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Paper: **The world in the next thirty years, hopes and fears**

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Abstract

The world in the next thirty years, hopes and fears

The world is fast accelerating changes, with the synergetic effects of many shifts, innovations and disruptions. These changes appear in many fields generating both fears and hopes. This paper attempts to evaluate successes and drawbacks foreseeable in the next 20-30 years, a timespan that most of us will live.

The future is not what it used to be. The time scale has changed, now long term has become short term. Sometimes it is enough to just analyze the present to understand the future

The crucial landscapes which can be relatively well forecast are **population and wealth trends.**

The future of work is to be a major aspect and concern. Digitalisation, robots and artificial intelligence are even more important an issue as they will directly affect the way people live. Although the future seems to be almost predictably charted in these fields, there still are major unknowns, particularly on the rate of development and the positive or negative impacts in the world.

Most important, and likely to affect all above, are breakthroughs in technology.

Potential may be overwhelming and examples are many. At the origin of all there is the need for energy. Just two accelerating demands, for electric cars and for air conditioning of the 3 billion people who need it are likely to disrupt all current forecasts on energy consumption.

Conclusions

Science advances much faster than human trends and understanding. However, overall benefits are likely to be much higher than drawbacks.

There was an annual event in Aix en Provence in early July this year, at the Rencontres Economiques, sometimes coined as “the French Davos”. This year’s theme was about Metamorphoses for the Future. The general introduction, and conclusion after three days of debates, was that “nothing is known of the future”.

The purpose of this paper is not to be so assertive, with no clue, and defeatist. It is rather to rank what can happen within just one generation.

Population

One of the most vertiginous trend, happening and continuing, and one that can be most easily forecast for one or two generations, is the trend in world population.

Two disturbing questions are "how many people have ever lived?" and "what percentage of people who have ever lived are alive today?" Estimates of the "total number of people who have ever lived" is currently at 100-110 billions. So, now alive, there are about 7% of all the Homo sapiens that ever lived in the last 500 millennia. Exponential if anything…

The world population of 7.6 billion in 2017 is expected to reach 8.6 billion by 2030, 9.8 billion in 2050 and 11.2 billion in 2100.

The annual growth rate is slowing down however:

1.55% per annum in 1995
1.25% in 2005
1.18% in 2015
1.10% in 2017

Long term current United Nations, UN, projections are based on a **continuing decrease of the fertility rate,** in average, from 2.5 births per woman in 2010–2015 to 2.2 in 2045–2050 and to 2.0 in 2095–2100. 2.1 is the agreed figure for just replacement of the existing population. More and more countries now have fertility rates less than 2.1. The phenomenon has not been brought about by any famine or natural disaster but by the sheer fact that people do not want to have children.

The next three decades will be the first time in history when senior citizens make up a significant percentage of the human population. This is a true success story, a triumph indeed for humans. Compared to 2017, the number of persons aged 60 or above is expected to more than double by 2050 and to more than triple by 2100, rising from 962 million globally in 2017 to 2.1 billion in 2050 and 3.1 billion in 2100.

People are living longer, and they also are living better in old age, which will make the significance of age 65 less and less relevant. After all the definition of “old age” was defined for the first time at 65 by Cicero, this is a long time ago. Now it seems 65 is the new 55, and going to improve. Millennials and the generations that follow them could very well see the day when 100 becomes the new 40. People born after 2000 may never grow old the same way their parents, grandparents and ancestors did.

A diminishing population is not all bad. Even though the total economy may be shrinking, people in the US, Europe and Japan will be doing better than before. Why? Because a less crowded country means less dependence on (foreign) oil, lower pollution, fewer traffic jams, more space and food abundance. As an historical example, Europe became more prosperous after the Black Death, the plague of the years 1347-1351, when one third to half of the population died from the pandemics.

All countries will need to implement bold policies to cope with these demographic changes. Supporting an ageing population will require greater participation in the labor force from women and the elderly. Greater participation in the workforce by people in their late 50s, 60s and 70s could have a significant impact on GDP. The younger population in Africa may be a major opportunity, but it will require the right policy. Young people are only an advantage there are enough jobs for them.

Today, about two thirds of the population lives in Asia, with China and India respectively at 19% and 18% of total world population.

More than half of the global population growth between now and 2050 will occur in Africa, which is to double to 2.5 billion. Most of the global increase is attributable to a small number of countries:

India is expected to become the largest country in population size, surpassing China as early as 2022, while Nigeria could surpass the United States by 2050. By 2050, six countries are expected to exceed 300 million: China, India, Indonesia, Nigeria, Pakistan, and the USA.

Gross domestic product and wealth

By 2050, the world is likely to have changed drastically from now.

The UK company, PricewaterhouseCoopers, PwC, wrote a report, entitled "The long view: how will the global economic order change by 2050? », ranking 32 countries by their projected global gross domestic product by purchasing power parity*. At an average annual growth rate of 3% between 2017 and 2050, the world economy could almost triple by 2050, from 85 trillion dollars to 225 trillion dollars, much faster than population growth, due to continued technology-driven productivity improvements, and to the rise of emerging markets. Emerging markets (E7) could grow around twice as fast as advanced economies (G7) on average. As a result, six of the seven largest economies in the world are projected to be emerging economies in 2050 led by China (1st), India (2nd) and Indonesia (4th).

Total world and main country GDP in 2017 and 2050, in trillions of dollars

	2050	**2017**
World	225000	85000
1. China	58499	11938
2. India	44128	2439
3. United States	34102	19362
4. Indonesia	10502	1011
5. Brazil	7540	2081
6. Russia	7131	1469
7. Mexico	6863	1142
8. Japan	6779	4884
9. Germany	6138	3652
10. United Kingdom	5369	2565

Source: Price Waterhouse The world in 2050

The issue of the development of inequalities is extensively discussed, heavy with emotional and political arguments. Is growing inequality good or bad? When a huge corporation equals the GNP of a small country, it may raise indignation… Why should it be a problem in general? The private corporation is generally better managed than a state of the same size…

The story of Basic Universal Income is a recurring one that has more shortcomings than advantages.

In all emerging countries, two main groups benefit from globalization, the “top 1 percent” and the “emerging middle class”. The income of the “emerging middle class” rises even faster than that of the top 1 percent. And this “emerging middle class” accounts for about half of humankind. This is a very positive result.

Technology advances

There have been periods of intensive change in history before. But unlike other periods of significant changes, like the agricultural or industrial revolutions, the new technical/digital revolutions seem limitless. Looking into the topic of technology advances to come in the next thirty years opens an endless universe of visions and creativity. It is really much, too much, to be embraced in this paper.

Just to remind the richest and most exciting sources that were screened, three may be quoted: PwC (PricewaterhouseCoopers), MIT (Massachusetts Institute of Technology, and TED (Technology Entertainment Design). Of course there are many others.

Every year since 2001 MIT Technology Review picked what they call 10 Breakthrough Technologies. In the vision of MIT, for the last three years, there are, fully detailed, with the state of availability, with the links:

10 breakthroughs technologies 2018
3-D Metal Printing
Artificial Embryos
Sensing City
AI for Everybody
Dueling Neural Networks
Babel-Fish Earbuds
Zero-Carbon Natural Gas
Perfect Online Privacy
Genetic Fortune-Telling
Materials' Quantum Leap

10 breakthroughs technologies 2017
Reversing Paralysis
Self-Driving Trucks
Paying with Your Face
Practical Quantum Computers
The 360-Degree Selfie
Hot Solar Cells
Gene Therapy 2.0
The Cell Atlas
Botnets of Things

10 breakthroughs technologies 2016
Immune Engineering
Precise Gene Editing in Plants
Conversational Interfaces
Reusable Rockets
Robots That Teach Each Other
DNA App Store
SolarCity's Gigafactory
Slack
Tesla Autopilot
Power from the Air

This is just to open some thoughts to what might happen. The major breakthroughs identified by so many sources are a very long list, including, at various stages of development. Among the most advanced stages development, likely to have an impact in the next 20-30 years as they are already visible, there are:

3D printing, developing from plastics to metal, glass and wood
Internet of Things, IoT
Drones
Self-driving cars
Augmented reality (AR)
Virtual reality (VR):

Not mentioned here is the huge field of biology, health, medicine, extended life, in which research and breakthroughs are as much and even more active.

Although the future seems to be almost predictably charted in these fields, there still are major unknowns, particularly on the rate of development and the positive or negative impacts in the world.

Sometimes the speed of development may bring surprises, as some poorer areas may leapfrog to the future. For instance, 12% of adults in Sub-Saharan Africa have a mobile money account, while globally only 2% do. Disruptive new technologies can be very rapid. It took 100 years for the telephone to penetrate most households. The smartphone has achieved the same in less than a decade.

The future of energy

Energy is the driving force behind the rise of mankind. Every time humanity mastered a new form of energy, fire, coal, oil, nuclear, solar, progress accelerated.

Now the question is if and when a really cheap and safe energy becomes available. Solar, and only solar, not wind or others could fill the bill with major improvements in efficiency and storage. Otherwise, there is more and more some allusion to new sources, still too controversial to be widely discussed.

Short of such a momentous change, not to be excluded, improvements in the classical renewables, solar essentially, is to change many areas in the world, in particular warm countries where economy is still emerging and the sun potential is huge.

Definitely, major investments in energy will be needed in the next thirty years, for many reasons:

Slowing down the use of fossil fuels, coal, and gas, later, under many pressures, and possible reduced availability

Grow of renewables with all their pros and cons, sun, wind, tide, geothermic, thorium and fusion, and more…

Rising demand from increased population and better living conditions

Rising demand from new developments, such as widespread air conditioning and electric cars, seldom mentioned

One major result is that the developing world will reach the standard of living of the developed world much faster than imagined. Like mobile phones have allowed the developing world to leapfrog over the need to invest billions into a massive landline network, the same will be true with energy, instead of investing trillions into a centralized energy grid, the developing world can invest much less into a more advanced decentralized renewable energy grid.

In fact, it is already happening. In Asia, China, India, Japan are beginning to invest more in renewables than in traditional energy sources like coal and nuclear.

A nagging, and hopeful, question remain open.

What happens when humanity enters a future world filled with nearly free, limitless, and clean renewable energy? This is a future that could happen, but also one that humanity has never experienced. Current forecasts rest on the hypothesis that energy is limited and expensive. Vast amounts of energy can be available through nuclear processes, fusion, and others still uncharted.

A free energy would bring major changes of paradigms, hard to grasp. For instance, this could imply an end to drought via desalination of seawater.

An innovation could suddenly happen that would change everything. However, there is no trend or indication that suggests a timeline for such a development, it could happen next year, or still be a dream a century from now.

The future of work

Work takes up to one third of a total human life and its future is to change drastically. The relation of people to work, whether it fits their aspirations, the way they go about it, the tools they will use and their impact is likely to be one of the most significant change in the future of the next generation.

The major question mark about the future of jobs worldwide is what will happen to existing and future jobs with the impact of artificial intelligence, AI, and of robots.

Artificial intelligence are software algorithms, actually a chain of software instructions, in a way like kitchen recipes, this just said to dedramatize the apparently forbidding topic…The concept includes many applications, such as machine learning, with development of programs that can teach themselves to learn, understand, reason, plan, and act.

Artificial intelligence is to impact simple and repetitive tasks of mind work, and robots are to impact physical labor. These two powerful technologies are increasing productivity, improving lives, and reshaping the world. But what happens to jobs? Will there still be jobs for all?

Unemployment is a bad thing. The International Labor Organization estimates that 65 millions of jobs have disappeared since the global economic crisis in 2008, with up to about 210 million people unemployed globally in 2018. Nearly 500 million new jobs will need to be created within two years. And the more distant future, the next thirty years, is a huge question mark. At the same time, many industries are facing difficulty hiring qualified staff.

Current and future impact of AI and robots

Technology replacing human labor has been a recurring issue for centuries, the only difference now is the speed at which jobs are disappearing. Automation, digital platforms, and other innovations are changing the fundamental nature of work. The development of automation with robots and artificial intelligence brings the promise of higher productivity, and economic growth, increased efficiencies, safety, and convenience.

According to several referenced McKinsey studies, more than half the activities could be automated. But, very few occupations, less than 5 percent, can be fully automated. Research estimates that between almost zero and 30 percent of the hours worked globally could be automated by 2040-2050, depending on the speed of adoption, which itself depends upon the mix of activities and prevailing wage rates.

Automation development depends upon technical feasibility to automate, but not only. There are other important factors, such as the cost of developing and deploying both the hardware and the software for automation. Also important are the supply and demand of labor. When workers are available, with sufficient skills, and less expensive short term than automation, this can slow the development of automation.

Beyond labor substitution, there are other reasons for automation, like higher output, better quality and fewer errors, improved safety and capabilities that surpass human ability. Not to be neglected, regulatory and social issues, must also be weighed.

Even while technologies replace some jobs, they are creating new work in industries, and new ways to generate income. One-third of the new jobs created in the United States in the past 25 years just did not or barely existed, in Information Technology (IT) development, hardware manufacturing, software creation. The growing role of big data in the economy and business will create a significant need for statisticians and data analysts. An estimated 250 000 new data scientists will be need in the US, just in the next ten years.

Workers in small businesses and self-employed occupations can benefit from higher income earning opportunities. The world still is in the early stages of digital technologies.

The United States has captured 18 % of its potential from digital technologies, and Europe only 12%. Emerging economies are further behind, with no more than 10 % of their digital potential.
More than half the world's population is still offline, concentrated in about 20 countries. This population is rural, low income, elderly, illiterate, and female. This limits the potential to benefit from digital.

In India, for example, McKinsey has a program to provide the foundation for many innovations that could contribute $550 billion to $1 trillion of economic impact per annum as soon as 2025, with the MGI Empowerment Line.

In India, also, Google has created the Internet Saathi (Friends of the Internet) program in which rural women are trained to use the Internet, and then become local agents who provide services in their villages through Internet-enabled devices. The services include working as local distributors for telecom

products (phones, SIM cards, and data packs), field data collectors for research agencies, financial-services agents, and para-technicians who help local people access government schemes and benefits through an Internet-based device.

The true challenge is whether workers will be educated fast enough to master the transition. Only when this transition is badly managed will there be unemployment and depressed wages.

The world is not at real risk to become a world of robots dominated by AI, for several reasons:

First, artificial intelligence, 3D printers and other innovations are generally designed to excel at a very specific set of tasks.

Second, new technologies not only destroy, but also create jobs. Throughout history, technological innovations have enhanced the productivity of workers and created new products and markets, thereby generating new jobs in the economy. This will be no different for AI, robotics and 3D printing.

Third, just because it is technically feasible to substitute an entire profession with computers, does not mean it will happen soon. Various economic, legal, regulatory and socio-political factors will prevent many occupations from disappearing. A study found that, by 2016, only one out of 270 occupations listed in the 1950 US census had been eliminated by automation, elevator operators.

Activities most susceptible to automation include physical ones in predictable environments, such as operating machinery, in all industries. Collecting and processing data are two other categories of activities that increasingly can be done better and faster with machines. This could displace large amounts of labor, for instance, in administrative work, accounting, translation, and back-office transaction processing.

Automation will have a lesser effect on jobs that involve managing people, applying expertise, and social interactions, where machines are unable to match human performance for now.

Jobs in unpredictable environments, occupations such as gardeners, craftsmen, plumbers, or providers of child and elderly care, will also see less automation, because they are technically difficult to automate and often command relatively lower wages, which makes automation a less attractive business proposition.

However, even when some tasks are automated, employment in those occupations may not decline, and workers may perform new tasks. "Will robots, the digital revolution, automation and artificial intelligence produce enormous unemployment? Apparently, little risk…There are tremendous job markets for the next thirty years.

Altogether, over 1 billion new jobs, at least, for the next 30 years, most of them locally required.

Minimum number of additional workers needed worldwide, as estimated, in millions, by 2050

New general consumption demands, food, clothing, maintenance, by new middle classes	300
New health care and assistance aides, needed by ageing population	85
New jobs needed for international tourism up from 1 billion in 2017 to over 2 billion in 2050	300
New jobs related to information technology	50
New jobs related to repairing and creating infrastructures and buildings	250
New jobs for energy needs, to rehabilitate or create grids and power plants	50
Marketization of previously unpaid domestic work	70

The most difficult to estimate is the number required for infrastructure and buildings, in great need for overhauling, or creating. Most of the roads, bridges, public buildings, were built decades ago. Infrastructure is to be created in all emerging countries. These jobs include architects, engineers, electricians, carpenters, and other skilled tradespeople, as well as construction workers. Not much can be automatized, and most is to be needed locally.

In both the developed and the emerging world, there will be a major demand for energy needs, whether to rehabilitate, or build grids, and to create renewable energy sources. Wind, solar, geothermic, or other,

will create demands in manufacturing, construction, and installation. By 2050, the world will have to entirely replace its aging energy grid, if it is still needed, and power plants.

The categories with the highest percent job growth, outside of automation will thus include the following:

Healthcare providers
Professionals such as engineers, scientists, accountants, and analysts
IT professionals and other technology specialists
Managers and executives, whose work cannot easily be replaced by machines
Educators, especially in emerging economies with young populations
Global tourism growth, to at least double, now 1 in 10 jobs worldwide
“Creatives,” a small but growing category of artists, performers, and entertainers
Builders and related professions, in infrastructures and buildings
Manual and service jobs in unpredictable environments, such as home-health aides and gardeners

Hence the next three decades will see one of the biggest job booms in recent history.

The changes in net occupational growth or decline imply that a very large number of people may need to shift occupational categories and learn new skills in the near future. The shift could be on a scale not seen since the transition of the labor force out of agriculture in the early 1900s in the United States and Europe, and more recently in China.

Up to 1 billion may need to switch occupations and learn new skills.

In advanced economies, occupations that currently require only a secondary education or less see a net decline from automation, while those occupations requiring college degrees and higher grow.

In India and other emerging economies, there will be higher labor demand for all education levels, with the largest number of new jobs in occupations requiring a secondary education, but the fastest rate of job growth will be for occupations currently requiring a college or advanced degree.

The number of jobs based on routine tasks that can be automated will fall.

Without the disappearance of salaried work that is sometimes considered possible, there will probably be an increase of self-employed people. This trend is already visible in the US, 35% of freelancers, and in Europe, 25% of freelancers.

Algorithms will become allies rather than enemies to much more educated people, who will also need permanent education and training.

Resource scarcity and pollution

Some of the other problems predicted for the near future include limited and diminishing arable land, deforestation, wild urbanization, disappearing family farms, degradation of land and water, irrigation problems, waste, the extinction of certain types of crops, pollution and depleted resources in the oceans. 1.6 acres of rainforest, coined the “lungs of the world”, as they produce oxygen, are disappearing through logging every second. Almost half of the Amazon rainforest will be gone by 2050.

Pollution is everywhere, in the oceans, on land, in the remotest areas of the world like Lake Titicaca in the Andes, and affecting all consumer goods, food, cosmetics, textiles, buildings, transports and all over.

Only 3% of the world’s water is freshwater, and only a quarter of that is accessible from rivers, lakes or the ground. The rest is locked in to inaccessible stores such as glaciers.

Food production will be another major challenge in 2050. It will need to increase by 70 percent to feed the over 9 billion people. A large percentage of the grain is used to produce meat. For example, it takes 10 kilos of grain and 20 000 liters of water to produce a single kilo of meat. Traditional sources of meat, like fish and livestock, are incredibly inefficient sources of protein, when compared to protein derived

from plants. The current buzz on vegetarianism and veganism in the West may become a must instead of a whim. Some consider insects and huge insect farms.

The world is in a crisis. Modern societies are taking too much of the finite resources of the planet at a rate that simply cannot be sustained through this century.

Conclusions

What will the future look like, not in a century but in thirty years?

In terms of geopolitics, the world will be multi-polar. The US will no longer be the only superpower in the world with the rise of China and India. Brazil will be a regional power in Latin America. Indonesia will be a regional power in South East Asia. Iran and Turkey are competing to become the regional power in Middle East. Africa will become the youngest and the fastest growing continent in the world. It will be the manufacturing factory of the world and a self-sufficient one, after Asia. Unlike Asia though, it might have trouble shifting its entire economy from low-values to high-tech ones because of the automation in and the competition with the rest of the world. Russia may greatly benefit from climate warming, if any.

Old Japan and Europe economies will decline to rely on tourism and luxury industries, but they may bounce back in unexpected ways.

English is to stay the number one international language, but Mandarin becomes the second most popular foreign language because Chinese universities keep ranked in the top 100 and because of the abundance of Chinese tourists.

One of the best website that was found, with sometimes mind-shattering vision, is that of the Canadian Agency Quantum Run, with many thought provoking visions for the near and more distant future.

Two recent, and successful books, from Yuval Noah Harari, an Israeli historian and author of “Sapiens” and “Homo Deus,” offer a sweeping history of humankind and a forecast of what lies ahead: an age of algorithms and technology that could see us transformed into “super-humans” with godlike qualities. Humans, Harari warned, “have created such a complicated world that we are no longer able to make sense of what is happening.

In technical aspects, there is:

The certain, extrapolated
The possible, guessed or hoped
The unexpected, the Black Swan

What is practically certain to happen is

Exponentially accelerating computer power, the single greatest force for change as of now
Convergent technologies
Emergent machine intelligence
Reframing of complex problems as scalable, largely automated systems
Evolution of “asset value” from material property to intellectual property (IP)

In everyday life, there will be drones, robots, self-driving vehicles everywhere, humans staying behind the screens to control these machines. Bullet trains will prevail, at the expense of air travel. Oil and gas will still be important because of the interest as raw materials for petrochemicals. Phones will replace wallets, banks, all mainly operated by voice commands. All jobs that could be replaced by software will be replaced by software.

Among the possible:

There may be major biology advances in medicine, health, the end of diseases, DNA sequencing and manipulation, life extension. Stem cell technology may allow to get artificial tissues and organs.

Some major breakthroughs, now just outlined, like more space knowledge and discovery, energy sources and improvements.

The unexpected

All the above, the certain and the possible, rests on the assumption of “ceteris paribus”, everything remaining the same. Yet, there are events that are impossible to predict, as to affect the known world. That includes major catastrophic events better not to be thought about. This is sometimes what is called the **black swan theory.** It describes an event that comes as a surprise and has a major effect. The book of Nasik Nicholas Tabev popularized the word and the concept in a 2007 bestseller, The Impact of the Highly Improbable.

This theory refers to 'X factors' that can be bold, exciting, and optimistic predictions of a future not far from us today. Or they are going in the other direction, with predictions of diseases not yet discovered, or invented, possible destructions in many ways.

But the real "X factor" is how to deal with the changes that are sure or possible to come. All current forecast are extrapolating from the known. There is no clue as to what really may happen.

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* PPP is an economic measure that compares different countries' currencies through a "basket of goods" approach. According to this concept, two currencies are in equilibrium or at par when a basket of goods (taking into account the exchange rate) is priced the same in both countries. PPP is used by macroeconomists to determine the economic productivity and standards of living among countries across a certain time period.

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