceutical companies.
3. **Goal-focused philanthropy.** Large amounts of money spent in particular and directed ways is a new and powerful force in the world. The high-tech revolution created an entirely new breed of wealthy techno-philanthropists

who are using their fortunes to solve global, abundance-related challenges. Bill Gates is focused on eliminating malaria; Naveen Jain is crusading against poverty in India; Pierre and Pam Omidyar are bringing electricity to the developing world. The list goes on and on, a force unrivaled in history.

4. **The “Bottom Billion” join the global marketplace.** The world’s poorest inhabitants are poised to become the “Rising Billion.” The creation of a global transportation network was the initial step down this path, but it’s the combination of the Internet, microfinance and wireless communication technology that’s truly transformational. Over the next decade, and for the first time ever, 3 billion new people will join the global marketplace.

Alone, each of these forces has enormous potential. But together, amplified by exponentially growing technologies, they make the dream of abundance for all possible.

The authors rely on exhaustive research and extensive interviews with top scientists, innovators, and captains of industry. They provide a detailed reference section filled with graphs, charts and graphics offering much of the source data underpinning their conclusions.

2 – DOING BIOTECH IN THE BEDROOM

Apropos of the preceding, a recent article in [Technology Review](#) tells of one such do-it-yourself young biologist:

In a spare bedroom of his family’s house in County Cork, Ireland, Cathal Garvey is repeating the feats that led to the dawn of the biotechnology age. He’s growing bacteria. He’s adding DNA. He’s seeing what happens.

“To transform bacteria was once a huge deal, a new method,” he explains. “Today, you can do it

with Epsom salt and an over-the-counter brand of laxatives.”

Garvey, who is 26, dropped out of a PhD program at a big cancer lab two years ago. Instead of giving up on science, however, he started doing it on his own, spending \$4,000 to equip a laboratory in his parent’s house. As a member of the “do-it-yourself” biology movement, Garvey takes inspiration from the early days of hobby computers, when garage tinkerers spawned companies like Apple and the

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rest of the PC industry. The idea now is that anyone – not only big-budget academic labs or large companies – should be able to practice biotechnology.

His goal, he says, is to show that biology can be done in an open-source fashion, and on a shoestring budget.

DIY biology is part of a wider trend in design that's sometimes called maker culture: people are using 3-D printing services or cheap, custom electronic circuits to develop prototypes of gadgets, products, or vehicles.

Several DIY biologists have begun making inexpensive equipment so that more people can participate. CoFactor, a California company, now sells a \$599 DNA-copying machine called OpenPCR. And via Shapeways, a 3-D printing company, Garvey is selling a plastic test-tube holder he designed. When attached to a drill bit at home, the \$50 piece becomes a fast-spinning centrifuge. Near San Francisco, there's now a 2,400-square-foot laboratory called BioCurious, where community members can test their molecular-biology skills.

Some would-be garage biologists have run into obstacles. Nor is everyone impressed by the movement. Another worry is that hobbyists will be flushing bacteria down household sinks, or even creating dangerous germs. Even so, some futurists think citizen biology could one day rival industrial biotechnology, much as open-source software challenges commercial products. In 2007, Freeman Dyson predicted that leadership in biotechnology would eventually shift away from large corporations like Monsanto to kitchen laboratories, becoming "small and domesticated rather than big and centralized."

One company that sees the DIY trend as a business opportunity is Autodesk. The software maker, which sells high-powered design programs for engineers and architects, has recently begun sponsoring college genetic-engineering competitions and is developing software to aid biologists in their goal of re-wiring the genes of bacteria so that they will make fuel or drugs.

3 – THE COMING TECH-LED BOOM

The emerging technologies of 1912 – electrification, telephony, automobiles, stainless steel, radio – drove fantastic growth for the rest of the century. Yet even knowledgeable observers of the time failed to grasp their transformational power. So it is with today's technologies: we again sit on the cusp of grand technological transformations whose potentials are underappreciated by contemporary observers.

So write Mark Mills and Julio Ottino in the [Wall Street Journal](#).

Mills and Ottino write of three grand technological transformations, all of which find their epicenters in America: big data, smart manufacturing, and the wireless revolution.

1. **Big data.** Information technology has entered a big-data era. Processing power and data storage are virtually free. A hand-held device, the iPhone, has computing power that shames the 1970s-era IBM mainframe. The Internet is evolving into the "cloud" – a network of thousands of data centers, any one of which makes a 1990 supercomputer look antediluvian. From social media to medical revolutions anchored in metadata analyses, big data is transforming the world.
2. **Smart manufacturing.** This is the first structural shift since Henry Ford launched the economic power of "mass production." While we see evidence already in automation and information systems applied to supply-chain management,

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we are just entering an era where the very fabrication of physical things is revolutionized by emerging materials science. Engineers will soon design and build from the molecular level, optimizing features and even creating new materials, radically improving quality and reducing waste. This era of new materials will be economically explosive when combined with 3-D printing, also known as direct-digital manufacturing – literally “printing” parts and devices using computational power, lasers and basic powdered metals and plastics. The era of near-perfect computational design and production will unleash as big a change in how we make things as the agricultural revolution did in how we grew things. And it will be defined by high talent, not cheap labor.

3. **The wireless revolution.** Soon most humans on the planet will be connected wirelessly. Never before have a billion people – soon billions more – been able to communicate, socialize and trade in real time. The implications of the radical collapse in the cost of wireless connectivity are as big as those following the dawn of telegraphy/telephony. Coupled with the cloud, the wireless world provides cheap connectivity, information and processing power to nearly everyone, everywhere. This introduces both rapid change – e.g., the Arab Spring – and great opportunity. Again, both the launch and epicenter of this technology reside in America.

Few deny that technology fuels economic growth as well as both social and lifestyle progress, the latter largely seen in health and environmental metrics. But Mills and Ottino also consider three features that most define America, and that are essential for unleashing the promises of technological change: our youthful demographics, dynamic culture, and diverse educational system.

Demographics. By 2020, America will be younger than the populations of both China and the euro

zone. Youth brings more than a base of workers and taxpayers; it brings the ineluctable energy that propels everything. Amplified and leavened by the experience of their elders, youth and economic scale (the US is still the world’s largest economy) are not to be underestimated, especially in the context of the other two great forces: our culture and educational system.

Culture. The American culture is particularly suited to times of tumult and challenge. Culture cannot be changed or copied overnight; it is a feature of a people that has, to use a physics term, high inertia. Ours is distinguished by incontrovertibly powerful features, namely open-mindedness, risk-taking, hard work, playfulness, and, critical for nascent new ideas, a healthy dose of anti-establishment thinking. Where else could an Apple or a Steve Jobs have emerged?

Education. Then there’s our educational system, often criticized as inadequate to global challenges. But American higher education eludes simple statistical measures since its most salient features are flexibility and diversity of educational philosophies, curricula and the professoriate. There is a dizzying range of approaches in American universities and colleges, and more than half of the world’s top 100 universities are to be found in America, a fact underscored by soaring foreign enrollments.

What should our politicians do to help usher in this new era of entrepreneurial growth? Liquid financial markets, sensible tax and immigration policy, and balanced regulations will allow the next boom to flourish. But the essential fuel is innovation. The promise resides in the tectonic technological shifts under way.

America’s success isn’t preordained, warn the authors. But the technological innovations circa 2012 are profound. They will engender sweeping changes to our society and our economy. All the forces are in place. It’s just a matter of when.