Introduction: what drives change

In the introduction, I chart the concept of change through a historical lens, tracing it back to the major thinkers on the industrial revolution, Marx, Weber, and Durkheim. I then turn to technological waves in a historical context, tracing them all the way to our contemporary technologies and concerns and through to coronavirus and what might come next. That becomes the backdrop for a quick tour of the structure of the book, which has two parts. The first part is dedicated to a macro perspective on technology. The second part is designed to help you, as an individual, respond to technological change, both as an individual and in the groups you find yourself in (at work, in social movements, in your social life, or in your family).

Change is a misunderstood concept. When weather, seasons, emotions, or people change, all of us are driven to oversimplify. We look for a single cause, even though we know that change is typically caused by a myriad of factors. Why? Because simplifying things helps us cope. Our psychological reaction precedes an intellectual explanation.

Technological change is particularly complicated. Historically, we tend to overvalue technology's role in change. That phenomenon even has a name—technological determinism. Even though this is a book called *Future Tech*, I will try not to fall victim to that determinism. Instead, I will go behind the technologies and look at what created them and what sustains them. Subsequently, I will get in front of them and chart what lies ahead, based on

other equally salient disruptive forces, such as influences from government, business, society, or even the physical environment that surrounds us, earth's ecosystem.

The future of technology is, of course, not an exact science. I share the fate of many futurists who have, wisely, stepped back a bit from prophecies. Instead, we chart scenarios. We model likely developments based on the forces of disruption we see in play already today. That can be done only by having a clear idea of how contemporary society is put together, a necessarily incomplete and simplified model of how things generally tend to work, which in turn requires an awareness of history.

To start with, let me just note that social change is usually equally important in terms of shaping technology as technology is in shaping social change. To prove that point, it is tempting to quickly begin to summarize the lessons of the 2020 coronavirus pandemic. That event indeed has set the context for an enormous amount of change—and it came from the environment (an animal carried the virus), to society (manifesting itself first in China, then in Italy, then across Europe, and in Iran, spreading to the United States, and then to Brazil), and only subsequently influencing sci-tech (stimulating a massive vaccine effort among all the world's top life science labs combined).

However, an even better perspective is gained from looking a bit further back in history. I would like to bring your attention to the industrial revolution. The reason I do that is that even though we call it an "industrial" revolution, the emphasis is often on technology when, in fact, it was social upheaval in cities that created the incentive and opportunity for such massive changes to take hold.

What the industrial revolution taught us about today's changes

The industrial revolution of the 18th century caused migrations, upheaval, and economic progress, and created new winners and losers, individually and collectively. German thinkers Karl Marx and Max Weber, and French sociologist Emile Durkheim, and others, each attempted to explain this change—Marx and Weber found the driving forces to be at the individual level, Durkheim found them mostly to be at the collective level. Both ways of looking at it can be fruitful.

Marx's observations on change

Marx's (1990) explanation, largely based on UK data, focused on how individuals respond to the class struggle. He held that class struggle (within the capitalist system) was inherent to the new industrial production of goods. A worker's identity was tied to the goods that were produced. To realize their true selves, workers had to rise above their status as servants to the technology to become owners of the instruments of production.

In other words, technological progress had to go hand in hand with changes in the ownership of the instruments of production. In Marx's mind, progress stems from the conflicts that necessarily arise out of people exercising their true interests. Marx's writings are commonly misunderstood as calls to action instead of explanations of the process of social and technical change, yet they were both. Any true revolutionary has a deep understanding of the society they are trying to change. Anything else would be unethical and short-sighted.

Weber's observations on change

Weber's (1922) explanation of change centered on the specific role of the Calvinist interpretation of the protestant work ethic in fueling capitalism as the answer to whether people should expect to be saved. Calvinists first broke from the Roman Catholic Church in the 16th century. Weber maintained that a complex set of rationales could help people attain meaning through the external evidence they saw from their efforts. As a result, hard work, discipline, and frugality became traits that, over time, produced tremendous change in the living conditions for workers as well as, in turn, for society. Weber's analysis, which appeared in 1904–05, was based on studying a particular Swiss-German version of Protestantism around the turn of the century, and in a historical perspective and context. Calvinism is arguably a major denomination still thriving today, although today's adherents, at least in the US, have abandoned many key Calvinist tenets and many Puritan ministers also have adapted the message slightly—although the work ethic certainly made it to the new world, and to America in particular. Today, however, it would be fair to say that hard work is motivated by the secular version of the American dream as much as by a religious motivation.

But Weber, in his foresight, had thought of that. He was also worried that rationalization would lead society astray. He worried about the inescapable iron cage of bureaucracy gone amok. Many have worried about bureaucracy and clearly there are governments that attempt to control individuals to an unnecessary degree.

What Weber pointed out was how the interplay of class, status, and party contributes to distribute power in a community. With that came the gradual understanding that economic value is complex and cannot just be derived from simply looking at the material conditions that created it. Weber, in fact, built the foundation for the understanding of social value, a much more complicated thing, and immensely much more valuable than pure economic gain. Technology, in this picture, is not an economic causality, it is much more complex, and is tied to social value and, in Weber's eyes, to the specific culture of the metropolis (Weber, 2005).

Durkheim's observations on change

Durkheim, on his side, focused on the role of the collective in bringing people together in new ways (enabling solidarity), such as in larger cities. To him, the collective was a more natural state (than simply being an individual) in which people were bonded by their affinities, to their families, friends, tribes, and co-workers. The collective represented a social consciousness that prioritized harmony over discord. Alienation, or suicide, was explained by the breakdown of the bonds of the collective, a function of the way society "worked," and not the result of individual action and thus subject to rationality or motivation, as such.

What gradually happened in the industrial revolution, according to Durkheim, was that the earlier *mechanic solidarity* (people mostly had shared beliefs and sentiments) gradually incorporated *organic solidarity* (further specialization and increased interdependence). As societies become more complex, the collective binds itself together in more intricate ways, but even more so feels the need to interact. There is a division of labor in which each part has its place.

The understanding of this process is not always perfect in any society. Note the surprise experienced by elites around the world during 2020's coronavirus pandemic when they discovered that food service workers, nurses, and delivery personnel are crucial to the operation of contemporary society. These are not merely frontline workers, they are "essential" workers, that is they are key to the functioning of society as we know it.

Bourdieu on habits of change and stasis

Thinkers who followed in Durkheim's footsteps, notably fellow French sociologist Pierre Bourdieu (1977), have pointed out that the way change

(and at times, lack thereof) occurs is through each collective (and social class, incidentally) learning to incorporate active habits (Bourdieu calls it *habitus*) from their surroundings through a socialization process. By the way, the bastardization of this line of thinking is found in today's applications of behavioral science to product development and marketing, mostly inspired by and loosely derived from empirical psychology. Purely utilitarian observations and experiments that attempt to prove which products various social groups want are, at best, shortcuts to a more complex reality, and at worst, provide pseudo-scientific rationales for consumption that scarcely has roots in human nature. Having said that, behavioral approaches may, on average, be slightly better than purely intuitive approaches that don't ground their observations in empirical behavior at all.

Conventional wisdom would indicate that children of academics tend to have deep discussions over the dinner table, read books on the bookshelf and dig into multiple sources online, and learn to learn, which is generically useful. Yet they may lack fundamental practical or commercial skills. Children of police learn to serve the community through prioritizing maintaining order, and typically follow a career path along those lines. Children of executives are taught about business by example, may learn to create material value, above all else, but they also, these days, tend to learn something about managing people, which is an essential skill. Children of engineers model another professional behavior, learn to take apart and put together machines, and so learn to create new, better machines, and they have a distinct advantage when it comes to understanding science and technology. Children of entrepreneurs learn to recognize challenges and embrace novelty and risk to solve them, and they learn the value of taking outsized risk (and they occasionally learn about entrepreneurial failure).

Now this would, again, border on determinism, if I did not insert that people can escape their upbringing (to some extent). Some children even make it a point to do things differently from their parents and may rebel for years, even for a lifetime. The point is simply that escaping your childhood is that much more difficult and kudos to those who feel they need it, want it, and achieve it. For instance, it has taken me near 50 years to realize that I am much more suited to life as an intellectual than life as a corporate executive, combined with being an entrepreneurial tinkerer and being a connector between worlds, even though that was already given from my upbringing. I think many of us resist our upbringing so much that we cannot see straight about all the upsides of following in our own footsteps, as it were, as opposed to seeing it as being forced into something by fate.

Learning also occurs across cohorts, among groups of children that spend enough time to mirror each other's interests and so on. There is a whole strand of thinking along these lines called social learning. These habits, in turn, become structural tools (legacy behavior patterns) that define a social group's identity, and in so doing defend it from outsiders. These ways of behaving become "what really matters," regardless of the neuroplasticity that always remains inherent in you and could be mobilized if you tried harder.

Integrating strands of thought on change

Durkheim and Bourdieu are "functionalist" thinkers. To them, everything has a "goal," but the full extent of that goal is not simple, and not visible to each person. Contrary to what some people think, this line of thinking is very powerful in attempting to understand how people cope with sweeping change, because it illustrates how it's even possible to feel "okay" in the midst of it all.

Neither Weber nor Marx ever fully explained how an individual *copes* with their predicament. Marx, in fact, argued the answer always was to rebel, because he hyper-emphasized fairness. What Durkheim grasped, and has to teach us today, is that even though the function of something might be relatively static, its role can shift, even quite radically, without altering the basic understanding that "life goes on." This is a useful insight when trying to understand change, crisis or innovation. We can, in fact, simultaneously believe in collective values and take issue with some of the excesses of prioritizing the group over allowing for individual expression.

While Marx's, Weber's, and Durkheim's views differ as to whether technological progress had a greater impact on the individual or the collective, they would each agree that change impacts both the individual and the collective. It was difficult even for social scientist icons to keep the two apart. The process of change based on what occurred 200 years ago (the industrial revolution and its aftermath) is still poorly understood. What were the most important factors in kickstarting the changes? Why were some parts of the world industrialized much faster than other parts? Why did some individuals and social groups persist in trying to reject change instead of embracing it? If you accept that change, as such, and its social causes and consequences, are still shrouded in mystery, how can we expect to fully understand what's happening around us right now? The interpretive process has, for sure, not gotten easier with time because new variables are constantly added to the mix. History may not be a perfect guide, but rejecting its lessons does not do us any favors.

Technological waves in a historical context

The best answer to the mystery of change is that true understanding takes time and requires historical context. Which is why we now, several hundred years later, can start to appreciate how the historically specific *"waves" of technology* a few years later typically become viewed as *economic waves* because the effect is now visible in overall productivity. However, if we, as Marx, Weber, and Durkheim taught us, instead first (and ultimately) try to understand the effects in terms of *social waves*, we can better capture the gradual shift that also occurs in the way social dynamics can play out once technologies are part of society's infrastructure.

Not all technologies reach that level of maturity. For those that do, the importance of the platform created by the install base (e.g. the railway infrastructure) far outweighs the individual performance of the trains running on that infrastructure. This fact is quite frustrating for consumers who ask for faster trains, better cars, and more stable computers.

As consumers, we generally believe (in vain) that technologies are only about making things better, when in fact all they typically do is make things different, and usually—at least when successful—more standardized. The improvements that endure (when we are lucky, that is) are all due to putting technologies to use in an efficient manner, and for that we need to know where the train lines should go, what features will become important in cars, and what computers really are all about—are they productivity tools, entertainment devices, or control machines for government suppression? Or are they all of the above in certain situations?

These are much more complex questions than building the first prototype of each of these technologies, and something about which inventors, engineers, or vendors typically have very little to say and very little influence over. Historically, this was even more true, because the insight that has slowly emerged about user testing and design thinking was not prevalent in earlier technological waves. Thus, to some extent, we would have to consider the success of all those technologies as a stroke of luck.

Unbundling the second industrial revolution of the 20th century

Immediately after the second industrial revolution of the 20th century which brought us trains, electricity, and telephones, many observers initially thought

that a *post-industrial dynamic* was at play, and that it was the service sector, not technology, that was going to drive all the changes. In 1976, Daniel Bell published *The Coming of Post-Industrial Society: A Venture in Social Forecasting*, stating that the rise of the service sector and a new class of professionals in the United States proved that technology had run its course.

In some ways, observers such as Bell argued "everything has been invented" and all we have to do is watch history play out, letting technology "service" society and servicing each other with technology as a tool to make it more efficient.

Technology's embedding with the constant struggles of democracy

On the political science side, this kind of argument is what led to Francis Fukuyama's book-length essay *The End of History and the Last Man* (1992), in which he claimed that western liberal democracy had won and that there were no other models of government that would succeed. But as we know from the past decade, history didn't end, progress didn't stop, and democracy hasn't won. At least, there are many forms of democracy and some are only disguised as democracies for the time being. There are also substantial voices questioning the legitimacy of what many had considered unquestionably democratic institutions, processes, and electorate processes.

The current unraveling of the United States as a superpower and as a democratic governance entity, regardless of the causes, which we have no time to get into in this book, is a case in point. The rise of far-right movements in European politics is another. Things are never that simple. Manufacturing, in that view, in which one lumped in technology as simply a means of more efficient production, was simply the means to produce an end. We are now entering an era where we are slightly wiser, and where manufacturing will regain some of its stature as a legitimate industry in which essential functions are being carried out, but the process of gaining that awareness has been slow.

Knowledge, and human capital, became what mattered. Why knowledge? Because knowing what (insight) is going on is a big prerequisite for knowing how (technology). In this human-centric worldview, machines are mere tools, instruments for the human domination of all things. There was something comforting in that view. Again, we could focus on literature, on academia, on thinking as opposed to action, and on building skills needed to manage the technologies that were already developed.

Is knowledge the true source of invention and innovation, or are material changes and technology? Obviously, it depends on how wide you make that term. For a few decades, it almost looked like this was an accurate description. Few truly novel inventions arrived on the scene between 1930 and 1970, as I put the jet engine (1930) as happening right at the end of the past cycle of innovation and discount soft-serve ice cream (1938), ATMs (1939), superglue (1942), the microwave oven (1945), and the birth control pill (1960), and even—under doubt—freeze-dried coffee (1964). I will say that the fiber optic cable (1952) was pretty amazing, though. Having mentioned all those fly-in-the-face inventions, there were also under-the-radar innovation developments underway, but the point is this, they did not come to fruition in that era.

What was happening was not just society riding a technological wave and adjusting to them. In fact, many of the aforementioned innovations are somewhat insignificant in the greater picture—they are small spikes on the slow, ongoing innovation curve. Rather, it was a period dominated by a depression, followed by a world war, followed by immense rebuilding of society and corresponding economic progress.

But the technological change that fostered it was incremental, which does not at all mean that it was insignificant. It just was not disruptive. And because it was not disruptive, it could be exploited by the new class of professionals, technocrats who did not know the details of the technologies but who could serve as managers.

From this gist rose the whole cadre of professional managers in industry, as corporations grew and needed principles to manage their workers. Management practice fostered schools of management, and the MBA degree was born. The first MBA was awarded at Harvard in 1908 but only became a globally recognized degree by the 1950s. It was all very convenient and responsive to the changes that were happening in the workplace. But as we all know, history tends to get more complicated.

As infrastructure increasingly developed outside the government's immediate control, or was slowly deregulated in order to achieve what one thought of as higher efficiency, the emerging platforms consolidated, started to interact more closely, and then, seemingly "out of the blue," another technology wave hit us, starting in the mid-1970s, with GPS (1973) and magnetic resonance imaging, also known simply as MRI (1977), and one that had been brewing in the U.S. and U.K. military and in industrial laboratories for three decades: digitalization. At first, it was only a game of number crunching, and it happened on isolated machines. You can only go so far with that and the applications were important, such as statistics, cryptography, and

weather prediction. But not they were not earth shattering at this point, partly because the use cases were limited and the full scope of those technologies had not yet been reached.

The consumer tech upheavals of the 1990s and 2000s

Then, in 1990, came the third industrial revolution and the introduction of the internet and online markets, enabled by the internet's ecommerce opportunities (1991) and the consumer release of WiFi (1997). With e-commerce and now blockchain, transactions can occur without central points of authority. Artificial intelligence has been applied to image recognition, chess game aptitude, and analytics. While we still have no idea what these technologies will lead to, we can and should speculate. Why? Because the advent of so many new technologies together holds enormous potential for cross-fertilization and wide-ranging, potentially uncontrollable, impacts.

Throughout the 2000s, there was a series of (arguably) great inventions and milestones, including the iPod (2001), which was the precursor to MP3 players, the first camera phone in various Asian phones by Sharp and Samsung and Nokia's N90 breakthrough 2005 phone with Zeiss optics, the final sequencing of human DNA from the human genome project (2003), voice calls over the internet with Skype (2003), social media with MySpace (2003) and Facebook (2004), YouTube (2005), Twitter (2006), the iPhone (2007), and the Amazon Kindle e-book reader (2007), to mention some (Forrest, 2015).

The environment strikes back: coronavirus of 2020

Occasionally, history brings an event that appears to come out of left field (it seldom does, it just looks that way at the time). This book is not the story of the impact of coronavirus. However, the virus will drastically affect the next decade's technology evolution. Arguably, the impact of the coronavirus pandemic will unleash a fourth industrial revolution, only a brief generation after the third, which might not have happened otherwise.

What that revolution will entail is still shaking out, but it clearly has to do with a deep societal response to the systemic risks presented by infectious disease run amok, and a set of social practices to counter the negative consequences of this increased risk. It also, hopefully, serves as the dress rehearsal for even worse pandemics and, to some extent, for the biggest crisis of them all, extinction-scale climate change. Furthermore, it seems

clear that technology will play a part in enabling more mature and widespread usage of the technologies brought to us by the third industrial revolution. Finally, we are about to see the most severe split of haves and have nots in several hundred years: those who fully embrace, and are able to sustain, systemic risk and those who do not.

While we can look at previous industrial revolutions and reduce the changes that occurred to a single driving factor—say technology, politics, innovation, or consumer demands, take your pick—we need to overcome our inclination to oversimplify the explanation for these changes. While technology, politics, innovation, and even consumer demand are all important factors, each one of them is only a *contributing* factor. What drives change is not only skills, not only technologies, not only politics, or even human capital in and of itself. Rather, change is driven by the interaction of these four forces, and in the case of coronavirus, by the contextual force which is our embedding, our footprint, in the physical ecosystem around us, in this case, most likely, our proximity to wild animals (e.g. zoonotic spillover). To gain any insights, we need to watch each factor very carefully.

To understand technology, start analyzing what it was intended for

This book addresses the trends that both lead up to and follow from the emergence of new technologies. Rather than addressing technologies as such, we will tackle the evergreen principles that bring them about and modulate their usage, and what to do about it, for most of the book. Technology means "knowing *how*." Technology is just one factor and it is not always even the most crucial facet. Knowing how to do something doesn't help you figure out the motivation for using it (social), what makes it an improvement (innovation), or what safeguards are necessary to prevent against misuse (regulation).

The misguided notion of STEM

It is ironic how only a certain aspect of tech literacy, called STEM (the acronym used to push a certain basic knowhow in Science, Technology, Engineering and Math), has indeed become a fashionable basic skillset taught from K-12 to universities. As we will see, the focus on such a limited set of instrumental skills is alluring but shortsighted.

Very briefly, STEM is not what STEM is about. Truly appreciating STEM's potential requires in-depth awareness of the rationale, the meaning of technology, and its potential (desired and undesired) use cases. There is even the argument, as top engineering schools revise their curricula to meet the demands of today's students and what we now know in terms of learning science, that you cannot productively teach STEM aside from how it is used (NEET, 2020).

As with new technologies, the same goes for the "Big Data" that new technologies create. Data itself—even tons of it—does not yield better insights. We now make inexpensive sensors that can pick up data on just about anything from temperature to human emotion, but what are we looking to find or solve in all of this data? In science, reaching a conclusion too quickly and based on weak or faulty premises is called a fallacy (IEP, 2020). What we are dealing with here is typically the "fallacy of defective induction." Simply put, the availability of many observations does not necessarily make it easier to arrive at a theory that explains what is going on. An abundance of data simply creates an endless availability of potentially spurious correlations, things that co-exist in some sort of pattern that we far too quickly assign as a cause and effect. What we need is some understanding of what ties our world together.

The 21st century's challenges: what future tech is all about

In *Future Tech*, I ask a simple question: How should we, as business professionals, policy makers, and entrepreneurs, respond to the deeper tech trends that will shape our decade? I also ask you to do the research yourself and become enough of an insider to know what is likely to only be a fad, and what likely is a lasting, disruptive change you need to focus on. With technology, there is no substitute for depth. Do your homework. Develop your own informed opinion based on looking into the issues. Don't rely on random newsletters coming your way or annual emerging technology clickbait reports from consulting firms.

This book is about technologies that have direct relevance across many industries and across society in the 3–5-year range and typically through the decade. Many of them will foster lasting changes and become valuable platforms, and there is no knowing what innovations, business models, and social practices they will foster.

The main forces of disruption

The first part of the book is all about the macro-view on technology. How does it function in society? What do we know about how it works in various disruptive ways? Which technologies matter in this decade?

In Chapter 1, I explain the forces of disruption: technology, policy, business, social forces, and the environmental context that surrounds them. Tracking changes in emerging technologies, policy, business, and social dynamics can help you determine which priorities to chase, which interrelationships to be aware of, and what gaps to fill. While simple, this is a far better approach than simply chasing the hottest technologies and tracking whatever information you can find on the internet. In fact, the precision needed from digging at least one level deeper into each of these four categories of disruptive forces is where the true power of the analysis is revealed. That is why I have written a book about it and not just a chapter.

How sci-tech fosters innovation

In Chapter 2, I investigate the way science and technology foster innovation, each in different ways. Three main lenses are helpful: platform technologies, taxonomies, and tech visualization.

Government policy regulates the playing field for tech

In Chapter 3, I look at the effect of government interaction in emerging markets that were created or are impacted by innovation. While many believe that government standardization, prohibitions, or detailed rules constrain and slow innovation, the truth is that by enabling a level playing field, government regulation benefits equal market access, consumer protection, and public safety, such as in the case of clinical trials for new drugs. Those who attempt to innovate within "regulated" industries without regard to regulations are likely to suffer setbacks even if their tech is good. The startup 23andMe is a case in point, as it miscalculated what a startup would be allowed to communicate to consumers about serious health issues—and the FDA noticed.

The rise of business models

We may not spend a lot of time thinking about them, but in Chapter 4 I reveal how business models have become a major instrument of innovation.

From being relatively unimportant because they were so commonplace and changed relatively slowly, the novel business models of today can reshape industries almost instantly. Perhaps the best meta-business model is that of creating a startup, and we will particularly look at a few unicorn startups, such as the sharing economy companies (Uber, Airbnb). However, the novel business model of today may not help us understand what will work tomorrow. Rather, to protect our business and to capture opportunity, we have to constantly look out for such novelty ourselves.

Social dynamics stems or stimulates tech

In Chapter 5, I emphasize the role of social dynamics in the adoption of trends. Social dynamics (i.e. whether people "catch on" or "adopt") can both preempt and stall all other forces by the sheer force of numbers. Consumers have become immensely powerful in retail and arguably have more influence over what is being sold than shops, vendors, or even B2C entrepreneurs. Whether this will last and what the future holds for ownership, pricing, product strategy, physical retail, and a host of other issues will be discussed in this chapter. I'll also consider the science behind psychographics, which was popularized by disgraced pollster/influencer Cambridge Analytica, but which is both a richer tradition than that saga contends and somewhat less powerful and scary than initially assumed.

The technologies of the decade

Chapter 6 dives into five technologies that matter at this time: artificial intelligence, blockchain, robotics, synthetic biology, and 3D printing. Why? They interact with each other, creating previously unthinkable conditions of technological, biological, material, social, and psychological change. Using these technologies, items as commonplace and well-known as a wall, a piece of cloth, and a human being may become nearly unrecognizable from their predecessors over the past 1000 years within the span of this decade. How? Well, it will take us about 10 pages to explain. We quickly describe what each technology is capable of today, what it might achieve in 10 years and who you should track (scientists, innovators, startup founders), and what you should read (publications) or what tech conferences you should attend, to have any inkling about where it truly is evolving day by day, year by year.

Micro-view: how individuals respond to disruption

In the second part of the book, I focus on how individuals can best equip themselves to take advantage of these disruptions to their personal and professional lives in order to both understand and profit from change.

Polymaths of the 21st century

In Chapter 7, I outline the growth opportunities for individuals in this new landscape—specifically, how to become a "T-shaped expert", grow into far more useful "Pi-shaped" experts, or even move beyond expertise as such (which is only part of the ingredients of change) and into the territory of a polymath—fruitfully combining deep perspectives from several domains (which is the basis for recipes of change). The ideal is not only to be an expert in two or more domains and very deeply immersed in a dozen, if not more, but to demonstrate results from it that can benefit humanity. We cannot afford to have only an elite class of citizens perform this function. Rather, it has to become a widespread capability.

Personalizing your insight

In Chapter 8, I suggest a number of tools to help you tackle the future head on. There are many tools available to track trends, including low-hanging fruit (subscription to market research, consumer search engines), traditional approaches (relying on trade association newsletters and gatherings), time-consuming ones (attending industry events), expensive one-off stints (hiring strategy consultants), novelty tricks (on-demand expert networks), in-house approaches (strategy, internal consulting or R&D teams), or partnerships (universities, accelerators, VC firms, etc.). Given today's shifting knowledge needs, none of these works in isolation. The market for online content discovery tools will only continue to grow as the complexity of navigating online content increases. So as tools evolve, so should you. The winners of tomorrow will have access to a personalized growth toolkit. What does that mean? Simply put, you need a diversified approach to acquiring and processing information, deliberating decisions, and scaling your implementations. Whatever you do, do not go it 100 percent alone. You will surely fail.

A down-to-earth view on man/machine symbiosis

In Chapter 9, I suggest you take an ambitious stance and embrace the man/machine approach. Actively seek integration with various available machine intelligences and hardware. Make sure to spend enough time training the most advanced AI you can get hold of—everyone else who is smart will be doing the same. The emphasis of the next 3–5 years and likely the whole decade will be on augmenting human capability, not completely replacing it with AI-infused robotics.

The mixed blessings of change—human enhancement

I conclude by looking at the mixed blessings of change. All trends point to the fact that by 2030, unless we take action, the global labor force will be led by an elite set of knowledge workers enhanced and enabled by robotic AI—and by the next generation the roles will likely be reversed. What I mean is that you are likely looking at a scenario where there is an army of AIs (in robotic form factor or simply in software) and a smaller set of humans who (hopefully) control and enhance their work.

You can view this as a threat or as an opportunity, depending on how much you value going to work. However, beware that already in 1930, the American economist John Maynard Keynes predicted a society so prosperous that few had to work (Rosen, 2016). It turned out that increased productivity has not translated into increased leisure time, even for the elite (with some exceptions). Why, then, do we still work long hours? Certainly not awaiting the robots. We work because that is who we are. Our essential function as human beings is not likely to change anytime soon. We will just find other ways to work. Note that the Manufacturing Institute's skills gap study (2018) predicts some 2.4 million manufacturing jobs will be awaiting skilled workers between the time of the study and 2028.

The strategies for capturing surplus value from disruptive industry trends, which all tend to involve technology at this point, remain largely the same as they were before technology became a major factor. To capture value, you need to deeply understand what value is before it emerges and everyone else knows.

The question of (societal) value beyond pure economics

However, the entire question of value is much more complicated. Recently, as Wittenberg-Cox (2020) writes, a slew of female economists—Esther

Duflo, Stephanie Kelton, Mariana Mazzucato, Carlota Perez, and Kate Raworth—has begun to gain ground questioning what it actually means. Creating economic value is traditionally defined in monetary terms, but would there be a broader construct that could encompass how it serves people? Take the concept of gross domestic product (GDP), which ignores unpaid labor like housework and parenting and is sometimes antithetical to sustainable growth because it also finances weapons or fossil fuels. Finally, Wittenberg-Cox says, Carlota Perez reminds us how new growth is spurred by aspirational desires as opposed to guilt and fear.

Viewed that way, the future will not cause the angst that my fellow futurist, Alvin Toffler, captured in his book *Future Shock* (1970) 50 years ago. Even though the future has just begun, we have come a long way in our understanding of it—but that knowledge needs to be shared, again and again. If we keep learning, our technological future can be bright, both as individuals and as a collective, and it can serve the greater purpose of building a human future—a place where we can all thrive.

Key takeaways and reflections

1. Technological change is complex, yet we seek ways to simplify so we can understand it. How would you put the evolution of technology into your own words? Try to jot down a few technologies you care about and write a sentence or two about what you know about their origin.
2. Think about the first and second industrial revolutions and then think about what is happening today. Which period would you rather live in? In which period would you thrive? Which period will be viewed as more significant, looking back?
3. Consider the new framework, the forces of disruption. Can you describe each of the forces in your own words? Which of them are you most familiar with? Which one will it require more investment of time and effort to untangle?
4. Consider the notion of societal value compared with economic value and how each currently is measured or not measured. What human activities contribute true value? What is a fair measure of value?