Globalization and Emerging Technologies: Advances that Will Transform Business and the Global Economy

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Over the past four decades the world has been transitioning into a global marketplace. Today financial markets, industry and politics are all internationalized. This internationalization has led to an increases transfer of capital across borders (including Panama Papers!), increased communication throughout the world, an increased importance of trade in the economy, an increase in international trade policies. Globalization has had drastic effects on the economic world and has created many challenges politically as well. In the first part of my presentation, I will discuss recent trends and then share several different perspectives on globalization. In the second part, the major emerging technologies will be explored.

Globalization: Trends and Perspectives

[1] *An increase in technology and transportation*. Globalization has been rising side by side with the increase in available technology and convenience of improved transportation. Technology has made it simpler for people to communicate across borders, and has also lead to a decline in the cost of transportation.

[2] *The liberalization of government trade policies*. The question is how much regulations do we need and what type. The government has a big place in globalization by setting standards for international trade and monitoring the structure for international trade and determining which sectors should become privatized. In fact International Monetary Fund loan terms require certain sectors to become privatized.

[3] *An increase in the inequalities among nations.* Globalization has lead to an increase in the inequalities of nations. Literature has many contradicting viewpoints on exactly how unequal nations are currently, and how big a factor globalization is playing in the inequalities. The richest of nations are continuing to increase in wealth while the poorest nations are continuing to get poorer.

[4] *An increase in the inequalities of incomes between citizens of a single nation*. Along with the increase in the inequalities of nations there was an increase in labor inequalities between the citizens of a single nation. According to the existing literature this inequality and poverty are due to globalization. For example, China chooses to increasingly participate in the global economy it will hurt the income of many of Chinese citizens. The same thing can be said for India and other low wage emerging economies.

Emerging Technologies

Important technologies can come in any field or emerge from any scientific discipline, but they share four characteristics: [1] high rate of technology change, [2]broad potential scope of impact,[3] large economic value that could be affected, and [4]substantial potential for disruptive economic impact.

Many technologies have the potential to meet these criteria eventually, but leaders need to focus on technologies with potential impact that is near enough at hand to be meaningfully anticipated and prepared for. Therefore, my presentation will focus on technologies that I believe have significant potential to drive economic impact and disruption by 2025.

The technology is rapidly advancing or experiencing breakthroughs. Disruptive technologies typically demonstrate a rapid rate of change in capabilities in terms of price/performance relative to substitutes and alternative approaches, or they experience breakthroughs that drive accelerated rates of change or discontinuous capability improvements. Gene-sequencing technology, for example, is advancing at a rate even faster than computer processing power and could soon make possible inexpensive desktop sequencing machines.

- **The potential scope of impact is broad**. To be economically disruptive, a technology must have broad reach touching companies and industries and affecting (or giving rise to) a wide range of machines, products, or services. The mobile Internet, for example, could affect how five billion people go about their lives, giving them tools to become potential innovators or entrepreneurs—making the mobile Internet one our most impactful technologies.

- **Significant economic value could be affected.** An economically disruptive technology must have the potential to create massive economic impact. The value at stake must be large in terms of profit pools that might be disrupted, additions to GDP that might result, and capital investments that might be rendered obsolete.

- Advanced robotics, for example, has the potential to affect $6.3 trillion in labor costs globally.
- Cloud technology has the potential to improve productivity across $3 trillion in global enterprise IT spending, as well as enabling the creation of new online products and services for billions of consumers and millions of businesses alike.

- **Economic impact is potentially disruptive.** Technologies that matter have the potential to dramatically change the status quo. They can transform how people live and work,

create new opportunities or shift surplus for businesses, and drive growth or change comparative advantage for nations. Energy storage technology could change how, where, and when we use energy. Advanced oil and gas exploration and recovery could fuel economic growth and shift value across energy markets and regions.

I believe that the technologies which were identified have potential to affect billions of consumers, hundreds of millions of workers, and trillions of dollars of economic activity across industries.

Mobile Internet

In just a few years, Internet-enabled portable devices have gone from a luxury for a few to a way of life for more than one billion people who own smart phones and tablets. In the United States, an estimated 30 percent of Web browsing and 40 percent of social media use are done on mobile devices; by 2020, wireless Web use is expected to exceed wired use. The technology of the mobile Internet is evolving rapidly, with intuitive interfaces and new formats, including wearable devices.

Automation of knowledge work

Advances in artificial intelligence, machine learning, and natural user interfaces (e.g., voice recognition) are making it possible to automate many knowledge worker tasks that have long been regarded as impossible or impractical for machines to perform. For instance, some computers can answer "unstructured" questions (i.e., those posed in ordinary language, rather than precisely written as software queries), so employees or customers without specialized training can get information on their own. This opens up possibilities for sweeping change in how knowledge work is organized and performed. Sophisticated analytics tools can be used to augment the talents of highly skilled employees, and as more knowledge worker tasks can be done by machine, it is also possible that some types of jobs could become fully automated.

The Internet of Things

The Internet of Things—embedding sensors and actuators in machines and other physical objects to bring them into the connected world—is spreading rapidly. From monitoring the flow of products through a factory to measuring the moisture in a field of crops to tracking the flow of water through utility pipes, the Internet of Things allows businesses and public-sector organizations to manage assets, optimize performance, and create new business models. With remote monitoring, the Internet of Things also has great potential to improve the health of patients with chronic illnesses and attack a major cause of rising health-care costs.

Cloud technology

With cloud technology, any computer application or service can be delivered over a network or the Internet, with minimal or no local software or processing power required. In order to do this, IT resources (such as computation and storage) are made available on an as-needed basis—when extra capacity is needed it is seamlessly added, without requiring up-front investment in new hardware or programming.

The cloud is enabling the explosive growth of Internet-based services, from search to streaming media to offline storage of personal data (photos, books, music), as well as the background processing capabilities that enable mobile Internet devices to do things like respond to spoken

commands to ask for directions. The cloud can also improve the economics of IT for companies and governments, as well as provide greater flexibility and responsiveness.

Advanced robotics

For the past several decades, industrial robots have taken on physically difficult, dangerous, or dirty jobs, such as welding and spray painting. These robots have been expensive, bulky, and inflexible – bolted to the floor and fenced off to protect workers. Now, more advanced robots are gaining enhanced senses, dexterity, and intelligence, thanks to accelerating advancements in machine vision, artificial intelligence, machine-to-machine communication, sensors, and actuators. These robots can be easier for workers to program and interact with. They can be more compact and adaptable, making it possible to deploy them safely alongside workers.

These advances could make it practical to substitute robots for human labor in more manufacturing tasks, as well as in a growing number of service jobs, such as cleaning and maintenance. This technology could also enable new types of surgical robots, robotic prosthetics, and "exoskeleton" braces that can help people with limited mobility to function more normally, helping to improve and extend lives.

Next-generation genomics

Next-generation genomics marries advances in the science of sequencing and modifying genetic material with the latest big data analytics capabilities. Today, a human genome can be sequenced in a few hours and for a few thousand dollars, a task that took 13 years and $2.7 billion to accomplish during the Human Genome Project. With rapid sequencing and advanced computing power, scientists can systematically test how genetic variations can bring about specific traits and diseases, rather than using trial and error.

Autonomous and near-autonomous vehicles

It is now possible to create cars, trucks, aircraft, and boats that are completely or partly autonomous. From drone aircraft on the battlefield to Google's self-driving car, the technologies of machine vision, artificial intelligence, sensors, and actuators that make these machines possible is rapidly improving. Over the coming decade, low-cost, commercially available drones and submersibles could be used for a range of applications.

Autonomous cars and trucks could enable a revolution in ground transportation—regulations and public acceptance permitting. Short of that, there is also substantial value in systems that assist drivers in steering, braking, and collision avoidance. The potential benefits of autonomous cars and trucks include increased safety, reduced CO_2 emissions, more leisure or work time for motorists (with hands-off driving), and increased productivity in the trucking industry.

Energy storage

Energy storage technology includes batteries and other systems that store energy for later use. Lithium-ion batteries and fuel cells are already powering electric and hybrid vehicles, along with billions of portable consumer electronics devices. Li-ion batteries in particular have seen consistent increases in performance and reductions in price, with cost per unit of storage capacity declining dramatically over the past decade.

Over the next decade, advances in energy storage technology could make electric vehicles (hybrids, plug-in hybrids, and all-electrics) cost competitive with vehicles based on internal-combustion engines. On the power grid, advanced battery storage systems can help with the integration of solar and wind power, improve quality by controlling frequency variations, handle peak loads, and reduce costs by enabling utilities to postpone infrastructure expansion. In developing economies, battery/solar systems have the potential to bring reliable power to places it has never reached.

3D printing

Until now, 3D printing has largely been used by product designers and hobbyists and for a few select manufacturing applications. However, the performance of additive manufacturing machinery is improving, the range of materials is expanding, and prices (for both printers and materials) are declining rapidly—bringing 3D printing to a point where it could see rapid adoption by consumers and even for more manufacturing uses.

With 3D printing, an idea can go directly from a 3D design file to a finished part or product, potentially skipping many traditional manufacturing steps. Importantly, 3D printing enables on-demand production, which has interesting implications for supply chains and for stocking spare parts—a major cost for manufacturers. 3D printing can also reduce the amount of material wasted in manufacturing and create objects that are difficult or impossible to produce with traditional techniques. Scientists have even "bioprinted" organs, using an inkjet printing technique to layer human stem cells along with supporting scaffolding.

Advanced oil and gas exploration and recovery

The ability to extract so-called unconventional oil and gas reserves from shale rock formations is a technology revolution that has been gathering force for nearly four decades. The combination of horizontal drilling and hydraulic fracturing makes it possible to reach oil and gas deposits that were known to exist in the United States and other places but that were not economically accessible by conventional drilling methods.

The potential impact of this technology has received enormous attention. With continued improvements, this technology could significantly increase the availability of fossil fuels for decades and produce an immediate boon for energy-intensive industries such as petrochemicals manufacturing. Eventually, improving technology for oil and gas exploration and recovery could even unlock new types of reserves, including coal bed methane, tight sandstones, and methane clathrates, potentially ushering in another energy "revolution."

Renewable energy

Renewable energy sources such as solar, wind, hydro-electric, and ocean wave hold the promise of an endless source of power without stripping resources, contributing to climate change, or worrying about competition for fossil fuels. Solar cell technology is progressing particularly rapidly. In the past two decades, the cost of power produced by solar cells has dropped from nearly $8 per watt of capacity to one-tenth of that amount. Meanwhile, wind power constitutes a rapidly growing proportion of renewable electricity generation.

Renewable energy sources such as solar and wind are increasingly being adopted at scale in advanced economies like the United States and the European Union. Even more importantly, China, India, and other emerging economies have aggressive plans for solar and wind adoption that could enable further rapid economic growth while mitigating growing concerns about pollution.

I am sure many of you, like me, have contemplated on what the near future holds with regards to new technology and the Internet. If we look at how technology has progressed over the past 20 years or so and we note the massive spike in consumer technology in the past 5 years or so. then the next 10-20 years look very interesting indeed.

The paralyzed will walk. Using a machine-brain interface, researchers are making it possible for otherwise paralyzed humans to control neuroprostheses –essentially mechanical limbs that respond to human thought–allowing them to walk and regain bodily control. The same systems are also being developed for the military, which one can only assume means this project won't flounder due to a lack of funding.

A 1 Terabyte SD Memory Card probably seems like an impossibly unnecessary technological investment. Many computers still don't come with that much memory, much less SD memory cards that fit in your digital camera.

The 1TB SD card became commonplace in 2014, and increasingly necessary given the much larger swaths of data and information that we're constantly exchanging every day (thanks to technologies like memristors and our increasing ever-connectedness). The only disruptive factor here could be the rise of cloud-computing, but as data and transfer speeds continue to rise, it's inevitable that we'll need a physical place to store our digital stuff.

The first around-the-world flight by a solar-powered plane will be accomplished by now, bringing truly clean energy to air transportation for the first time. Consumer models are still far down the road, but you don't need to let your imagination wander too far to figure out that this is definitely a game-changer. Consider this: it took humans quite a few milennia to figure out how to fly; and only a fraction of that time to do it with solar power.

The world's first zero-carbon, sustainable city in the form of Masdar City will be initially completed just outside of Abu Dhabi. The city will derive power solely from solar and other renewable resources, offer homes to more than 50,000 people.

Personal 3D Printing is currently reserved for those with extremely large bank accounts or equally large understandings about 3D printing; but by 2020, printing in three dimensions (essentially personal manufacturing) will become a common practice in the household and in schools. Current affordable solutions include do-it-yourself kits like Makerbot, but in four years

it should look more like a compact version of the uPrint. Eventually, this technology could lead to technologies such as nanofabricators and matter replicators–but not for at least a few decades.

Light Peak technology, a method of super-high-data-transfer, will enable more than 100 Gigabytes per second–and eventually whole terabytes per second–within everyday consumer electronics. This enables the copying of entire hard drives in a matter of seconds, although by this time the standard hard drive is probably well over 2TB.

Insect-sized robot spies aren't far off from becoming a reality, with the military currently hard at work to bring Mission Impossible-sized tech to the espionage playground. Secret weapon: immune to bug spray.

Nuclear Fusion: Energy from a fusion reactor has always seemed just out of reach. It's essentially the process of producing infinite energy from a tiny amount of resources, but it requires a machine that can contain a reaction that occurs at over 125,000,000 degrees. However, right now in southern France, the fusion reactor of the future is being built to power up by 2019, with estimates of full-scale fusion power available by 2030.

Crash-proof cars have been promised by Volvo, to be made possible by using radar, sonar, and driver alert systems. Considering automobile crashes kill over 30,000 people in the U.S. per year, this is definitely a welcome technology.

There are more future technology forecasts available at the link here. Crazy, crazy stuff indeed! I remember when I was a child I used to dream of a handheld device which could hold all my music, which I could connect and share things with my friends through, which I could do all my school work on, something that was touch screen etc etc.

Who knew this was going to come in the shape of a phone? not only that but a phone for less than £100. I could only dream when I was a child! Now kids grow up with online gaming in their living rooms.

The next 10 years will be an era of unprecedented connectivity; this much we know. It will build upon the social networks, both real and virtual, that we've all played a role in constructing, bringing ideas together that would have otherwise remained distant, unknown strangers. Without twitter and a steady drip of mainstream media, would we have ever so strongly felt the presence of the Arab Spring? Keeping in mind that as our connections grow wider and more intimate, so too will the frequency of our connectedness, and as such, your own understanding of just what kinds of relationships are possible will be stretched and revolutionized as much as any piece of hardware.

Truly, the biggest changes we'll face will not come in the form of any visible technology; the changes that matter most, as they always have, will occur in those places we know best but can never quite see: our own hearts and minds.

Conclusion-What is next?

Policy makers and societies need to prepare for future technology, too. To do this well, they will need a clear understanding of how technology might shape the global economy and society over the coming decade. They will need to decide how to invest in new forms of education and infrastructure, and figure out how disruptive economic change will affect comparative advantages.

Governments will need to create an environment in which citizens can continue to prosper, even as emerging technologies disrupt their lives. Lawmakers and regulators will be challenged to learn how to manage new biological capabilities and protect the rights and privacy of citizens.

Many forces can bring about large-scale changes in economies and societies— demographic shifts, labor force expansion, urbanization, or new patterns in capital formation, for example. But since the Industrial Revolution of the late 18th and early 19th centuries, technology has had a unique role in powering growth and transforming economies. Technology represents new ways of doing things, and, once mastered, creates lasting change, which businesses and cultures do not "unlearn." Adopted technology becomes embodied in capital, whether physical or human, and it allows economies to create more value with less input. At the same time, technology often disrupts, supplanting older ways of doing things and rendering old skills and organizational approaches irrelevant.

We view technology both in terms of potential economic impact and capacity to disrupt, because we believe these effects go hand-in-hand and because both are of critical importance to leaders. As the early 20th-century economist Joseph Schumpeter observed, the most significant advances in economies are often accompanied by a process of "creative destruction," which shifts profit pools, rearranges industry structures, and replaces incumbent businesses. This process is often driven by technological innovation in the hands of entrepreneurs.

Today, we see many rapidly evolving, potentially transformative technologies on the horizon— spanning information technologies, biological sciences, material science, energy, and other fields. The institutions set out to identify which of these technologies could have massive, economically disruptive impact between now and 2025.