



Notes from the Edge



Insights into an Evolving Future

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DEMOGRAPHICS

The world isn't facing an overpopulation problem. The total world population should plateau at about 13 billion by 2100, and actually decline thereafter. Draconian measures driven by xenophobia are not necessary to slow the expansion of our numbers. Nor do we need pandemics, famines or wars to cull our numbers. So long as we continue to invest in education, public health, access to contraception and global trade, our numbers are likely to decline naturally and painlessly. [No Overpopulation](#)

Current world population. At the dawn of agriculture, about 8000 B.C., the population of the world was approximately 5 million. Over the 8,000-year period up to 1 A.D. it grew to 200 million (some estimate 300 million or even 600, suggesting how imprecise population estimates of early historical periods can be), with a growth rate of under 0.05% per year.

A tremendous change occurred with the industrial revolution: whereas it had taken all of human history until around 1800 for world population to reach one billion, the second billion was achieved in only 130 years (1930), the third billion in less than 30 years (1959), the fourth billion in 15 years (1974), and the fifth billion in only 13 years (1987). The latest United Nations projections indicate that world population will reach 10 billion persons in the year 2056 (six years earlier than previously estimated).

World Population

We'll live to 100 – How can we afford it? In most countries around the world, standards of living and healthcare advancements are allowing people to live longer. Since the middle of the last century, life expectancy has been increasing rapidly. On average, it has been increasing by one year, every five years. Babies born today in 2017 can expect to live to over 100, or in other words, they will live to see

the year 2117. The expectation that retirement will start early- to mid-60s is likely to be a thing of the past, or a privilege of the very wealthy. Absent any change to retirement ages, or expected birth rates, the global dependency ratio (the ratio of those in the workforce to those in retirement) will plummet from 8:1 today to 4:1 by 2050. [Living to 100](#) [Living Longer](#)

Russia's working population will decline by 25% by 2050. In Russia, male life expectancy is low (64) and has been linked to heavy drinking. Women are having less children, with the birth rate at 1.7 per female, below the 2.1 births needed to replenish the working population. The situation is further exacerbated by low retirement ages. A Yale study estimates that Russia's working population will decline by 25% by 2050. [How will Russia fare?](#)

South Africa's economic woes not unique. Between 2015 and 2050, Africa's youth is expected to almost double, from 230 million to 452 million while most African states seem to have no plan to train their youth and create sufficient job opportunities for them. Sello Hatang, the chief executive of the Nelson Mandela Foundation, expressed particular concern by the fact that by 2050, half of Africa's population will be below 25 years old. He said the forum noted that lack of youth-targeted developmental programs was contributing to young people risking their lives and crossing the Mediterranean seas to Europe in search of better opportunities. [Africa's Economic Woes](#)

RESOURCE SCARCITY

COP22 and beyond: protecting Africa's agriculture from climate change. With 28 African countries expected to more than double in population by 2050, and 10 African countries – Angola, Burundi, Democratic Republic of Congo, Malawi, Mali, Niger, Somalia, Uganda, Tanzania and Zambia – expected to grow “by at least a factor of five” by 2100, according to the UN Department of Economic and Social Affairs, Africa will be hard pressed to feed itself as temperature increases drive farm production down. While increases in temperature and carbon dioxide “can increase some crop yields in some places,” experts at the U.S. Environmental Protection Agency have noted, Africa isn't among them. In fact, the opposite is true: The scientific consensus is that a temperature increase of 2°Celsius would result in an average reduction of 15% to 20% in agricultural yields on the continent. [Africa's Agricultural Woes](#)

Edible insect ingredients: sustainable protein. Textured insect protein (TIP), formerly called “C-fu,” is able to act as a replacement for meat, dairy, and eggs; aiding in solving hunger and food security issues. A pound of TIP versus a pound of beef requires 5 times less feed, 200 times less water, and produces 23 times less greenhouse gases. According to calculations made by Dan Caticha, a mealworm farm the size of Rhode Island could feed 2 billion people, which is the population increase expected by the year 2050. [TIP Anyone?](#)

This new solar-powered device can pull water straight from the desert air. You can't squeeze blood from a stone, but wringing water from the desert sky is now possible, thanks to a new spongelike device that uses sunlight to suck water vapor from air, even in low humidity. The device can produce nearly 3 liters of water per day for every kilogram of spongelike absorber it contains, and researchers say future versions will be even better. That means homes in the driest parts of the world could soon have a solar-powered appliance capable of delivering all the water they need, offering relief to billions of people. There are an estimated 13 trillion liters of water floating in the atmosphere at any one time, equivalent to 10% of all of the freshwater in our planet's lakes and rivers. If a portion of that could be harvested water shortages around the world could be reduced or eliminated. [Water in the Desert](#) [Water in the Air](#)

MEDICAL

Gene therapy could wipe immune memory and "turn off" severe allergies. Scientists may be one step closer to discovering a way to genetically "turn off" allergic responses with a single injection. A team of researchers at the University of Queensland has developed a new process that has successfully

silenced a severe allergic response in mice, using blood stem cells engineered with a gene that can target specific immune cells. "We take blood stem cells, insert a gene which regulates the allergen protein and we put that into the recipient," says Professor Ray Steptoe, explaining the new process developed by his team at The University of Queensland. "Those engineered cells produce new blood cells that express the protein and target specific immune cells, 'turning off' the allergic response." This new discovery could mean that, within 10 or 15 years, asthma and other lethal allergic responses might be eliminated with a single, one-time treatment. [No More Allergies](#)

SECURITY

What biosecurity and cybersecurity research have in common. Biosecurity and cybersecurity research share an unusual predicament: Efforts to predict and defend against emerging threats often expose and create vulnerabilities. In the wrong hands, both types of knowledge can be used to develop a weapon instead of a vaccine or a patch. How can we protect against misuse without limiting discovery and innovation? [Protect Without Limiting](#)

AUTONOMY

Ford, autonomous cars and the edge of the driverless cliff. Nobody knows for sure what urban transport will look like in 10 years, but one thing's for sure: self-driving cars are going to cause a massive revolution. This revolution will not only impact the way we get around, but in the way our cities and social lives are designed. It's also a huge time of upheaval for automakers, who are staring down the barrel of a fundamental shift in their business model. Most car manufacturers are now coming to grips with the fact that individual car ownership is likely to absolutely plummet in the next 20 years. [A recent paper by RethinkX](#) has put some numbers to it; within just 10 years of regulatory acceptance, driverless cars will be doing 95 percent of road miles, even if they'll only represent 40 percent of the cars on the road. At a recent mobility discussion panel in Sydney, Ford's Australian President and CEO Graeme Whickman admitted that Ford's internal discussions had ranged as far as VTOL flying taxis and 3-D commuting, but stressed that the focus over the next few years is squarely on Level 4 autonomy and making sure that the company isn't left behind when this wave breaks. [Ford's Autonomy](#)

Intel predicts a \$7 trillion self-driving future. The race to be the first to deploy autonomous vehicles is on among carmakers, emerging startups, and tech giants. Amid this constant news cycle of deals and drama, the purpose of all of it can get lost — or at least a bit muddled. What exactly are these companies racing for?

A \$7 trillion annual revenue stream, according to a [study](#) released Thursday by Intel. The companies that don't prepare for self-driving risk failure or extinction, Intel says. The report also finds that over half a million lives could be saved by self-driving over just one decade.

The study, prepared by Strategy Analytics, predicts autonomous vehicles will create a massive economic opportunity that will scale from \$800 billion in 2035 (the base year of the study) to \$7 trillion by 2050. [Autonomy to the Tune of \\$7 Trillion](#)

LEGISLATION

Law requires reshaping as AI and robotics alter employment, states new IBA report. The present wave of automation, driven by artificial intelligence (AI) – the development of computer systems able to perform tasks normally requiring human intelligence – is creating a gap between current legislation and new laws necessary for an emerging workplace reality, states a report published recently by the International Bar Association Global Employment Institute (IBA GEI). Titled *Artificial Intelligence and Robotics and Their Impact on the Workplace*, the 120-page comprehensive report focuses on potential future trends of AI, and the likely impact intelligent systems will have on: the labor market, the structures of companies, employees' working time, remuneration and the working environment. In addition to illustrating the thread and importance of law in relation to these areas, the GEI report assesses the law at different points in the automation cycle – from the developmental stage, when computerization of an

industry begins, to what workers may experience as AI becomes more prevalent, through to issues of responsibility when things go wrong. These components are not examined in isolation, but in the context of economics, business and social environment. [Fix the Laws Now](#)

TECHNOLOGY/CRYPTOLOGY

Big scientific breakthrough at sub-atomic level holds promise for secure comms. Chinese scientists have pulled off a major feat with one of the sub-atomic world's weirdest phenomena: photons that behave like twins and experience the same things simultaneously, even over great distances. The space-based technique developed by the researchers and reported in the journal *Science* holds potential for revolutionizing telecommunications and perhaps someday developing a hack-proof internet. The principle is called quantum entanglement, in which photons or neutrons are created in such a way that they are linked and behave as if they were one entity, even if they are physically separated. In a groundbreaking experiment led by Professor Jian-Wei Pan of Hefei University in China, a laser on a satellite orbiting 300 miles above the earth produced entangled photons. They were then transmitted to two different ground-based stations 750 miles (1,200 kilometers) apart, without breaking the link between the photons, the researchers said. That distance is 10 times greater than the previous record for entanglement. The experiment also marked the first time entangled photons were generated in space. [Quantum Communications](#) [How Copy?](#)

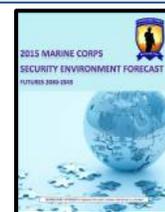
First quantum-secured blockchain technology tested in Moscow. Quantum computers pose a significant security threat to cryptocurrencies such as Bitcoin. Now a team of Russian scientists has worked out how to secure blockchains using quantum mechanics. Interest in cryptocurrencies is currently at fever pitch; the cryptocurrency market has begun to rise exponentially, and last month reached an astonishing \$90 billion in market capitalization. Whatever happens next, cryptocurrencies look certain to play an increasingly influential role in the global financial system. The threat from quantum computers is certainly real – and not just for blockchain technology. Any information that is currently stored using conventional cryptography will become unsecure as soon as the first powerful-enough quantum computer is switched on. Enter Evgeny Kiktenko at the Russian Quantum Center in Mosco and a few pals who have designed, built, and tested a quantum blockchain system in which the security is guaranteed by quantum mechanics. They've built it using a standard quantum cryptography system of the kind that is already commercially available. [Quantum Blockchain](#)

FUTURES ASSESSMENT DIVISION

The *Science Fiction Futures* anthology, the *MCSEF*, and previous editions of *Notes from the Edge* can be found at the link:

[Futures Assessment Division](#)

“Let us not go over the old ground, let us rather prepare for what is to come.” – Marcus Tullius Cicero



This newsletter is intended to highlight issues and ideas which may prove significant in the evolving future. In keeping with our focus on both alternative futures and analysis, items in this bulletin will generally be of an alternative nature, or drawn from atypical sources.