David Moschella

"A very important read"

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seeing Digital

a visual guide to the INDUSTRIES, ORGANIZATIONS, & CAREERS of the 2020s

Foreword by
Mike Lawrie, CEO, DXC Technology

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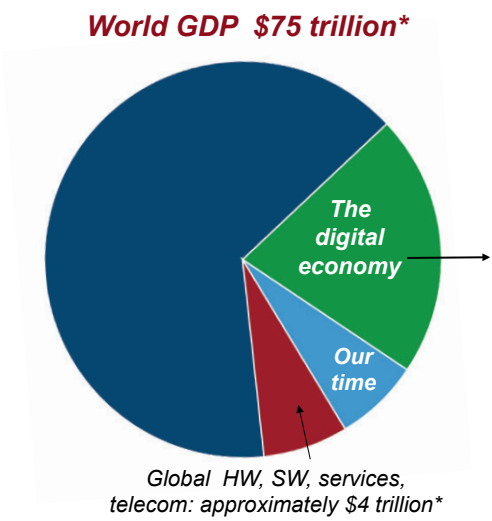
In this final chapter, we will assess the evolution of global IT leadership. We see two main trends: the rise of China, not just as a manufacturer and a vast domestic market, but also as an innovator, determined to challenge the US in many next-generation technologies. However, we also expect that many smaller nations will have important advantages in terms of developing advanced information societies. The result will be much more multipolar demand-side innovation, amidst often fierce bipolar US/China supply-side competition.

What do we mean by 'the IT industry?'



A useful first step in trying to assess global IT industry leadership is to define what we mean by 'the IT industry.' As shown in the figure, one can take a narrow or much broader view.

Most research firms and government agencies opt for the former, essentially taking a *supply-side* approach, estimating the value of IT hardware, software, and services sales. The first two of these are relatively straightforward; the last more subjective. Does *IT services* include professional services, training services, distribution services, online services, network services, etc?

But as shown on the right, the IT industry can also be seen to include just about everything that technology enables, and this *demand-side* approach comprises a much larger share of the global economy. Some would even argue that the time we spend using computers should also be counted. As a simple example, if one billion people spend an hour a day online, and we value their time at just $10/hour, this would account for $10 billion/day, or $3.65 trillion/year – roughly the size of the narrow definition above.

The point of this isn't to wallow in the definitional depths, but rather to argue that what we mean by global IT industry leadership is very different, depending upon whether we are taking a supply- and/or demand-side view. In this chapter, we will do a good bit of both, while acknowledging that most people think of global leadership as primarily a supply-side issue.

IT is now the main driver of both economic growth *and* austerity

IT-driven growth

- *New markets*
- *New products*
- *New firms*
- *New value*
- *New know-how*
- *New jobs/skills*

IT-driven austerity

- *Lower costs*
- *More automation*
- *Virtual operations*
- *Fewer employees*
- *Self-service*
- *Labor arbitrage*

These supply- and demand-side forces also capture the odd (but intriguing) reality that in today's global economy, digital technology is both the driver of growth and the engine of austerity. The growth comes mostly from the supply side of the industry, as technology companies create new markets, jobs, and prosperity, while the austerity is driven more by the demand side, as organizations use technology to become ever-more efficient.

Thus, the overall impact of technology is clearly a question of balance, and it is here that the rough market size estimates on the previous page take on important additional meaning. Put bluntly, economic growth is heavily associated with the success of digital suppliers, while austerity extends across the much larger demand-side economy.

This doesn't necessarily mean that the net balance is negative. Demand-side efficiencies lower costs, enabling significant increases in total consumption. We believe that this *elasticity* is strong enough to make digital technology a net growth contributor. However, most elasticity effects are almost invisible to society at large, while the use of technology for austerity purposes is often front-page news.

Throughout its history, developed societies have largely accepted that the economic benefits of technology – however hard to see – do indeed offset the more obvious job losses and dislocations. But today, this view is being increasingly challenged, potentially setting up a new era of technology industry skepticism, as discussed over the next three pages.

Society is becoming increasingly wary of IT's overall impact

1. Technology increases income inequality, especially for the 1%
2. Technology is a net job destroyer; MI will make this much worse
3. The *gig economy* undermines workers' rights
4. Internet and social media addiction is widespread
5. We are increasingly under surveillance, with little privacy protection
6. Digital media and algorithms can be easily manipulated
7. Cyber crime is rampant and getting worse
8. Social media is increasing societal coarseness and polarization
9. Silicon Valley lacks diversity and social responsibility
10. Google, Facebook, and Amazon have too much market power

Is all of this true/fair? What, if anything, should be done?

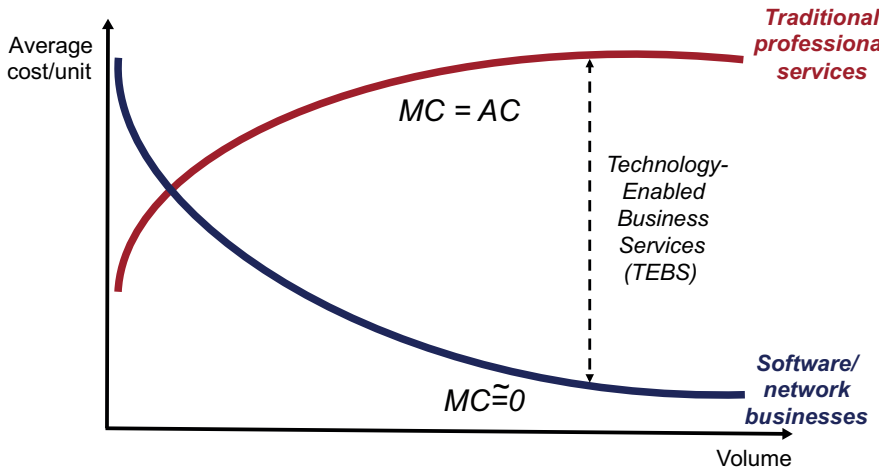
Over the decades, the leaders of the IT industry have gotten used to being lionized – they've been seen as smart, entrepreneurial, passionate, the embodiment of the digital future, and (of course) often unfathomably rich. They have moved freely in the upper ranks of business, celebrity, political, and cultural circles.

But this mingling is getting more awkward, as the overall impact of technology is openly questioned in the areas shown in the figure and more. While one can argue about whether these criticisms are fair, there is enough truth in them that they can't be easily dismissed. For the first time, the US technology industry is on the defensive.

This matters because the dynamism of the US technology sector has been helped by a mostly deregulated environment. But this philosophy is now being questioned. Should internet companies pay more taxes? Do citizens have the right to change what the internet says about them? Should service providers be responsible for the content on their systems? Should Uber drivers be treated as employees? Do antitrust laws need to be more strictly enforced? We could easily go on.

Some of this pushback is the natural result of the extraordinary success that technology firms have had, and some regulatory tweaking could well be useful. But the bottom line is that the technology sector is at risk of a political and cultural backlash, and this is now an important dynamic in global competition.

Economics explain why some IT markets are *winner-take-all*



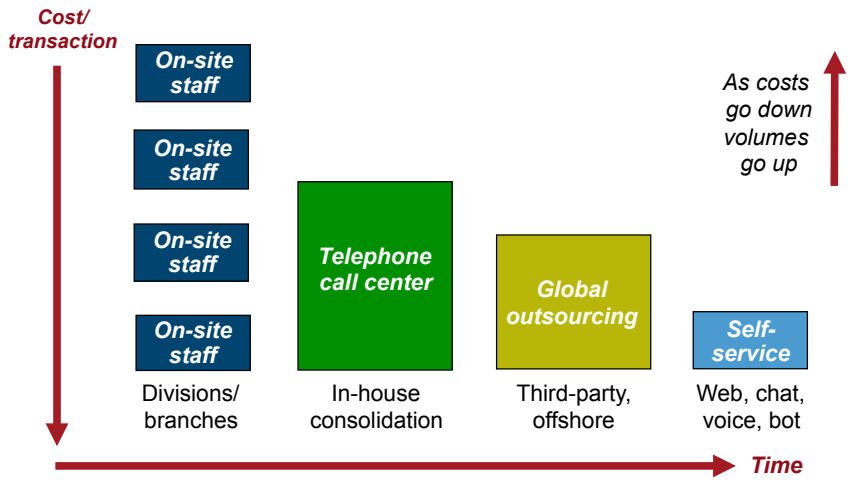
Even though you've heard the statistics – the assets of the world's eight richest people equal those of the 3.5 billion poorest; the top one percent own over half of all wealth; and so on – the numbers can still shock. It's not surprising that such inequality is a major source of societal discontent.

Information technology plays a major part in this – the richest eight include Bill Gates, Mark Zuckerberg, Jeff Bezos, and Larry Ellison (as well as Michael Bloomberg and Carlos Slim). Indeed, inequality is essentially built-in to the underlying economics of the internet, as depicted above. The top curve shows a typical large professional-services firm, say for accounting, law, or consulting. As the volume of business grows, there are initially important economies of scale due to learning and experience, but these eventually flatten out. In economic terms, the marginal cost (MC) comes to equal the average cost (AC) of adding more human capacity.

The lower curve shows how software and network markets are different. Here, the marginal cost of adding a new user to, say, Google or Facebook is close to zero. This means that average costs keep falling with volume, generating increasing returns to scale, and a tendency to create highly profitable, winner-take-all (or near all) industry structures.

In the middle are markets requiring both computer and human interaction. As we shall see, these *Technology-Enabled Business Services* are an important hybrid case, especially in global B2B sectors.

Customer service typifies today's relentless digital automation



The nature of technology automation – lower costs, higher volumes – is depicted above, using the familiar example of customer support.

For decades, banks, insurance agencies, stores, government offices, and many other businesses supported their customers face-to-face or locally over the phone. But this approach had obvious inefficiencies, especially when service volumes fluctuated. Centralizing support into a shared telephone call center was a natural solution.

However, once this consolidation was in place, it became much easier for the entire customer support function to be outsourced to a specialized supplier. These third parties could serve multiple customers to increase their economies of scale. They could even move work offshore to further drive down costs. While the results were often not very customer-friendly (to say the least), businesses could offload a significant administrative headache, and lower their costs at the same time. Many couldn't resist, despite often high levels of customer dissatisfaction.

Today's internet businesses seek to eliminate human costs entirely, and deliver support through technology-based self-service operations. How many of us have ever talked to a customer account person at Amazon, Google, or Facebook, even once? Technology is the only way that these companies can efficiently support their billions of users, and still provide a generally excellent customer experience. Today's enthusiasm for software agents and chatbots is the natural extension of this trend, although using bots to create a high-quality customer experience remains challenging.

But all the jobs aren't going away

The world needs to:

1. *Raise global living standards*
2. *Narrow income inequalities*
3. *Modernize national infrastructures*
4. *Expand healthcare access*
5. *Improve care for the aging*
6. *Transform food, energy, and transportation*
7. *Revitalize teaching and education*
8. *Repair/sustain the environment*
9. *Rebuild war-torn and broken nations*
10. ***Create entirely new industries/jobs***

10 billion people by 2050

There is an immense amount of work to be done all around the world. The real question is: Which nations will thrive?

Customer service is just one example of automation's impact on employment. Retail stores are closing; banks and insurance companies are shedding workers; convenience stores are embracing self-checkout; fast-food restaurants are experimenting with entirely automated operations; and so on. Not surprisingly, many people fear that there won't be enough good, paying jobs to go around.

While such concerns can't be entirely dismissed, similar predictions have been made many times in the past, and have proven wildly, even comically, wrong. And although history doesn't always repeat itself, the evidence thus far also seems reassuring.

To say that 'all the jobs are going away' is really saying that humans no longer have needs that can't be met by machines. But as shown in the figure above, there is a vast array of unmet societal needs. How much of this work can actually be done by machines? And of course, many entirely new industries will surely be created.

Economists often cite Say's Law that 'supply creates its own demand[21].' This doesn't mean that if you make something, people will buy it; it means that the payments needed to build a product or service essentially equal the purchasing power needed to buy it. The challenges above will require plenty of payments, and thus will create plenty of demand, which is why we believe that the question isn't whether there will be jobs, but where the best jobs will be.

21. Jean-Baptiste Say, *A Treatise on Political Economy (Traité d'économie politique)*, 1803

Nations compete for work – and jobs – in many ways

Culture	– *Language, ideas, knowledge, influence, media*
Policies	– *Laws, regulations, support, strategies, initiatives*
Ecosystems	– *Cooperation, know-how, R&D, critical mass*
Industries	– *Size, share, scale, capabilities, cohesion, agility*
Companies	– *Competitiveness, leadership, dynamism, reach*
Infrastructure	– *Physical, digital, financial, political, legal, resource*
People	– *Education, skills, motivation, entrepreneurism, cost*

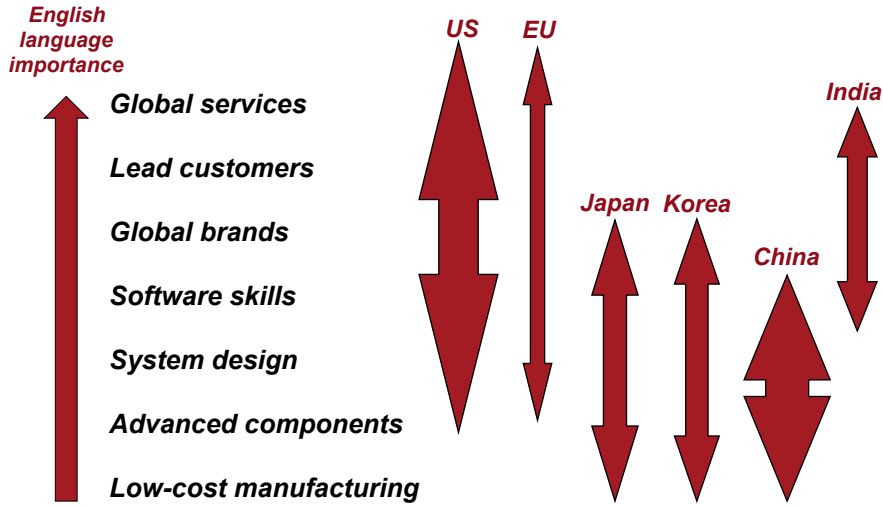
For much of human history, the primary competition between nations was military. Which country had the strongest armies and navies, and how was this power projected around the world? While military competition certainly continues, the principal form of national competition today is economic. Which nation is doing the best job of generating companies, jobs, and prosperity for its people?

We look at this competition through the seven-layer stack above. We think this model is a particularly useful way to assess global technology competition. For example:

- Which nations have the most skilled programmers, engineers, and workers?
- Who has the most advanced network and related infrastructure?
- Which countries generate global tech companies, and which do not?
- How important and effective are various industrial policies and strategies?
- Where is the national technology ecosystem doing world-class work?
- Are government IT policies mostly effective, or counter-productive?
- Is a nation within the *Anglosphere*, the *Sinosphere*, or on a different path?

These questions make it clear that there is room for a wide range of national strategies and approaches. But taken together, they give us a way of thinking about the exciting but high-stake global technology competition ahead. Over the rest of this chapter, we will use this type of layered thinking to imagine how global technology competition is likely to evolve over the course of the 2020s and 2030s.

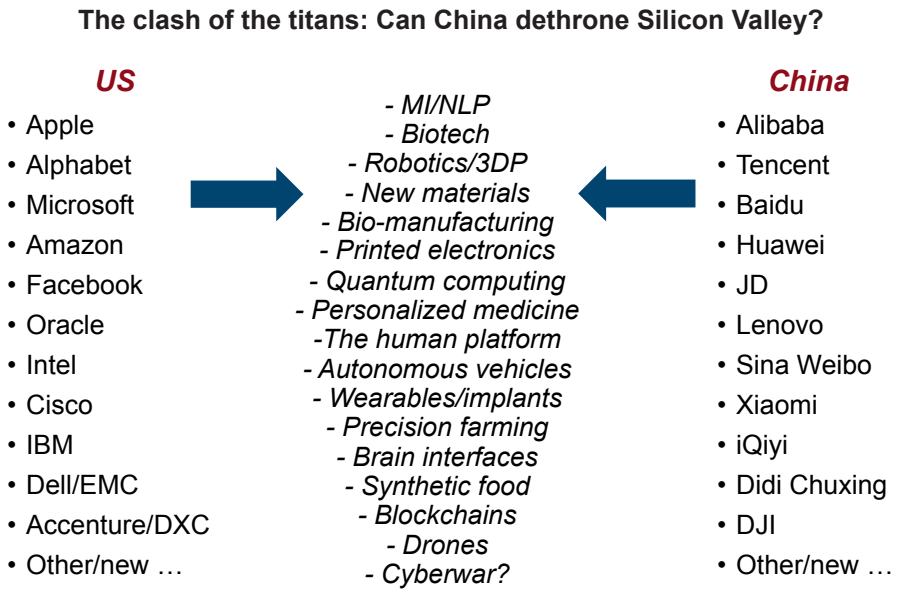
National IT strategies mostly focus on distinct value chain layers



Today's global IT competition can also be viewed from a layered, stack perspective, as different nations/regions tend to have different strengths and weaknesses. Although there are obvious challenges in reducing complex global markets to a single image, we think the overall pattern in the figure above holds true. For example:

- Although China has tremendous strengths in engineering, components, and low-cost manufacturing, it isn't yet as far along in establishing its own global brands as Japan and Korea.
- India is in the opposite position. It is currently weak in systems and hardware and its domestic market lags, but its great skills in software have enabled its IT services firms to become important global players.
- Europe competes across most of the technology stack, but not always as successfully as it would like (hence the thin line). The UK semiconductor firm ARM (now owned by the Japanese firm Softbank) has been a big exception.
- The US has long dominated the IT stack. But can it maintain this status through the next great waves of digital innovation?
- The importance of the English language rises as we go up the stack.

In short, the national strategy of each player is to lengthen and/or thicken the arrows above, as discussed over the rest of this chapter. As suggested by the figure, the most intense competition today occurs in the lower half of the stack.

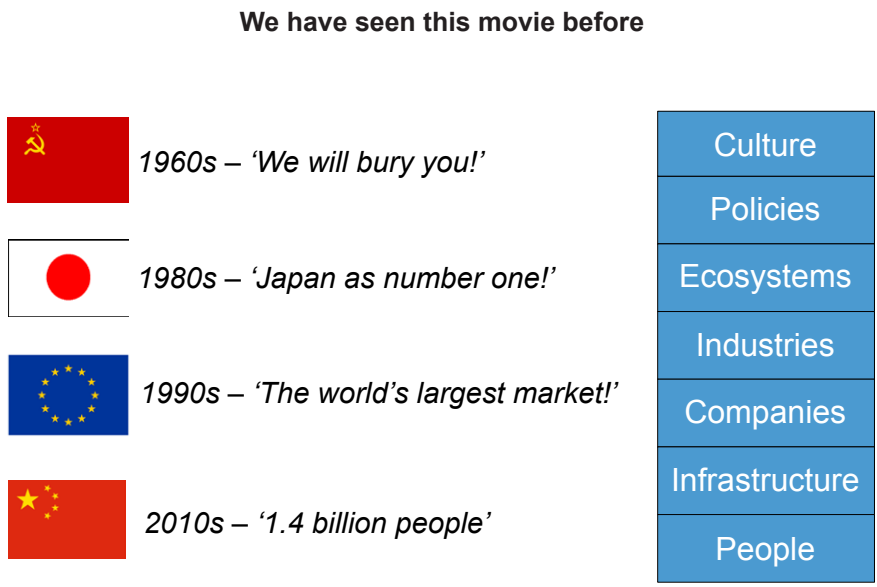


While American firms dominate the global IT industry, China has had two great successes. It's the world's leading high-tech manufacturer, and it has spawned its own set of powerful internet firms. This combination of global supply-side integration and domestic independence is an impressive strategic accomplishment. But China now has much greater ambitions, as it seeks to lead in many of the emerging areas shown in the figure. New markets often do result in new leaders.

Of course, we all know China has great strengths – 1.3 billion people, vast numbers of skilled engineers, a rapidly growing economy, rising wealth, and a strongly supportive state. But it also has major weaknesses – corruption, censorship, environmental degradation, and an often-unreliable legal system. These latter traits can make it difficult for China to attract and retain world-class talent.

Language is also a barrier. The number of people who speak some version of English or Chinese as either their first or second language is roughly the same, but English usage is growing faster. The global dominance of English makes it hard for Chinese firms to move up the stack.

But overall, we expect China to thrive in many emerging technology areas, as will many American and other firms. Borrowing a term long popular in the oil industry, people are now referring to the combined US and Chinese giants – Google, Apple, Facebook, Amazon, Microsoft, Alibaba, and Tencent – as the new *seven sisters*.

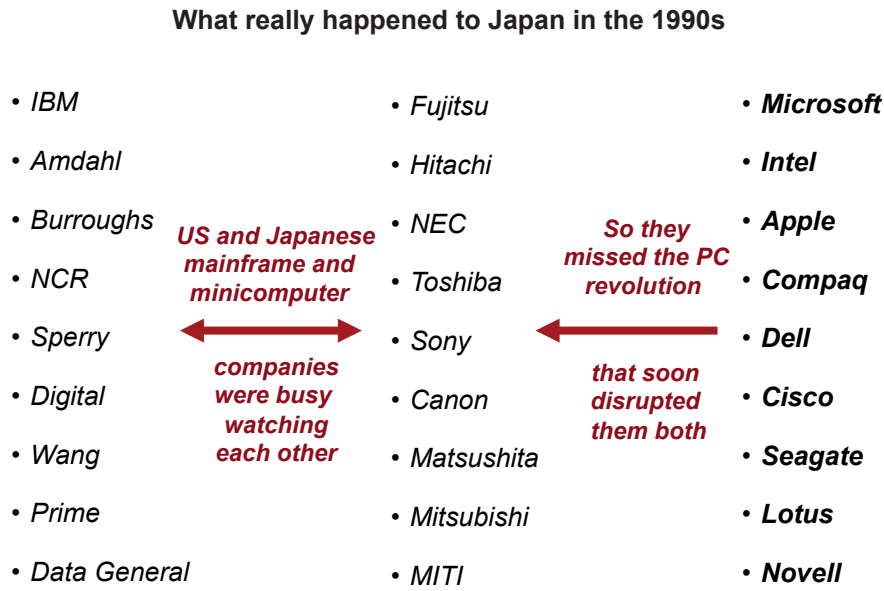


It's almost too easy for Americans to dismiss predictions that China will overtake the US in key technology markets. After all, we've heard similar forecasts for pretty much as long as the IT sector has existed, and they have always been decisively proven wrong. This history is shown in the figure, and briefly recapped below:

- In the 1950s and 60s, many 'experts' proclaimed that Soviet-style centralized five-year planning was the way of the future, essentially endorsing Nikita Khrushchev's prediction that: "History is on our side. We will bury you."
- In the 1970s and 80s, we were told that Japan had developed a superior form of capitalism based on close business / government cooperation, interlocking networks of firms (keiretsu), social cohesion, and long-term thinking. Ezra Vogel's *Japan as Number One*[22] (1979) became an international best-seller.
- In the 1990s, we were told that an integrated European super-state was destined to write the rules of global capitalism, that the Euro would rival or replace the dollar, and that being the world's largest market would prove decisive.

Of course, Japan has had many technology successes and Europe has important IT companies and policies, but none of this has changed global technology leadership. The question is whether things will be different with China. While there are many similarities, China seems to be avoiding the mistakes of its predecessors, as demonstrated by the comparison with Japan that follows.

22. Ezra Vogel, *Japan as Number One: Lessons for America*, Harvard University Press, 1979

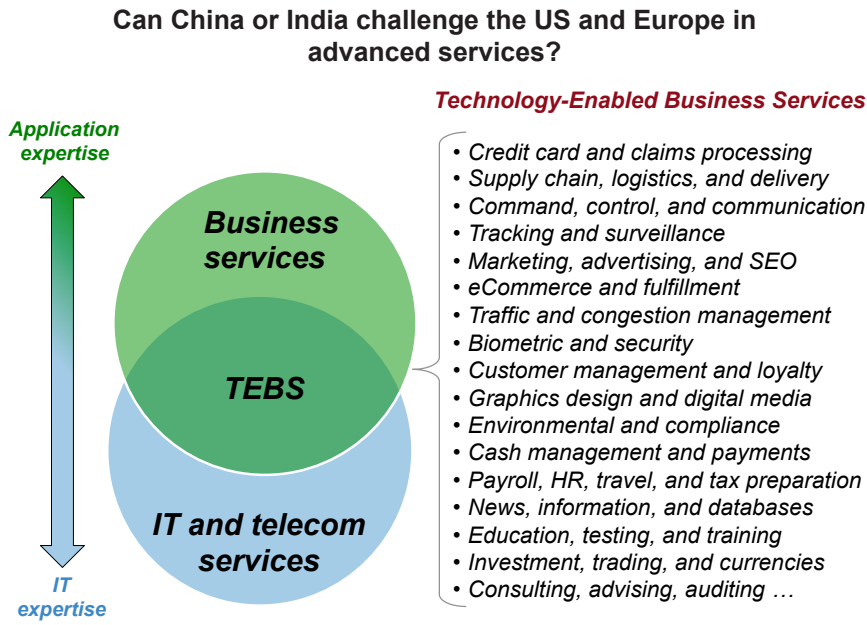


Unless you were actually in the tech industry in the late 1980s, it's hard to imagine how scared the US government and Silicon Valley were by Japan. In one commodity sector after another – memory chips, disk drives, printers, displays, etc. – giant Japanese conglomerates were combining high quality with low prices to put seemingly unbearable pressures on smaller US firms. Their eventual triumph seemed inevitable to many.

But by the mid-1990s, the threat was over. What happened? As shown in the figure, the major Japanese firms were fixated on IBM – and to a lesser extent the other US mainframe and minicomputer companies. They believed that if they targeted the current US leaders, they would eventually defeat them, hence their heavy emphasis on IBM-compatible mainframes, disk drives, PCs, and so on.

But just like IBM and the other US incumbents, the leading Japanese firms failed to see how specialized suppliers including Intel, Microsoft, Cisco, Seagate, and others were rapidly building a new PC-centric IT industry value chain. They also failed to see the decisive role of software – think of the iPod vs. the Sony Walkman.

China isn't making this mistake. While its internet firms do closely track the US leaders (Amazon/Alibaba, Google/Baidu, Uber/Didi, etc.), China also has many well-funded start-ups that are real innovators in emerging technology areas – including software and machine intelligence. It's a major strategic difference.

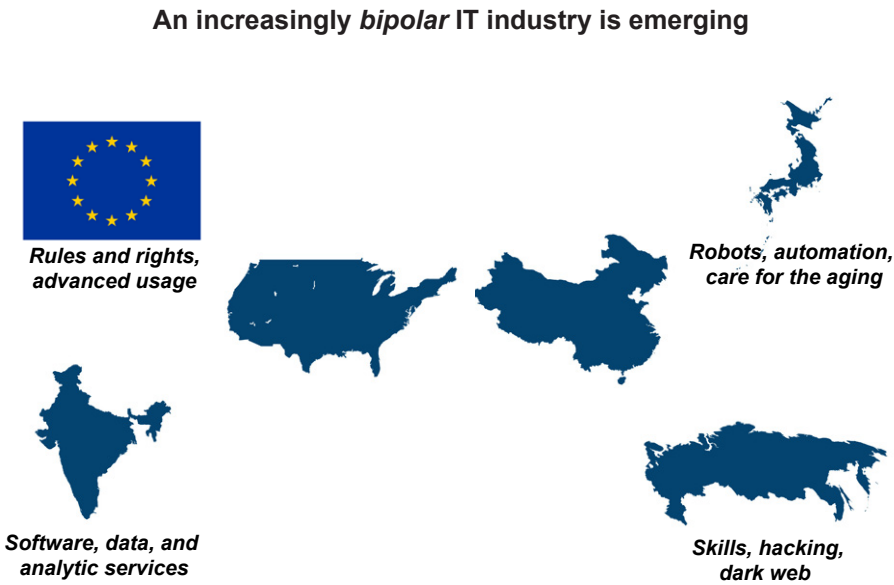


As discussed at the start of this chapter, the IT industry can be defined narrowly in terms of its key technology products, or much more broadly to include all the things that IT is used for.

This distinction is particularly relevant with 'services.' Defined narrowly, 'IT services' typically refer to companies such as IBM, Accenture, DXC, Cap Gemini, Infosys, and Wipro, and perhaps telecom services. But when defined broadly, it also includes both consumer services – Google, Facebook, etc. – as well as the Technology-Enabled Business Services (TEBS) shown in the figure. Both markets are critical to the future of global technology competition, but the significance of TEBS is often under-recognized.

Today, TEBS are dominated by US and European firms, but will this change? As of now, we think it's fair to say that China isn't focused on these markets (outside of China), and thus its global prospects do not look strong, although acquisitions are always a possibility.

India, of course, has a much stronger global services position than China, but mostly in back-office *outsourcing*. While becoming a brand-name TEBS supplier is a lesser challenge for India than for China, it isn't easy to establish the strategic customer relationships required. Thus, we expect India to make steady, but not rapid, TEBS gains at a brand-name level, while doing much of the IT work behind the scenes. However, here too acquisitions could certainly accelerate this progress.



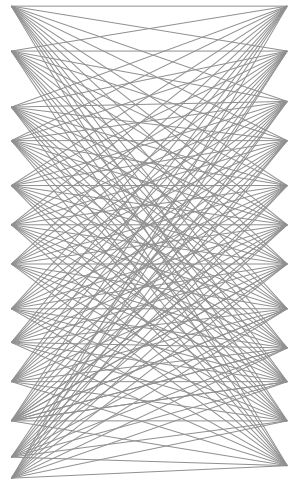
The figure above summarizes our overall competitive outlook, as expanded upon below (apologies to South Korea which could also have been included):

- The US position is currently so strong that some weakening seems inevitable, especially if America's technical education declines and/or Silicon Valley 'hollows out.' But the opportunities ahead are still tremendous.
- China will continue to be globally integrated and domestically independent. It will also lead (and establish its own brands) in many of the key markets of the 2020s.
- India's vast software, data, analytic, and mathematical skills will be essential in building an intelligent planet. It will slowly move up the services value chain.
- Europe will remain a leader in advanced services and usage. It will also help set many privacy, data usage, and competitiveness norms. But the likely loss of the UK will hurt its supply-side competitiveness.
- Japan's need to cope with a declining and aging population will further drive its emphasis on advanced robotics and automation.
- Russia has world-class mathematical and technology skills, especially for IT security. But can these talents be better leveraged outside of the dark web?

In short, the challenge of building an intelligent global economy is so great that the knowledge, skills, and energy of the worldwide IT community are needed. Nevertheless, the coming competition between the US and China will result in increasingly *bipolar* supply-side dynamics.

Smaller nations often have significant digital society advantages

- *Sweden*
- *Norway*
- *Denmark*
- *Finland*
- *Netherlands*
- *Ireland*
- *Iceland*
- *Estonia*
- *Israel*
- *Chile*
- *Taiwan*
- *Singapore*
- *New Zealand …*



- *Wired/wireless infrastructure*
- *Universal service/access*
- *Health/genetic records*
- *Digital IDs*
- *Smart grids*
- *Car sharing, self-driving*
- *Online voting*
- *Digital cash/payments*
- *Connected classrooms*
- *Shared ledgers*
- *Drone regulation*
- *Social media regulation*
- *Privacy/citizen rights*

For most of the IT industry's history, the great majority of nations were consumers of IT. Local governments and businesses chose which technology products and services to buy, but they had little influence on how the global IT sector evolved. Symbolically, in the 1970s and 80s, the largest office building in the capital city of many nations was IBM's. Local populations often bristled at this imbalance.

But since the emergence of the web, this dynamic has been shifting. The way that nations and their citizens use the internet varies widely, with most countries having their own important digital players. We expect this shift to accelerate during the Matrix era, as the emerging applications shown above will require complex local implementation.

We believe this argument can be taken further to predict that smaller nations will actually lead in many of the areas listed. The required decisions and investments – and their cultural implications – tend to be much more manageable than in, for example, the US, Japan, and the larger European nations, with their layers of interests, bureaucracy, and complexity.

We look forward to the 13 nations listed above (and many others) serving as laboratories for Matrix innovation. Taken together, they could put a very different spin on what we mean by *global technology leadership*, especially if any significant leapfrog dynamics emerge in the less developed world. The result will likely be diverse multipolar demand-side innovation, amidst increasingly fierce bipolar supply-side competition.

*"**Seeing Digital** is like a GPS guide to the 2020s"*

"Seeing Digital is an exceptionally well-done piece of work. It combines both an in-depth macro-economic analysis of the impact of the digital age, with all of its micro implementation challenges, while containing a number of useful frameworks to help parse the future. Not a comfortable read, but a very important one."

PROFESSOR F. WARREN MCFARLAN, HARVARD BUSINESS SCHOOL

"I have long been a fan of Dave's incredible talent for flagging important technology and business trends with insightful perspective. This book is the culmination of his many years of research and thought leadership. The book's use of graphics is simply terrific."

PATTY MORRISON, EXECUTIVE VP AND CHIEF INFORMATION OFFICER, CARDINAL HEALTH

"Seeing Digital" is simultaneously profound, practical and hopeful. It embraces the coming world of pervasive machine intelligence, while at the same time providing the tools needed to get digital 'right.'

DAVE VELLANTE, CEO, SILICONANGLE MEDIA & CO-HOST OF theCUBE

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"Such a great book; virtually every page contains an insight that will make you ask "Why didn't I see that?"

ROB ATKINSON, PRESIDENT, INFORMATION TECHNOLOGY AND INNOVATION FOUNDATION

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