G00253498

Maverick* Research: Surviving the Rise of 'Smart Machines,' the Loss of 'Dream Jobs' and '90% Unemployment'

Published: 23 September 2013

Analyst(s): Kenneth F. Brant, Anurag Gupta, Dan Sommer

CIOs must change their mission to address the proliferation of smart machines in a widening range of jobs, including knowledge work, and causing increasing levels of unemployment. (Maverick research deliberately exposes unconventional thinking and may not agree with Gartner's official positions.)

Key Findings

- Most business and thought leaders underestimate the potential of smart machines to take over millions of middle-class jobs in the coming decades. Job destruction will happen at a faster pace, with machine-driven job elimination overwhelming the market's ability to create valuable new ones.
- Machines are evolving from automating basic tasks to becoming advanced self-learning systems mimicking the human brain. As such, the next wave of job losses will occur among highly valued specialists in the short term and generalists in the longer term.
- Labor markets, political systems and society at large will have to significantly re-form to digest the changes from smart machines and their impact on employment. Longer term, as much as 90% of jobs are at risk of replacement.

Recommendations

- Engage with the C-suite to assess your firm's strengths, weaknesses, opportunities and threats for engineering a digital workforce. Use scenario building, and identify how your organization could survive and thrive in a world of smart machines.
- Longer term, advocate the creation of a new role that bridges the utility of the smart machine and current organizational structures and more effectively addresses cost optimization opportunities beyond traditional IT programs.

- Pursue a full feasibility/impact study, and develop a technology road map for smart machines. Shortlist potential high-value pilot projects to conduct in 2014 and 2015. Include contingency plans for initial setbacks.
- Map out potential partners to work with that can help leverage the effects of smart machines in your organization.

Table of Contents

List of Tables

List of Figures

Strategic Planning Assumptions

Firms that have not begun to develop programs and policies for a "digital workforce" by 2015 will not perform in the top quartile for productivity and operating profit margin improvement in their industry by 2020.

> *Corollary: The careers of CIOs who do not begin to champion digital workforce initiatives with their peers in the C-suite by 2015 will be cut short by 2023.*

Through 2023, one-third of all highly skilled work done by doctors, lawyers, traders and professors will be replaced by smart machines or by less skilled (nonspecialist) humans assisted by cognitive computing technology.

By 2030, 90% of jobs as we know them today will be replaced by smart machines.

Analysis

*Maverick Research

This is "Maverick" research, designed to spark new, unconventional insights. Maverick research is unconstrained by our typical broad consensus-formation process to deliver breakthrough, innovative and disruptive ideas from our research incubator. We are publishing a collection of more than a dozen Maverick research lines this year, all designed for maximum value and impact. We'll explore

each of these lines of research to help you be ahead of the mainstream and take advantage of trends and insights that could impact your IT strategy and your organization (see Note 1 and Note 2).

Introduction and Summary

As the title implies, this document explores the rise of "smart machines," the loss of "dream jobs" and "90% unemployment." It is broken down into three key issues and follows a chronological order.

Key issue No. 1 explores **the rise of smart machines (2013 through 2020).** (See Note 3 for a definition of "smart machine.") Currently, there is little knowledge and buy-in, even at the highest levels (including among CEOs), of the emergence of an entirely new area of computing that could broadly be labeled "smart machines." What is different now is that computing is starting to become cognitive and self-learning in its behavior. While much of this is brushed off as "futurist fantasy," the stars are aligning for a disruption that will result in the next major technology market, with severe business ramifications. Here, we explore the business ramifications and their beneficiaries in an interim scenario model.

Smart machines will be a key driver for a constant undercurrent that we call "destructive creation" (a play on Joseph Schumpeter's "creative destruction"). This means that the rate, scope, scale and volatility of machine-driven job elimination will overwhelm the market's ability to create valuable new ones. In other words, while no one doubts that many net-positive aspects could evolve from smart machines, there is a real risk that unemployment will rapidly increase. We explore this notion further in key issues No. 2 and No. 3.

Key issue No. 2 explores **the loss of dream jobs (2020 through 2030).** While blue-collar worker jobs, such as in manufacturing and warehousing, are already disappearing en masse, we predict that the next wave of job losses will occur among specialist workers. This is counter to generally held beliefs that the most prestigious upper-middle-class jobs are less vulnerable to job losses. However, advances in language processing, reasoning, perception and mimicking human performance make it possible to encroach deeper into specialist domains. The first positive ROI stories from smart machines will come from domain-specific uses cases, where it is easier to write algorithms to automate and exploit machine-learning technology and where the current human capital has very high costs. We provide specific examples of how machines will initially help but will ultimately replace humans in the medical, legal and trading fields.

To drive home the sequence and pace of job replacement, we also introduce the job market hierarchy through a triangle depicting four segments of the workforce: low-skilled, medium-skilled generalists, high-skilled specialists and ultra-high-skilled versatilists. The low-skilled workforce is already being replaced. Next up for replacement will be the high skilled, and only afterward the medium skilled. The ultra-high-skilled versatilists, who represent only a small minority of the workforce, will continue to be safe, along with some other service professions where human interaction is imperative or preferred.

Key issue No. 3 explores a provocative extrapolation and end state of the other two key issues: **the loss of up to 90% of jobs as we know them today (2030 and beyond).** There will be an inflection point in unemployment where society can't go on like it does today. Increasing levels of

unemployment will cause friction on many levels, requiring fundamental rearchitecture of how society functions.

In some cases, the balance of power will be centralized to the elites, and they will be the main beneficiaries of smart machines. In other scenarios, the balance of power will largely be with the masses, and the role of smart machines will be net beneficial and liberating to society as a whole, versus repressive.

With this in mind, we explore four different progressions and their societal impact. "Techno-feudalism" is the darkest state, where smart machines are used in a top-down fashion by the very few to control humanity. "Guerrilla anarchy and isolation" refers to the darker isolationist and nongoverned repercussions of powerful technology being easily accessed by all, and the merging of man and machine. "Trans-human capitalism" refers to a state where the emergence of smart machines is largely ungoverned and deregulated, but where much of the innovation will be in the corporate domain, creating wealthy elites, but with benefits trickling down to most, if not all. An "open-source commonwealth" is a state where the emergence of smart machines in different fields has evolved in a more governed fashion, so that smart machines are largely there to serve humanity as a whole. This is also a state where work is more distributed, where a wealth of combined knowledge created in human platforms continues to trump machines, and where corporate structures lose their innovative edge.

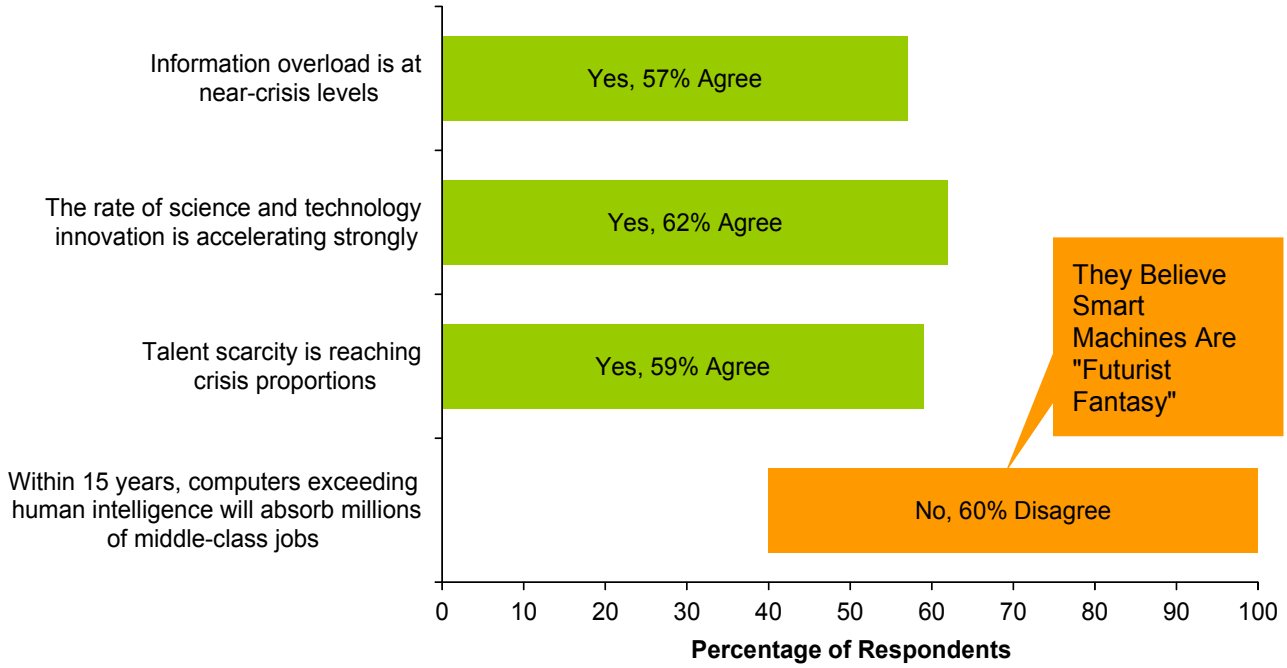
Apart from being thought-provoking, these three key issues serve one major purpose: To help us all carefully consider the disruptive impact of smart machines in combination with rising unemployment and the opportunity for organizational change led by technology.

Key Issue No. 1 — How Will Smart Machines Impact My Business and IT Function Through the Remainder of This Decade?

Your CEOs are wrong! Smart machines will have widespread and deep business impact through 2020.

Gartner's 2013 CEO survey showed that a 60% majority of CEOs believe that the emergence of smart machines capable of absorbing millions of middle-class jobs within 15 years is a "futurist fantasy" (see Figure 1). We believe CEOs are wrong to dismiss this trend. In that same survey, the majority of those same CEOs also recognize that "the rate of science and technology innovation is accelerating strongly," while a "talent scarcity is reaching crisis proportions" and "information overload is at near-crisis levels." The CEOs' positions regarding these latter trends indicate that CEOs recognize that a business case for smart machines in their firms will emerge sooner rather than later.

Figure 1. Majority of CEOs Believe Smart Machines Are a "Futurist Fantasy"



Source: Gartner (September 2013)

Your CEO may be missing what could quickly develop to be the most significant technology shift of this decade!

In fact, even today, there is already a multifaceted marketplace for engineering a "digital workforce," backed by major players on both the supply and demand side. This marketplace comprises intelligent agents, virtual reality assistants, expert systems and embedded software to make traditional machines "smart" in a very specialized way, plus a new generation of low-cost and easy-to-train robots and purpose-built automated machines that could significantly devalue and/or displace millions of humans in the workforce.

We believe that the capability and reliability of these smart machines will dramatically increase through 2020 to the point where they will have a major impact on your business and IT function. This brings us to the first strategic planning assumption (SPA) for you to consider.

Strategic Planning Assumption

Firms that have not begun to develop programs and policies for a "digital workforce" by 2015 will not perform in the top quartile for productivity and operating profit margin improvement in their industry by 2020.

> *Corollary: The careers of CIOs who do not begin to champion digital workforce initiatives with their peers in the C-suite by 2015 will be cut short by 2023.*

We believe the SPA will come to pass, and here are the reasons why:

- The technologies for building a large-scale and diverse scope of smart machines are coalescing and being tested by "first movers" now.
- The learning curve is incredibly steep.
- Capital ruthlessly requires greater productivity and profits.
- Ongoing weak revenue growth in the global economy will spur demand for cost reduction and productivity improvement by employing smart machines in place of humans.
- Big costs — IT cost is typically about 4% of annual revenue, whereas the labor costs that can be rationalized by smart machines are as high as 40% of revenue in some knowledge and service industries.
- Big data — Monetizing big-data-driven innovations will increasingly require smart machines.
- Big investment — The supply side of the market (including IBM, Google, Microsoft, Apple and Amazon) is placing large bets on the success of smart machines.
- Big brands — The demand side of the market includes high-profile first movers that will trigger an "arms race" for acquiring and/or developing smart machines.

However, we recognize this is a controversial topic, with a lot of good arguments on both sides, and we foresee reasons why the SPA could be false:

- Early pilots will fail to produce desired results.
- The technology will not progress rapidly through the end of this decade.
- The price of technology will not reduce rapidly through the end of this decade.
- Labor unions will reorganize and successfully oppose the intrusion of "job killing" smart machines.
- Citizens will protest higher and more prolonged states of unemployment, electing governments to legislate against smart machines.
- Consumers will reject the machines — either because of a highly publicized catastrophe or because of a more subtle and prolonged need for human interaction.
- People will provide even greater productivity increases than smart machine replacements.
- Legal challenges, stemming from the explicit "programmed morality" in automatic smart machines involved in accidents, will derail the market for autonomous agents.

Digitization Meets the Workforce — Smart Machines Are the Next Major Technology Market

Executives now expect that digitization will revolutionize marketing and online commerce. But they miss the wider implications of digitization as it pertains to the costs and capabilities of their workforce. We believe that the maturity of critical technologies and new combinations of them will create an important new market for smart machines, with distinct differences from the traditional IT

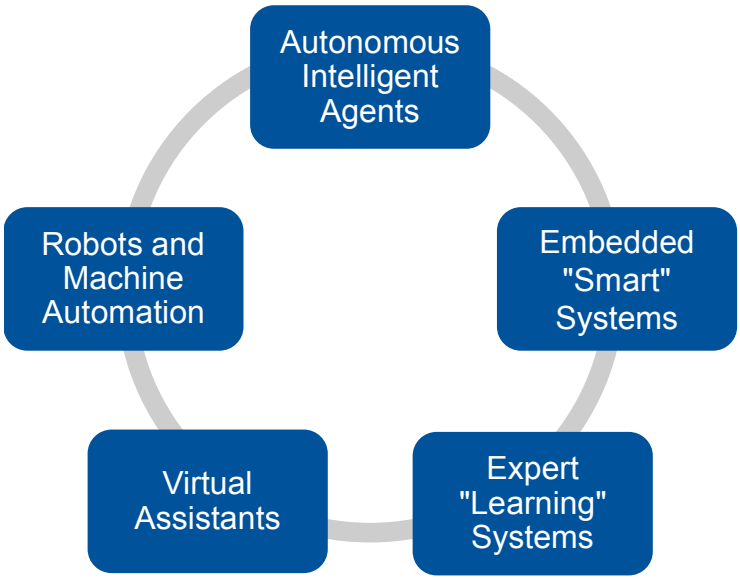
market that had its origins in human-oriented management information systems. CIOs' budgets and staffs may not currently have the resources and competencies to lead their firms in the right direction to capitalize on this next major technology market.

Smart machines will be sourced and built by firms across many industries. Building them is more like a system engineering exercise, combining hardware, software, embedded systems, electromechanical systems, artificial intelligence and virtual reality to create intelligent agents, learning machines, robots, chatbots, kiosks, virtual assistants, avatars and other business appliances that augment, assist or replace humans in the workforce.

We see first movers already taking this direction, and we believe that many firms will soon begin to source or engineer a "digital workforce" that first assists humans in the workplace. But very soon these agents will become capable of replacing many humans in the workforce as the machines acquire more refined sensory capability (in areas such as voice and image recognition), greater reliability and proven performance in autonomous roles. Because the challenges to improving performance in the workforce will vary from industry to industry and from job to job, the new digital technologies arriving to address these challenges will be extremely diverse. The multifaceted market will function more like an exchange for talent, technologies, products and services for complex, interdisciplinary system engineering problems.

Figure 2 illustrates the primary product segments of this new market.

Figure 2. Key Product Categories in the Smart Machine Market



Source: Gartner (September 2013)

The supply side of the market will consist of a dynamic set of technology, service and solution providers, with offerings to advance the digital workforce. The list of major providers making significant investments in smart machines includes Amazon, Apple, GE, Google, IBM and Microsoft.

Focused market entrants, such as Rethink Robotics and Intelligent Hospital Systems (Robotic IV Automation [RIVA]), demonstrate how dynamic this market will be over the next five years.

The demand side of the market will consist of many firms seeking to source and/or develop smart machines for their proprietary use. Major brands that represent the first movers across a range of industries include Amazon, Bridgewater Associates, Citi, Nielsen, USAA, WellPoint and UCSF Medical Center.

Transitional Scenarios — How Smart Machines Will Develop Through 2020

We certainly will not approach a state of 90% unemployment at any time in the near future. What is certain, however, is that many new combinations of technology — from intelligent software agents, expert systems and virtual reality assistants to software systems embedded in smart products and revolutionary new forms of robotics — will emerge in this decade, developing and impacting the workforce in dramatic ways.

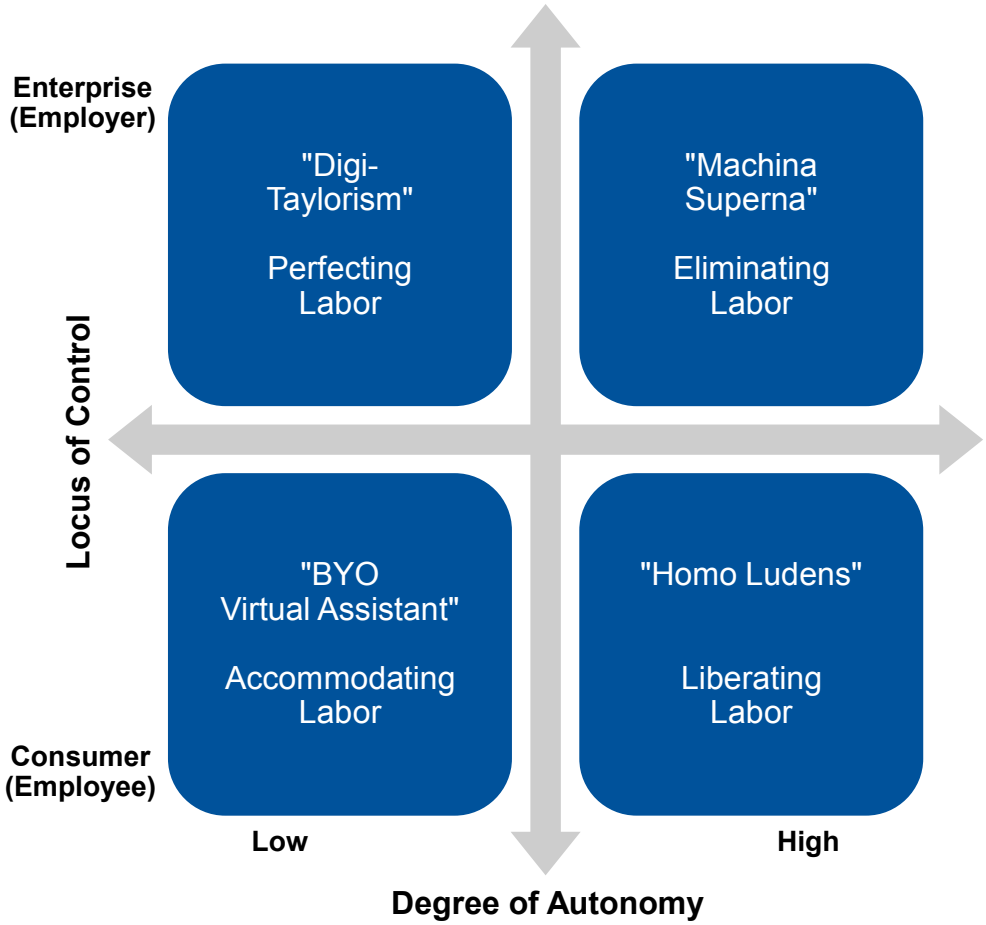
There are many "moving parts" and variables that affect the progression and ways that smart machines will impact employment, business and IT practices. In this section, we build scenarios to imagine the possible market development outcomes for short-range planning (through 2020). (Later, we follow up with longer-term scenarios for 2030 and beyond.) How these new forms and combinations of technology will impact jobs, business and IT through 2020 hinges on how capable the smart machines become and who will benefit from the value they create.

Key factors employed in building the transitional scenarios are as follows:

- The degree of autonomy for smart machines through 2020, ranging from low (expert assistants) to high (fully autonomous agents)
- The locus of control of the smart machines through 2020, ranging from consumer (employee) to enterprise (employer/owner)

Using these two factors, we can construct the following matrix of scenarios and envision four possible worlds that could emerge through 2020 (see Figure 3).

Figure 3. Transitional Scenarios for Smart Machine Development Through 2020



BYO = bring your own

Source: Gartner (September 2013)

"Digi-Taylorism" — The Fusing of Smart Machine Technology With Frederick Taylor's Principles of Scientific Management

In this scenario, smart machines are sourced by the enterprise and successfully perform expert advisory and supervisory roles in knowledge operations alongside the human workforce, adding value to human labor and not eliminating it. Humans accept smart machines as experts in their lives and workplaces. Process improvement with human actors is the primary goal in smart machine market development. The implications for IT organizations require them to shift to supporting "knowledge engineers" and building expert systems and supervisory systems in a new era of continuous improvement, facilitated by machine experts and advisors. Wages and consumer spending rebound as in previous business cycles and return to robust growth.

Signposts for this scenario: Watson succeeds in commercial pilots but does not advance as an autonomous agent. The market for smart machines in an "expert advisor" role expands, including offerings from other technology providers beyond IBM Watson.

BYO Virtual Assistant

In this scenario, smart machines continue to develop along the lines of "the consumerization of IT" and bring your own device (BYOD) — except with a focus on advanced software systems beyond the mobile device. The consumer (employee) has a menu of market options to bring virtual assistants to the workplace. Humans rebuff the intrusion of smart machines as their replacements in the workplace and source assistants in the "consumer marketplace." This scenario has a relatively low short-term disruptive impact on corporate results, labor and IT practices. IT organizations do not have to make significant changes to their mission; managing BYOD is a critical and ongoing program for incremental improvements in employee performance and IT cost.

Signposts for this scenario: BYOD progresses into the realm of software systems and virtual assistants for the workforce. Siri, Sherpa and Google Now evolve as personal productivity assistants on mobile devices in the business environment, and new entrants such as Google Glass are developed specifically for business applications.

Machina Superna (Superior Machine)

In this scenario, smart machines prove their superiority and ROI as replacements for humans at all strata in the workforce. Capital interests are compelled to expand the use, and we enter a digital workforce engineering "arms race" that decimates the human workforce at all levels of the job pyramid. Humans accept/submit to smart machines in their lives and workplaces. IT organizations must shift their mission and resources to sourcing and/or building smart machines; system engineering disciplines (combining hardware, software and electromechanical) are needed to advance competitive advantage in workforce capability/costs.

Signposts for this scenario: The smart machine market accelerates and expands rapidly. Watson and a cohort of smart machines develop a wider array of interfaces (voice), senses (audio, visual and so forth) and autonomous decision-making functions. Google, Microsoft, Apple and others advance comparable offerings. Corporations also embark on R&D to create proprietary smart machine technology for competitive advantage.

Homo Ludens (Playing Man)

This scenario presents a radical extension of BYOD, wherein employees source smart machines and maintain avatars in virtual reality to perform their work more productively, with the benefits of working fewer hours, earning better wages and enjoying a better quality of life, with time to pursue self-actualization beyond their working identities. New entrants enter the market with compelling virtual reality offerings for consumers/employees. IT organizations must develop strategies and policies to deal with the proliferation of virtual reality and avatars in the enterprise, with heightened security and legal challenges brought on by questions about counterfeit reality and authentication of the avatars.

Signposts for this scenario: Watson evolves to the realm of personal technology. Established corporate providers (such as IBM) and consumer technology providers (such as Apple, Google and Microsoft) compete for the professional virtual assistant market opportunity. Employees are the beneficiaries of productivity gains via quality improvement (fewer errors) and capacity expansion (increased availability).

Signposts Point to Major Impacts of Smart Machines in This Decade

You should consider the implications of all the transitional scenarios we present above, but don't be in denial about the impact of a smart machine on your business and IT practices and the rate of change that will occur through 2020. One key reason why many may dismiss the emergence of smart machines as a "futurist fantasy" can be attributed to esoteric debates about what it would mean for a machine to "think" and whether the machines will be "smarter than humans." Those debates miss the point that machines are smart enough to do many jobs today and will soon be superior in performance relative to humans (whether or not they are "smarter") in many professional and knowledge-intensive functions. We won't need to develop a full-functioning artificial brain by 2020 for smart machines to have radically changed our business models, workforce, cost structure and competitiveness.

For a list of concrete evidence that supports a robust smart machine market emerging today, see Appendix 1.

Smart Machines and the Specter of Destructive Creation

> Destructive creation: When the creation of smart machines drives job destruction with such great speed, scope, scale and volatility that the labor market and people can't prepare and adapt to the changes.

Given the potential elimination of manufacturing and product distribution jobs posed by the adoption of smart machines such as Baxter and Kiva Systems robotics, the natural argument would be that "creative destruction" is an inevitable and desirable process of markets and innovation. The Luddites — artisans who violently revolted against the introduction of textile machines that replaced artisan workers during the Industrial Revolution in England in 1812 — were deemed to be wrong because the volume of artisanal jobs lost was easily and quickly absorbed by new near-field jobs in the rapidly expanding industrial sector. The rate of new job creation was high (unlike today's low labor-intensive startups), and the ability of labor markets to adapt to it was manageable.

But what if the destruction of jobs begins to occur at rates faster than the economic, educational, social and political systems can create equivalent or higher-order job replacements, with higher wages and purchasing power? What if the higher-order "dream jobs," such as doctor, pharmacist, lawyer, trader and professions in the science, technology, engineering and mathematics fields, simultaneously face elimination by smart machines? Just like Erik Brynjolfsson and Andrew McAfee suggest in "Race Against the Machine," what if the new classes of jobs are so unpredictable, so

difficult to prepare for as a career path and so fleeting in themselves that the new volume created is increasingly less than what is destroyed? At that time, we will have reached the tipping point where creative destruction becomes destructive creation, and where no safe harbor exists for human workers in the next digital economy.

So what business segments will be disrupted by this incoming change, and what will be the impact on the business and job market? This brings us to key issue No. 2.

Key Issue No. 2 — What Are the Applications and Impacts of Smart Machines Among Highly Skilled Specialist Occupations, and What Particular Jobs Are at Risk for Substitution?

Strategic Planning Assumption

Through 2023, one-third of all highly skilled work done by doctors, lawyers, traders and professors will be replaced by smart machines or by less skilled (nonspecialist) humans assisted by cognitive computing technology.

We believe the SPA will come to pass for the following reasons:

- The cost of paying specialists is rising rapidly. The average specialist medical practitioner's salary in the U.S. is $340,000, compared with the annual salary of a generalist practitioner of $186,000 (data is sourced from Healthcare Salaries). The average American CEO's pay is 354 times that of the average worker's (data is sourced from CNN Money).
- Humans frequently fail in their judgment and are error-prone. They also fail in their reliability and consistency of customer service, even as more organizations try to improve the user experience and consistency of service.
- The technology evolutionary pace of artificial intelligence and cognitive computing (and associated machine learning) will grow much faster in the next five years alone, just as the amount of available data has at least doubled in the last five years.
- There is increasing acceptance of machines supporting/replacing human jobs across organizations and a cautious acceptance among humans for substitutes. Lower cost and more convenience aided by technology are the primary drivers.

We also realize that unexpected issues could invalidate the SPA:

- Specialists currently continue to widen the income gap, placing a huge premium on their skill sets, with generalists earning just a fraction of what specialists earn. If, however, specialists reduced their wages dramatically to be in line with that of generalists, the SPA would be invalidated.
- Capitalism continues to drive the private enterprise (and the global economy) with the end goal of generating profits and increasing shareholder value. If, however, enterprises changed their motives to "not for profit" or "good for all," the SPA would be invalidated.

- Unions help maintain workers' rights. Unions can also cause massive lockouts and protests, if workers jobs are deemed to be in danger. If there is worker backlash or union protests or any government regulation banning the application of machines, the SPA would be invalidated.

Dream Jobs at Risk

Dream jobs generate the highest incomes and are a means to achieve status (money, position and power) in society, as well as to allow one to "bill higher" than the rest. Doctors, lawyers and traders are among the most highly paid jobs today, and hence they are the dream jobs for the majority of the middle class. It is a middle-class dream to ascend the social ladder and create upward social mobility through a well-paid and relatively safe dream job. But that is about to change. We estimate that dream jobs will start to disappear when today's teens graduate from college within the next 10 years!

Let's analyze these dream jobs and see how intelligent algorithms can help do the work better.

Doctors

Healthcare is one of the most complex markets, involving the interaction of multiple stakeholders, such as healthcare insurers and payers, providers (doctors and hospitals), and governments. Doctors and clinicians are at the center of the interaction with the patient, and they decide the treatment plan, starting with the diagnosis and continuing on with the treatment protocol and the need for hospitalization and/or clinical procedures. Clinicians base their documentation and patient notes along the subjective, objective, assessment and plan (SOAP) protocol, which is a good way to break down the process into sequential logical steps. Doctors make patient diagnoses based on symptoms, medical examinations, tests and their past experiences with similar cases. And therein lies the problem.

Some experts call this educated guesswork. In many older patients, chronic diseases are complicated by a simultaneous disease — for example, hypertension complicated by diabetes — and doctors are increasingly presented with complicated cases. The clinician is actually sitting at the center of this complex ecosystem, where it is equally important to ask the right questions and then analyze the available information before finalizing the diagnosis and then suggesting the globally accepted best protocol for treating the disease, while also incorporating the patient's genotype and phenotype. Patient data contains a variety of data and could be structured (information is available in a neat fixed-value format) or unstructured data (free-format data in the form of free texts, scanned images, video and audio files, and so forth).

It is impossible for any human to analyze this kind of information in real time and then make a real-time diagnosis. Unsurprisingly, misdiagnosis is all too common. According to The Telegraph, a U.K. periodical, one in every six National Health Service patients is misdiagnosed (up to 15% of cases).

Lawyers

Many times, clients have no idea about who to approach when confronted with a legal issue or whether to sue/file a case (based on past similar case records) or to settle. And managing high costs is still a challenge.

Once the case is filed, the pretrial process involves the critical step of discovery, in which each party can request evidentiary details from the opposite party. This process is especially prevalent in those countries with common law systems, where precedents form the foundation for future verdicts. During this step, legal associates collect and analyze vast amounts of data and find information that could be related to the case. This also involves understanding the relationship between various related events. For many years now, the whole discovery process has been the most arduous and time-consuming (but also highly profitable) for law firms. Generally, law firms depute large numbers of junior legal associates for discovery, who are billed by the hour to complete this work. This can be easily done when there are only a few hundred pages. But when case files run into the millions of pages, it can be an expensive and time-consuming process for clients.

Technology has come to the rescue, and companies are now using e-discovery solutions that plow through the mountain of case papers and data available, looking for relevant information or any snippet that could be valuable for a case. Software can now also mine for information and "learn" from its own experience — for example, who spoke with whom, what kind of information was exchanged and so forth. This could be along simple linguistic lines (such as a simple search), or it could take an advanced sociological approach (such as looking for correlation and patterns).This is exactly what happens in predictive coding: a computer-assisted document review, where a machine looks for a defined set of words and where software decides how relevant documents are for a specific case, instead of involving attorneys in a laborious manual process. This has found instant use in civil cases.

U.S. courts have also endorsed predictive coding. A Wall Street Journal article cites a Richmond Journal of Law and Technology Study that found that predictive coding identified 77% relevant documents, compared with only 60% identified by humans.

As a confirmation that e-discovery is replacing new legal associates, the number of jobs for law graduates is going down. According to the Wall Street Journal, 90% of new law graduates had jobs in 2005, compared with only 69% in 2009.

Traders

Within the financial world, Wall Street has started replacing traders with automated programs, mainly driven by costs (an average managing director at a credit trading desk could earn upward of $2 million) and the speed of response. Traders have the best advantage when they can respond to market changes at the earliest. Algorithms that can respond to these changes even more quickly are best-suited for this task.

Banks are increasingly leveraging algorithms for large mathematical calculations and are realizing higher productivity gains without associated errors (computers can respond in a millisecond without an associated error). As such, high-frequency trading (HFT) is already very popular and uses advanced algorithms to get into positions within fractions of a second. Wikipedia reports that, as of 2012, 50% of all financial trading was through HFT.

Where Is the Change Occurring?

Other notable signposts include the following:

- IBM Watson has started to help in healthcare decision making by processing more than 2 million medical journal pages and sifting through 1.5 million patient records. In tests, Watson's successful diagnosis rate for lung cancer was 90% (compared with 50% for doctors). It is being used at the Memorial Sloan-Kettering Cancer Center for oncology cases.
- Lifecom is a portable medical software system, where the system conforms to certain models of how clinicians act. It focuses on the most important aspect of medical care — clinical cognition and decision support. The system also anticipates error reduction mandates for which every medical practitioner is accountable.
- Blackstone Discovery uses e-discovery software to analyze legal data. It can look for specific terms and also find patterns within the data that conform to certain models of how lawyers act.
- Clearwell Systems, Fenwick & West, and Cataphora are some companies that can help create business contracts (highly repetitive work that can be automated by simple logic) and reduce the number of billable hours for extensive documents.
- UBS recently phased out a senior-level position within its credit-default swaps index trading division with an algorithm-driven system based on advanced modeling. Goldman Sachs and Credit Suisse have a growing number of banks that use mathematical models for trading instead of human traders. Automated trading systems already make 50% to 75% of all Eurex trading, and with the use of Real-Time Operating Systems, this number could grow to as much as 90%.

What Will This Lead To?

The labor market can be categorized into four tiers:

- Builders (low-skilled workers) have manual-work-intensive jobs that do not need a formal college degree.
- Generalists (medium-skilled workers) have some college qualifications. Most are graduates with employable skills and include, for example, nursing assistants, physician assistants, paramedics and legal associates.
- Specialists (high-skilled workers) have formal college qualifications, usually advanced university degrees in science, the arts or business. Their work involves some aspect of reasoning, but most of the work is repetitive (which makes them specialists).
- Versatilists (ultra-high-skilled workers) are ever-learning thought leaders within their realms (not industries). Driven by reasoning, they are able to apply concepts learned in one situation/industry/geography across another newer situation (by connecting the dots from past experience and applying tools mastered in past situations).

Lower-level jobs in many segments have already been lost to basic automation. Martin Ford's "The Lights in the Tunnel: Automation, Accelerating Technology and the Economy of the Future" talks

about the decline of agricultural jobs in the U.S. Whereas nearly 40% in the U.S. were employed by farms in 1900, this number dropped to only 2% by 2000. Over the 1990s, medium-skilled jobs have been lost to low-cost destinations through outsourcing (and expanding automation). Specialists in the past have enjoyed immunity from job losses, but that is set to change.

One exception will be the service job markets, where jobs are available at the bottom (such as hair dressers, nannies, bartenders and maids) and the top (such as top-grade painters, musicians and conductors). We also foresee that, counter to conventional wisdom, generalist roles — such as physician assistants and nurse practitioners (in healthcare), generalist legal associates (in the legal industry), and plain financial analysts (in trading) — may be better jobs for surviving upcoming employment market upheavals through 2023 because of their human "touch and feel" factor and because they simply cost far less to employ.

Figure 4 illustrates the labor market in 2023.

Figure 4. Expected Labor Market in 2023

Source: Gartner (September 2013)

At this point, all systems are being developed to help users, such as doctors and lawyers. But we anticipate that, although machines will start by supporting users, they will ultimately replace them. We estimate that the real endgame in this scenario, by 2030, will be the creation of digital "superdocs" (programs run by advanced machines) in the healthcare industry and similar programs within the legal and trading industries. Such programs will also allow machines to take over generalist and specialist positions, so that versatilists and some specialists (within the service sector) will be the only human positions available.

The top-level impact in 2030 will be to:

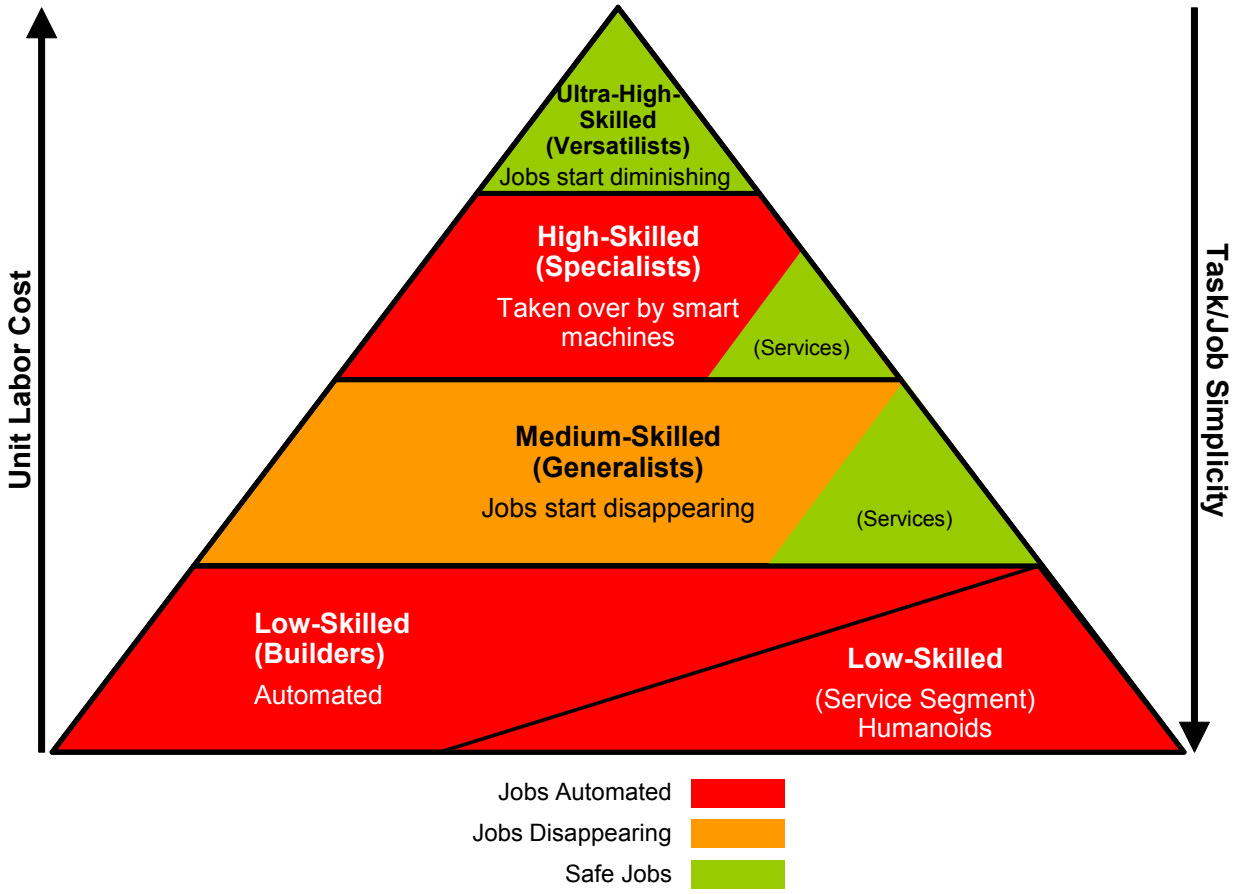
- Make services affordable, due to lower costs. Machines will be much less expensive to run.
- Make services accessible to all, by removing exclusivity around premium services.
- Increase the number of human-facing jobs. Relationship building will become even more important. High-profile lawyers and doctors can focus on relationship building and leave tedious and mundane tasks to machines.

Key Issue No. 3 — 2030 and Beyond: What Are the Political, Social, Economic and People Ramifications of 90% Job Replacement?

The first part of this document discussed the emerging business opportunity of smart machines and introduced a series of transitional scenarios. The concept of destructive creation highlights that job creation will not be able to keep up with jobs lost through the technological advancement of smart machines. This is in line with Erik Brynjolfsson and Andrew McAfee, who made a similar case in "Race Against the Machine" that this is the key reason why the disparity between productivity and job growth is widening. The second part of this document drove home the point that, perhaps counterintuitively, the next wave of job losses (2020 through 2030) will occur amid some of the most coveted and prestigious high-skilled specialist jobs. Humans will increasingly reach their upper bounds of upskilling; it will become more economical, accurate and efficient to use self-learning smart machines, and unemployment will rise.

In our 2030 scenario, the pyramid will look radically different (see Figure 5).

Figure 5. Expected Labor Market in 2030



Source: Gartner (September 2013)

Societal Crisis

The journey toward increasing numbers of jobs being replaced by smart machines won't happen in a linear fashion. Something needs to give — society can't continue without significant paradigm shifts in multiple areas. How can workers operate in their own best self-interest if they don't have anything to do? If profits are generated by machines, how should profits be distributed? Where will "consumer" spending come from? These are all questions looking for an answer. The emergence of smart machines and their impact on jobs will put major stresses on current political paradigms, such as capitalism. Continuing on the current path, we may very well see rioting in the streets, gated communities and crime where the masses have no food, nothing to do, and no money to spend. The ranks of the unemployed and sick will swell, and there will be increasing social unrest as helplessness becomes the fate of more and more of us. The privileged will be able to source low-cost humans for their personal benefit, which will make the class structures of a century ago look like utopia.

Nothing changes human society and culture faster and to a larger degree than technology, and technology is moving faster than society can keep up with. That means the technology we currently have has yet to make an impact on society. If our Maverick predictions come true, we are on the cusp of the greatest transformation in human culture since the dawn of civilization.

Hence, there will be inflection points where strong reactions of different sorts will occur. This may happen sooner than we think. It remains to be see whether it happens at 20%, 30% or 40% unemployment. Already today, we are already seeing social unrest and radicalization stresses on the system in countries such as Spain and Greece and parts of North America, where youth unemployment rates are near or above 50%. Structural changes will be made in a number of fields, such as in political models, monetary distribution and employment laws. We will likely see unionization and "countermachine/neo-Luddite" movements growing in magnitude, especially among high-skilled specialists who have a lot of clout in public discourse. This may happen at the industry level, or it may happen at more broadly encompassing political levels. Some sort of "grand bargain" may need to be struck between politicians, corporations and the displaced, where the latter will want something in return for the further progression of smart machines in society. If not, strong regulations and bans will be placed on the proliferation of smart machines. Or worse, the opinions of humans will be overruled in an autocratic fashion.

Postcrisis, Toward 90% Job Replacement

We believe that this societal friction will be overcome, either by force or by consensus, and smart machines will continue to replace current labor structures. However, the actions taken during this societal upheaval will judge which path society takes. This inflection point and its sequential actions will lead to many potential and separate paths being created:

- There is the possibility that societal upheavals will be quenched by governments that liaise with big corporations to spy on dissidents and nonconformists. This will pave the way for a more feudal, autocratic direction ("digi-Taylorism" to "techno-feudalism").
- There is the possibility that societal unrest, in combination with the ease of access to smart machines, will ultimately break down governance structures and empower and enable increased self-reliance but also isolation, paving the way for a more ungoverned direction ("BYO virtual assistant" to "guerrilla anarchy and isolation").
- There is the possibility of smart machines causing significant job replacement, but with social unrest minimized through compensation, such as through citizen salaries in combination with "freemium" access to benefits. This would pave the way for a reinvented market economic state ("machina superna" to "trans-human capitalism").
- There is the possibility that humans will unionize, get together and collaborate as a reaction to smart machines, which may lead to a situation where humans regulate and steer the development of machines through deeper collaboration, while also investing in their future by buying and working with the means of production in a knowledge-based, fast-changing economy. This may lead to more distributed work and dramatically reduced hours ("homo ludens" to "open-source commonwealth").

Overcoming societal unrest and friction will pave the way for our long-term scenarios and SPA below.

Strategic Planning Assumption

By 2030, 90% of jobs as we know them today will be replaced by smart machines.

Beyond those assumptions already stated in the sections on key issue No. 1 and No. 2, we foresee this SPA coming true because of the following:

- In the first 10 years, until 2023, smart machines may not be able to do all a doctor's job or an underwriter's job but only part of it. They will initially act as "power shovels," amplifying people's intelligence by doing the simple physical or mental parts of the job. This will increase unemployment since the work can be done with fewer people, but machines won't fully replace people in those parts of the job that require ad hoc thinking or empathy — the generalist portions. However, as artificial intelligence (an overarching term containing dozens of components, such as analytics, text mining and deep learning) makes further progress, it will be increasingly difficult to distinguish between human and machine — the widely publicized "Turing test." Not only will it be more difficult to distinguish between humans and machines, but in many cases, machines will be superior to humans for an increasing number of purposes. When this happens, medium-skilled generalist jobs will also largely disappear. Further, machines will capture a larger portion of the labor value chain for specialist workers and tip over to being used for full-fledged replacements rather than just labor rationalization and augmentation.
- It will continue to be difficult to replace the ultra-high-skilled versatilist with a smart machine, but this segment is estimated to make up only a small percentage of the workforce. It will consist of highly skilled engineers, programmers and high-value salespeople, for example.
- A minority of medium-skilled generalist and low-skilled job functions, largely in the service professions, will continue to be served by humans. For example, some customers might choose to have a suit tailored by humans for prestige purposes, even though machines could do a more accurate job.
- Corporate, governmental and societal structures will change (as described in the Societal Crisis section). Consequently, employment will need to be redefined to match how people perform tasks. Jobs will likely be more "microformatted" to suit specific short-term ad hoc requirements or medium-term project tasks rather than having humans in permanently and formally defined roles. Humans will need to be more adaptive to temporary labor needs.

As with any SPA, and particularly any Maverick SPA, there are many reasons why 90% job replacement may not come true. These include the following:

- During the societal unrest phase, heavy regulation or bans on a global scale could block the development of smart machines.
- Humans could invent an entirely new category of jobs at the same rate as old jobs disappear, counter to our notion of destructive creation.

- The development of smart machines could slow down if they are not able to fulfill the requirements of many job tasks.

However, if social unrest is overcome and technological change progresses at the pace we expect, our SPA is likely to become true.

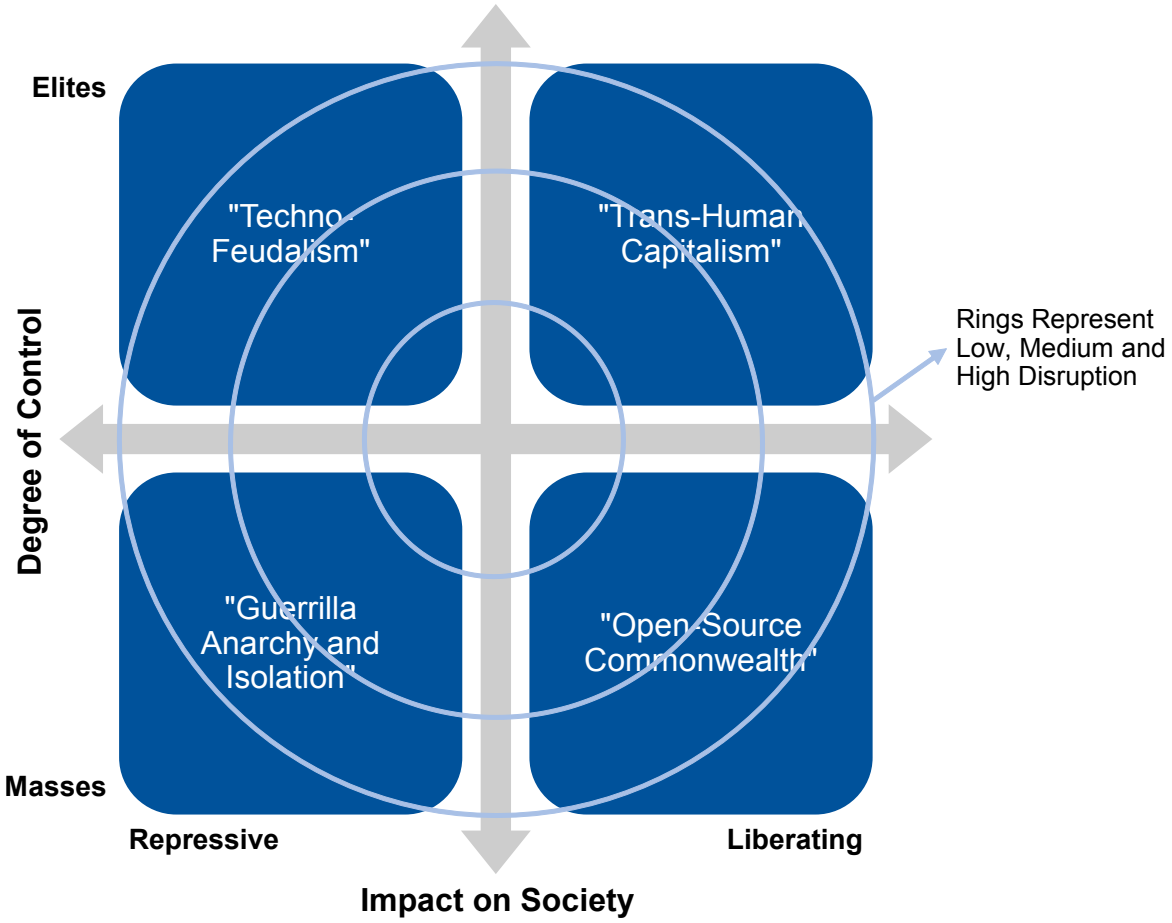
Role of Smart Machines in Society

This section introduces four potential outcomes of smart machines and their ramifications (see Figure 6). This is an extension of the transitory scenarios introduced in key issue No. 1. The difference is that this is further out in time (2030 and beyond, versus 2020), and the scope is beyond just business impact, taking into account the much broader societal impact of smart machines.

The impact will be made in different magnitudes — as represented by the circles, with the outer circle being the most hard-hitting — which will affect how strongly the scenarios play out. We are intentionally looking at four extremes to expose the risks and opportunities that may also exist (in smaller scale) in a centrist result. In reality, the outcome will potentially be a hybrid with different magnitudes.

We have built four outcomes based on whether the balance of control will largely be with the few (centralized among the elites, governments and corporations) or the many (distributed to individuals and the masses). On the horizontal axis, we explore whether the impact of smart machines will be largely beneficial (liberating) or detrimental (repressive) to humanity. These different worlds are explored around a series of detailed variables, such as the impact on politics, society, economy, technology and humanity, which can be found in Appendix 2.

Figure 6. Role of Smart Machines in Society



Source: Gartner (September 2013)

Techno-Feudalism — Smart Machines Used to Repress Humanity

In this scenario, societal upheavals are quenched by governments that liaise with big corporations. Elites rule the world with "enlightened despotism." Different ecosystems of elites jostle for position, with the help of a few centralized, cognitive supercomputers — a radical extension of expert systems. The future autocratic elites are recruited from the top brass in government and corporations (which are increasingly one and the same). But after a highly destructive conflict in 2032, an uneasy "balance of terror" is in place. "Robo-corp" (the megamerger between the top three tech and information corporations) dominates much of the Western Hemisphere, versus "OmniAsia" in the East.

Initially, there was an arms race to build the most powerful cognitive data centers, just like the space and nuclear buildups of the late 20th century. But innovation has slowed down as only a small portion of the populous is allowed to think freely, with the knowledge that one powerful algorithm or piece of innovation could undo the balance of power. Another stifling factor for

innovation is the lengthy legal intellectual property (IP) wars between factions, which has ended in gridlock. Mind and thought control is ever present, encouraged and manipulated by government and corporate elites (again, one and the same) through nanochips embedded into the human brain, feeding telematic information back to analytic data centers.

Capital and resources are extremely unevenly distributed, with 0.1% owning 99% of the resources. In a similar vein to George Orwell's "1984," another 10% form the outer circle in society; that is, they willingly serve the upper middle classes. Below them is the nonowning proletariat. Castes become more accentuated in society, where the proletariat is clustered together and predetermined (by the elites) to perform certain tasks. A very small portion of independent superprogrammers have been able to rig the system and bypass the strict thought-control regulations. These few individuals are the only ones with the power to disrupt current hegemonies and are seen as lethal terrorists. One method of disruption they use is information pollution, which is a method of sabotage to alter the predetermined actions of machines (see Appendix 2 for supporting variables and assumptions).

Guerrilla Anarchy and Isolation — The Human Becomes Dependent on the Machine

In this scenario, machines have the power — but their utility is more distributed on an individual or clan level. Societal unrest, in combination with easy access to BYO virtual assistants and self-utility, has broken down societal and governmental structures in a state that could be likened to anarchy. Virtual assistants are inexpensive and can perform most (if not all) production and services, both commercial and domestic, leaving humans to ponder their purpose on earth. 3D printing was a revolution that, in combination with IP leaking into the public domain, enabled people to get free blueprints for smart machines with a lot of customization. The sole purpose of omnipresent, inexpensive and distributed machines (an extension of today's personal computers) is to serve its masters, causing benefits but also downsides. Humans prefer the company of their devices over their friends and family. Humans with no formal job or place to be have a lot of time on their hands, which is seldom without problems. This leads to isolation and insulation, where humans and nonchallenging robots form relationships, even sexual. Ironically, humans become dependent and enslaved by the machine they created to liberate them. The two merge and morph, and it's increasingly difficult to separate man from the machine.

On the upside, the liberal arts and other "nonproductive" forms of expression flourish again, as humans don't have to fill their time with manual labor. Still, increasingly destructive behavior, such as drug abuse, is commonplace, and the machine is more than willing to help along the way. Crime and self-harm skyrocket. Robots serve the conflicting interests of their masters. In the void of formal government, clan- and gang-related civil wars erupt here and there, where inexpensive drones act as lethal warheads. Pervasive access to all things makes society vulnerable, and it takes only one "bad apple" to cause massive damage. Pockets of "back to nature" countermovements form, but it is unclear whether they are enough to bring back balance (see Appendix 2 for supporting variables and assumptions).

Trans-Human Capitalism — Humans Leverage the Machine

Trans-human capitalism is a largely deregulated, corporate and market-driven state, where smart machines have replaced much of the labor utility (an extension of machina superna). Corporate and

IP rights are strong, with centrally driven innovation meeting little to no regulation. Labor unions are weak. This has given the development of smart machines free rein, which will usher productivity into a new era. Much of innovation inside the corporate walls will be machine-driven, getting closer to Ray Kurzweil's vision on "singularity." In corporations and society, the CTO will be put on a pedestal and will become the future "rock star" inside and outside the firewall. Roughly 10% of the workforce is still in full-time employment, forming the very healthy upper and middle classes. Those who "make it through the hoop" in a rigid selection process are either part of the owning class, are stakeholders in one form or another, or are able to be net contributors beyond smart machines. They form the backbone of society, and social structures are held up through the aspiration of the populous to reach this stratum. Society is still meritocratic in the sense that perceived contributors from the lower strata can move up the ladder, after a rigid selection process. Programming is sexy again and is the key thing taught in schools.

For the remaining 90%, work hours are hard to come by, but it doesn't necessarily matter for them. Redundant/liberated citizens get inexpensive or free services and virtual assistance in a Google-like model in exchange for their loyalty to the corporation. The freemium pricing model reigns, and personal information can be used as currency, traded for goods and services. There is a lot of time for leisure and nonwork activities. Most buying power is with the capital owners and the upper 10%. For the rest, a combination of citizen salaries and minimum wages suffices to provide a decent life. Some friction exists between the haves and have-nots, but most humans live well off "the salt of the machines." Productivity and transportation can be done in a much more sustainable fashion than before, and environmental pollution starts to decrease for the first time since industrialization. While unequal income distribution is massive, the progress made from innovation means a net-positive outcome for humanity as a whole (see Appendix 2 for supporting variables and assumptions).

Open-Source Commonwealth — The Machine Enables the Collective

Another scenario holding positive promise is the open-source commonwealth state. Here, social unrest leads to a more managed phasing in and distribution of machine utility to benefit the many. An extension of the homo ludens state, technology enables humanity to reach new levels of work, innovation and cooperation. Avatars perform work functions in human absence, and digital assistants boost productivity while humans are on the job. Analogous to Hans Rosling's famous story that the washing machine is the best invention ever because it freed up women and enabled them to pick up a book and educate themselves and their children, the redundancy in labor from smart machines enables people to free up the most valuable resource they have — time. Rather than 90% unemployment, total work hours for the masses are reduced by 90% but are more evenly distributed. This means that, for most, "official" work hours are dramatically reduced or shortened. The owning and ruling classes realize that a redistribution of work and wealth generated from smart machines is necessary to maintain purchasing power. The basic citizen salary is reintroduced, which can be topped up in exchange for citizen efforts for the common good. Liberation through smart machines is complemented by "human platforms" — an evolution of today's gamification and crowdsourcing platforms. These factors also enable the public sector to become more shrink-wrapped and elastic.

The difference from the also net-positive trans-human capitalism state is that the populous, through personal smart machines, open-source "open data" information and collaborative platforms, start outperforming the corporate and governmental structures set up by the elites. This is also the main distinguishing factor from the guerrilla anarchy and isolation state, as people will come together rather than isolate themselves. Smart machines often replace much of the individual output, but they struggle to replicate the common worth of the collective output.

Easy access to open information and human platforms renews the way we govern ourselves. The people in self-serving and powerful government positions are replaced. The physical limitations of not being able to all come together to make decisions are removed. Decisions affecting the collective are based on a combination of discussion, wisdom of the crowds and analytics (see "Maverick* Research: Capitalism Goes Social, or How Technology Will Enable the 99% to Change Your Business Forever"). The most informed and educated individuals are the highest-ranking. Hence, education is rehauled, where areas such as information retrieval, critical thinking, source control, data quality and analytics are prioritized. Education is at an arm's reach and accessible everywhere. The requirement to attend structured multiyear education programs is reduced. With minimal employment in the traditional, structured sense, archaic organizational constructs, such as government, parliamentary democracy and corporations, move from being frozen entities to being virtual, elastic, fluid and dynamic. Innovation and advanced scientific research also flourish. Smart machines, limitations in information siloes and competitive gamification on open data enable collective rather than siloed innovation. The R&D output in corporations is therefore seriously challenged by the R&D in public domains. This mimics academia, where incremental findings are shared and built on top of previous findings from others. The incentive for humans to participate is partly the kudos received from peers, but also a token-based system that one can exchanged for counterfavors.

However, despite the massive gains that this society can bring to the collective, an inherent problem is that there is little patience for minority positions, or those challenging the paradigm. Unconventional wisdom debunking truths is often seen as counterproductive, rebellious behavior that doesn't follow the majority line. In other words, "group think" may be a challenge, even if counterthinking is officially encouraged (see Appendix 2 for supporting variables and assumptions).

Conclusion

- We foresee a scenario in which smart machines are much more than just futurist fantasy; the circumstantial variables pointing to a real revolution and new market force of smart machines are strong.
- There is budding evidence that the jobs lost from the emergence of smart machines cannot be fully replaced through upskilling, especially as we are seeing growing signs that, counter to popular belief, the next level of job losses will occur amid highly skilled specialists, such as traders, doctors and lawyers.
- Beyond 2030, we foresee that generalists will also be replaced, leaving room only for pockets of human activity in traditional job roles.
- We have introduced transient and long-term scenarios as to what the repercussions can be for business and society as a whole, describing four very different outcomes. It is now imperative

for humanity that we use the benefits of the machine for our own common good and survival, not the opposite.

The key point of this research is not to predict exactly what percentage of the workforce will be unemployed. Rather, it is to encourage a discussion on the emergence of smart machines and their impact on job replacement to corporations and society as a whole.

Appendixes

Appendix 1 — Signal Events That Demonstrate the Rapid Pace and Broad Scope of Smart Machine Market Development

On the supply side:

- In 2006, Jaron Lanier — a pioneer in "virtual reality," recipient of the IEEE Virtual Reality Career Award in 2009, and one of Time's 100 most influential people in 2010 — joined Microsoft as a partner architect in the eXtreme Computing Group (the group that produced Kinect) to research and develop somatic computing and avatars.
- In September 2011, IBM Watson Business Solutions was launched as a commercial entity, with its own profit and loss statement.
- In September 2012, Rethink Robotics introduced Baxter — a three-foot-tall light industrial robot that can work safely among humans, costs $22,000 and can be trained to do tasks such as loading and unloading, machine tending, packing and unpacking, light assembly, test and sort, and finishing operations without programming.
- In January 2013, Google hired Ray Kurzweil — inventor of the Kurzweil Reading Machine, inductee into the National Inventors Hall of Fame, and author of "The Age of Intelligent Machines" and "How to Create a Mind: The Secret of Human Thought Revealed" — as its director of engineering.
- On 19 February 2013, Google successfully road-tested its driverless car, one day after Texas became the fourth state to allow public road access to driverless cars, after Nevada, Florida and California.
- In July 2013, a Northrop Grumman naval drone landed aboard a moving aircraft carrier — the first pilotless unmanned jet to do so.
- By the end of July 2013, IBM Watson had rapidly advanced from being a game-playing phenomenon to a real-world business advisor, deployed in expanded roles and against compelling new use cases, ranging from healthcare advisor, financial advisor and customer service advisor to online self-service agent.

On the demand side:

- In December 2009, UCSF Medical Center ordered three RIVA systems (robotic pharmacy automation systems for filling IV syringes and bags) from Intelligent Hospital Systems.

- In March 2012, Amazon acquired Kiva Systems for $775 million in an all-cash deal. Kiva is a maker of robots for product distribution and fulfillment centers.
- In late 2012, David Ferrucci, the lead engineer for Watson, left IBM to work for Bridgewater Associates, a private hedge fund, which made no announcement of its new hire and did not disclose his responsibilities. Mr. Ferrucci himself described his role as "applying artificial intelligence to macroeconomic modeling and building predictive systems for investment decisions."

Appendix 2 — Defining Characteristics of the Four Worlds Based on Societal Variables

Table 1 outlines the defining characteristics of the four worlds based on societal variables.

Table 1. Defining Characteristics of the Four Worlds Based on Societal Variables

	Techno-Feudalism	Trans-Human Capitalism	Guerrilla Anarchy and Isolation	Open-Source Commonwealth
Characteristic	Balance of control is with machines and centralized. The machine is used to repress humanity.	Balance of control is with humans and centralized. Humans leverage the machine.	Balance of control is with machines and distributed. Humans and machines have an unhealthy symbiotic relationship.	Balance of control is with humans and distributed. The machine enhances the collective and frees individuals.
Political	Top-down control. Corporatism. Autocratic. Authoritarian. Elites rule the world (rise of the privileged). "Enlightened despotism." Alliances/axis of cooperation. Mind and thought control. Race of the supercomputers.	Capitalism with technocrat tones.	Anarchist. Bottom-up control. Isolation. Breakup of society. Symbiosis with machine-human creating increasing isolation	Direct democracy held together by social platforms (not socialist democracy).
Economical	Very high income distribution and economic inequality (Gini coefficient). The 0.1% capital owners and the 10% hangers-on. Potential enslavement. Capital and resources centered on very few individuals.	Smart machines usher productivity into a new era, giving a massive GDP boost. Information becomes a tradable good in freemium models. Positive economic impact is unevenly distributed. However, rising tide lifts all boats, and no one goes hungry.	Self-sufficiency (for example, growing your own crops) enabled by personal assistants. 3D printing eliminates some consumer needs. Bartering. Entrepreneurial, with many personal but isolated microenterprises. Lack of standards.	Redistribution of wealth created from automation. Citizen salaries topped up by utility tokens. Entrepreneurship encouraged, but with IP sharing.
Conflict	High: Toggle between all-out war and balance of terror. Return of power blocs.	Low: Some friction between the haves and have-nots, but most humans are content and live off the "salt of the machines."	High: No governance. No judicial system. Individuals and gangs with access to weapons of mass destruction.	Low: Social safety net in place. Rehabilitation brings outliers back into the group. Group think.
Social	Caste and class society. Strong hierarchies. Humans. Like ants in an ant-stack are allocated pre-determined tasks. The few use technological progress to enrich	The elites and masses stay largely separate from each other. Personal information is a tradable good.	Isolationist symbiosis between humans and machines. Breakup of society.	Social and collaborative platforms bring people together. For those still with a job, work weeks are shortened to 20 hours, with no loss of income or wealth. Workers have more time for leisure and nonwork activities. Avatars perform

	Techno-Feudalism	Trans-Human Capitalism	Guerrilla Anarchy and Isolation	Open-Source Commonwealth
	themselves. The haves and have-nots. Humans repressed by the machine.			work functions in their absence, and digital assistants boost productivity while they are on the job.
Technological Highlights	Centralized supercomputers and data centers. Slowing technological progress.	Expert systems and robotics.	Personal assistants are an extension of the personal computer. Computer goggles. Man-machine integration. Augmented reality. 3D printing. No common standards.	Human collaborative platforms. Gamification engines. Crowdsourcing. Collaborative decision making. Avatars. Humans liberated by machines. Common standards.
Legal/ Regulatory	Governments have slowed down progress. IP wars with massive resources have watered down common regulations and legal frameworks. Legal treatment and immunity dependent on position in society. Corruption rife. PRISM/ NSA-style surveillance.	Low regulatory environment.	No regulation. Weak legal frameworks.	After citizen protests, there is strong regulation against machine dominance. Robot-control unions arise to make sure robots serve the common good. Fair labor acts updated to provide everyone with the right to work with what they want with fewer hours and still make a living,
Crime	Low frequency. Closely monitored thought and opinion crimes (think PRISM/NSA) make people afraid to stray from the norm. Capital punishment for information pollution that tricks machines into behaving irrationally. Deep undercurrent of unhappiness, which may explode.	Gated communities for the wealthy needed because of some friction between haves and have-nots. Medium levels of crime.	High frequency. The most dangerous state, as individuals have access to weapons of mass destruction. Gang-related violence a la "Mad Max." Weak society causes citizen gendarmeries to form. Very high substance and drug use. High murder and suicide rates. Gated communities, kidnappings, rioting in the streets commonplace. Sectarian violence.	Low frequency. Two-track society, with those who choose to participate in society, and those who don't. Strong community isolates and rehabilitates the "bad apples." There is also a counter-community of subversive thinking. Information pollution is a serious crime.
Education	An "old boy" system where people "scratch each other's backs." Education mainly to teach the party line and how to get in line. Educated laborers who fol-	A meritocratic, very competitive selection process on who gets to join the elites. Harvard educated = God.	Self-education. Home schooling. The personal assistant and Internet as tutor.	Prioritized, but through open universities. Open access to information. Mentorship is rewarded. Information retrieval, collaboration, critical thinking, source

	Techno-Feudalism	Trans-Human Capitalism	Guerrilla Anarchy and Isolation	Open-Source Commonwealth
	low orders are number crunchers; whoever crunches the numbers fastest is supposedly the smartest.	Corporate mentorship and training play an increasingly important role for the lucky few who are chosen.		control, data quality and analytics are taught in school.
Innovation	Centralized on the big governments and corporations that fight legal IP wars. Innovation sometimes destructive rather than creative. Oligopolies and corporate entities of R&D units. Innovation centralized and improved in tiny increments. A slightly improved algorithm could disrupt the balance of power.	Innovation comes from t 10% and increasingly machines themselves. The best engineers and programmers still have jobs inside the corporate firewall.	Decentralized and individual. "The personal good." Lots of innovation, but few channels to spread it. Lack of standards inhibits scale.	Decentralized and collectivistic. "The common good." Incremental co-innovation, following academia's lead and how the human genome was discovered. connecting the dots across multiple domains.
Business	Industry consolidation. Coke/Pepsi, Boeing/Airbus phenomena.	Scientific management 2.0. "Intra"-trade exchanges.	Manufacturing is close to home (or in the home). Entrepreneurial.	Crowdsourcing and online worker and trade exchanges. Real "flat" world. .
Population	Controlled population. One-child-per-couple policy for the proletariat, which is 90% of the population.	Not regulated.	Declining. No incentive to mate and have children.	Healthy regeneration of the population, where crowdsourcing acts as a channel for mating. Monogamy will be seen as "old school."
Money	Back to the gold standard, with the limited resources centered on the few.	Introduction of the citizen salary. Information a tradable good	Bartering and blackmailing.	Currency arbitrage lost. US$1= Z$1 = 1 bitcoin = 1 token.
People	Rise of the privileged.	Rise of the CTO. Liberation from the oppressive and tedious aspects of work.	Rise of the "enhanced" (debatable) individual.	Rise of the collective.
Environment	Top-down controls can regulate damage to the environment, but occasional wars cause very strong damage.	Environment vastly improved by sustainable productivity gains.	Environmentally hazardous because of egotism and destruction.	Environmentally sustainable through innovation and commonly agreed caps on pollutions.

Source: Gartner (September 2013)

Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"Maverick* Research: A Workforce Without Humans: Three Ways Technology Will Eliminate Skilled Jobs in the U.S. Through 2020"

"Maverick* Research: Judgment Day, or Why We Should Let Machines Automate Decision Making"

"Maverick* Research: The Future of Humans: Get Ready for Your Digitally, Chemically and Mechanically Enhanced Workforce"

Note 1 Roots of the Word "Maverick"

Derived from the name of Texas rancher Samuel Maverick and his steadfast refusal to brand his cattle, "maverick" connotes someone who willfully takes an independent — and frequently disruptive or unorthodox — stand against prevailing modes of thought and action.

Note 2 New Ground Broken

This document challenges many commonly held beliefs, such as:

- Smart machines' being capable of massive job destruction is the stuff of "futurist fantasy."
- Technological unemployment is always simply temporary structural unemployment; that is:
  - "Technology has always impacted our economy, and people simply must be retrained for the new job opportunities of creative destruction."
  - "There is always a higher rung on the employment ladder to aspire to if you acquire the necessary skills to get there after losing your job."
  - "Automation impacts only the routine and low-value work that we don't want to do anyway."
- Highly skilled and specialized professional jobs are safe places to "migrate to" in the employment market.
- Technology to increase productivity is always good and welcome for the economy and society — people, businesses, markets and governments will always adapt.
- Recent recessions and prolonged jobless "recoveries" were caused by asset bubbles bursting and "liquidity traps" in the financial system — the impact of technology on wages and jobs that drive consumer purchasing power was a minimal factor.

Note 3 Definition of "Smart Machine"

Smart machines do what we thought only humans could do and what we thought machines couldn't do. Some smart machines are brute-force automation, while other technologies are autonomous, not programmed, self-learning and self-guided. A smart machine could have one or

several of these characteristics: has deep learning ability, is adaptive, creates own rules, learns from results, seeks data to test hypothesis and detects novelty.

GARTNER HEADQUARTERS

Corporate Headquarters
56 Top Gallant Road
Stamford, CT 06902-7700
USA
+1 203 964 0096

Regional Headquarters
AUSTRALIA
BRAZIL
JAPAN
UNITED KINGDOM

For a complete list of worldwide locations,
visit http://www.gartner.com/technology/about.jsp