WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

Industry Agenda

Digital Transformation of Industries

Demystifying Digital and Securing $100 Trillion for Society and Industry by 2025

In collaboration with Accenture

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Contents

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Foreword

There is widespread recognition among leaders in most industries that the role of digital technology is rapidly shifting, from being a driver of marginal efficiency to an enabler of fundamental innovation and disruption.

Digitalization is the cause of large-scale and sweeping transformations across multiple aspects of business, providing unparalleled opportunities for value creation and capture, while also representing a major source of risk. Business leaders across all sectors are grappling with the strategic implications of these transformations for their organizations, industry ecosystems and society. The economic and societal implications of digitalization are contested and raising serious questions about the wider impact of digital transformation.

While it is clear that digital technology will transform most industries, there are a number of challenges that need to be understood. These include factors such as the pace of changing customer expectations, cultural transformation, outdated regulation, and identifying and accessing the right skills, among others. These challenges need to be addressed by industry and government leaders to unlock the substantial benefits digital offers society and industry.

Digital Transformation of Industries (DTI) is a project launched by the World Economic Forum in 2015 as part of the Future of the Internet Global Challenge Initiative. It is an ongoing initiative that serves as the focal point for new opportunities and themes arising from latest developments and trends from the digitalization of business and society. It supports the Forum's broader activity around the theme of the Fourth Industrial Revolution.

A key component of the DTI project in 2015 has been the quantification of the value at stake for both business and society over the next decade from the digital transformation of six industries. The "compass" for these industry sectors is being set and it is imperative that all stakeholders collaborate to maximize benefits for both society and industry. Digitalization is one of the most fundamental drivers of transformation ever and, at the same time, a unique chance to shape our future. The World Economic Forum is committed to helping leaders understand these implications and supporting them on the journey to shape better opportunities for business and society.

In 2016, the DTI initiative will focus on the impact of digital transformation on an additional 10 industries, further deep-dives into industries from this year's project, as well as examine a number of cross-industry topics such as platform governance, societal impact, and policy and regulation.

The report was prepared in collaboration with Accenture, whom we would like to thank for their support. We would also like to thank the Steering Committee, the Working Group members, as well as the more than 200 experts from business, government and academia and over 100 Industry Partners who were involved in shaping the insights and recommendations of this project.

We are confident that the findings will contribute to improving the state of the world through digital transformation, both for business and society.

Jim Hagemann Snabe

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Executive Summary

The digital transformation of industries: An immense opportunity for industry and society

Rapid advances in digital technology are redefining society. The plummeting cost of advanced technologies (a top-of-the-range smartphone in 2007 cost $499; a model with similar specifications cost $10 in 2015) is revolutionizing business and society. And the combinatorial effects[1] of these technologies – mobile, cloud, artificial intelligence, sensors and analytics, among others – are accelerating progress exponentially. Technology is the multiplier.

Digital transformation provides industry with unparalleled opportunities for value creation. It used to take Fortune 500 companies an average of 20 years to reach a billion-dollar valuation; today's digital start-ups are getting there in four. Digital technologies are creating new profit pools by transforming customer expectations and how companies can address them. At the same time, digitalization could produce benefits for society that equal, or even surpass, the value created for industry – the mass adoption of autonomous vehicles and usage-based car insurance, for instance, could save around 1 million lives by 2025.

At present, digital transformation is not well understood, and a number of myths are obscuring the path to realizing its potential for value creation. The initiative demystifies some of the most common myths about digital, revealing, for example, the true extent of disruption by digital start-ups and how the impact of automation on employment is likely to be very different from today's received wisdom on the subject.

Action will be needed to realize the benefits to society and industry of digitalization

The importance of realizing the combined value of digital transformation cannot be overstated, given digitalization's central role in tackling many of the challenges we face today. For example, the world's energy and natural resource usage is unsustainable. Also, further increases in life expectancy are at risk without resolving the growing cost structures of overburdened health systems.

Yet the benefits of digitalization will not accrue automatically to industry or society, and there is a risk that the promise of digital transformation will go unfulfilled. Moreover, organizations do not always understand what impact their digital initiatives will have on different aspects of society – from employment to the environment and beyond – or what responsibility they should bear for addressing any unintended consequences of digitalization.

How can enterprises deliver combined value, maximizing benefits for both industry and society?

Our value-at-stake analysis suggests that the "combined value" – to society and industry – of digital transformation across industries is upwards of $100 trillion over the next 10 years. To assess how enterprises can maximize the value of digitalization for industry and society, four cross-industry themes were also analysed: digital consumption, digital enterprise, societal implications and platform governance. Individually and together, these themes represent dramatic shifts in the way demand is met by supply and the impact of digitalization on social outcomes.

From the nine industry and cross-industry white papers published this year, we have distilled our research and analysis down to a handful of key questions for industry leaders to consider and act on, to help deliver combined value.

Questions for incumbent industry leaders addressing digital transformation:

Governance and license to operate

- Do you have a digitally literate supervisory and executive board? Is it multigenerational, diverse and with sufficient expertise to advise on fast-moving business and technology topics such as cybersecurity on a permanent basis? Is digital transformation driven at the CEO and board level in your organization?
- Can you tie a value multiple of the societal benefits arising from your digital activities to the economic benefits? Are you communicating this with external stakeholders?

Business and operating models

- Is digital central to your corporate strategy and do you use data for real-time decision-making at scale? Are you working with industry clusters to create interoperability standards that address unmet customer needs?
- Do you have a platform business model strategy? Is it consistent with your role in the industry? Do you extend, maintain or change your role, and how will this affect your choices for creating a platform versus "plugging in" to others?
- Are you leveraging existing capabilities and making big bets in new and innovative digital business models? Is the risk-reward profile sufficiently ambitious to achieve top-quartile performance?

Talent and leadership

- Are you addressing both technical (e.g. data scientists) and creative (e.g. design thinking) digital skills in your talent strategy? Are you succeeding in recruiting the best talent and skills, flattening organizational hierarchies?
- As a CEO, are you frequently embedding digital into your online and offline interactions with employees? How do employees rate your effectiveness, and do you have an action plan to address dissatisfaction and remedy this in an open and transparent way?

Questions for governments/policy-makers addressing digital transformation:

Government/regulator operations

- Is your industry customer service model user-friendly, using open standards and easily accessible, in line with industry digital best practices?
- Do you provide a platform for rapid multistakeholder interaction and corporate consultation?
- Do you have clarity on the implications of global security, privacy and cross-border data flows in your industry? Do you have a timeline to coordinate and resolve challenges with industry stakeholders?

Government/regulator mission

- Do you understand the economic implications for industry when addressing societal opportunities? Are you implementing flexible policy frameworks to realize societal benefits in the short and medium term? What immediate changes could you consider for policies that are currently subject to legal challenge?
- What could you do to increase the relevance of regulations and policy frameworks to foster innovation while protecting customer interests?

Introduction to the Digital Transformation of Industries

During our research for the DTI initiative, we uncovered several influential myths about digital transformation. We believe that it is important to dispel these myths as a first step to securing the substantial economic, societal and environmental value that digitalization has the potential to deliver for society and industry. In addition to the examples highlighted below, we have also addressed additional myths in the cross-industry papers.

Common myths and realities about digital

Myth: Digital is the next dot-com bubble. The fad will end soon.

Reality: The train is leaving the station, and individuals and organizations need to get on board quickly

- Rapidly decreasing technology costs coupled with Moore's Law are creating combinatorial effects from technologies, such as artificial intelligence, big data, cloud and Internet of Things (IoT), which are combining to change how we interact and do business.
- For example, Didi Kuaidi, a leading Chinese ride-sharing service, was serving 3 million rides a day in July 2015. By December 2015, this had grown to 7 million – impressive for a taxi company that does not own a single taxi.
- Simple-to-use and scalable mobile technologies are creating similar "network effects". Despite recent devaluations of some unicorns, investors and corporates are investing in the "digital arms race" to create first-mover advantages in both B2C and B2B markets.

Myth: Digital transformation will widen inequality in developed and developing markets within a generation.

Reality: As in previous industrial revolutions, some workers will be displaced by new technology but digital also has the potential to promote inclusive growth

- The ability of technology to bring entire regions or socioeconomic groups out of poverty is remarkable. Notable examples include solar offering the prospect of clean, affordable power, and mobile solutions enabling farmers to sell their stock at market prices and predict weather conditions to protect historically volatile crop yields.
- Arvind Gupta, Head of the Digital India Foundation observes that "in India, digital transformation is a new jobs creator at the bottom of the pyramid. Digital technologies have also enabled 200 million Indians to open bank accounts in the last year alone".
- Recent research has identified that the biggest benefactors of the on-demand economy are demographics with below-median income.[2]

Myth: Incremental reform to regulation will be sufficient to keep up with digital innovation.

Reality: New frameworks are needed for regulation to remain relevant and not inhibit the realization of societal and industry value

- Innovation is moving much faster than regulation can keep pace. "Seven- to twelve-year regulatory policy timelines do not reflect the speed of the internet," says Jack Ma, CEO of Alibaba. "We should create an eWTO, led by business and supported by government."
- There are many potential negative unintended consequences that could result from digitalization. These include monopolies, single points of failure and violations of human rights such as privacy. At the same time, digital technologies have fostered innovation and significant gains in personal productivity, health and well-being, and environmental protection.
- Several ongoing regulatory changes are impacting world trade – for example, Safe Harbor, Google versus the EU Commission, and the Federal Aviation Administration and unmanned aerial vehicles (drones) – and are creating challenges to national boundaries, unfair competition and consumer protection. There are significant complexities in how to structure new regulations at the same time as existing ones are being displaced by self-regulation, such as customer reviews on TripAdvisor for the lodging and restaurant industries.

Onward and Upward? The Transformative Power of Technology

The digital revolution is already transforming many aspects of business and even whole industries. Just as the steam engine and electrification revolutionized entire sectors of the economy from the 18th century onward, modern technologies are beginning to dramatically alter today's industries.

Previous industrial revolutions have had huge societal impacts, supporting an explosion in the world's population over the past 200 years. The global population has doubled in the past 50 years and is forecast to grow to 11 billion by the end of the century. It took until 1804 for the global population to reach 1 billion. The most recent addition of 1 billion people took just 12 years.

To keep up with increasing demand, technology has had to accelerate. It has been frequently observed that improvements in computing power have largely kept pace with Moore's Law. After four decades of exponential increases, the world is now doubling an immense amount of processing power in every two-year period, which is leading to astonishing leaps forward in technological capabilities.

The cost of advanced technologies is also plummeting. Consider just one example: a top-of-the-range drone cost $100,000 in 2007; in 2015 a model with similar specifications could be bought for $500. As technology becomes cheaper, world demand is being met at lower price points and fueling an explosion of devices with ever more connections. Sophisticated artificial intelligence devices are now mass-market and better known as personal assistants by the names of Alexa, Siri and Cortana.[3] In less than five years, basic queries such as "What is the time?" have quickly moved onto more sophisticated requests such as "Does the person I just talked to like me?" Technology has been the multiplier.

The combinatorial effects of these technologies – mobile, cloud, artificial intelligence, sensors and analytics among others – are accelerating progress exponentially (see Figure 1). Once we overcome physical and chemical limitations that are inhibiting exponential gains in mass-market technologies such as battery storage and wireless charging, it is likely that the pace of change will accelerate even faster.

Figure 1. The combinatorial effects of new technologies are accelerating the pace of change

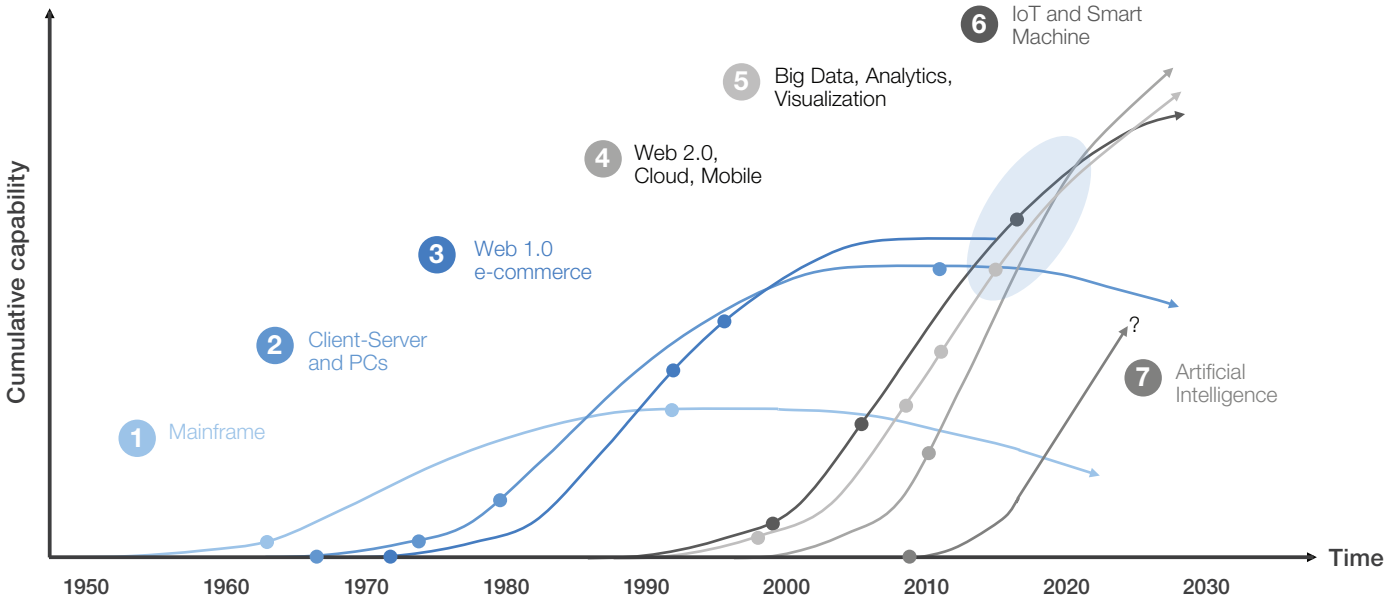


Figure 2: Industry digital initiatives identified in Phase 1 of the DTI project

Media	Health	Logistics	Automotive	Electricity	Consumer
Personalized Advertising	Patient Engagement at Scale	Logistics Control Towers	Infotainment	Energy Storage Integration	Data as an Asset
Personalized Content		Analytics as a Service	Usage-based Insurance	Digital Customer Model	Data Privacy and Transparency
Data Privacy and Transparency Reform			Multimodal Integration	Energy Solution Integration	Data to Improve Experience
Phygital: Digital Media becomes Physical	Precision Medicine	Drones		Energy Management	
'Advicetising': Advertising as Advice	Robotics	Autonomous Trucks	Connected Supply Chain		Physical Store Transformations
	Medical Printing	3D Printing	Digital Manufacturing	Asset Performance Management	E-commerce
	Accessible Intelligence	Crowdsourcing	Disrupted Retail	Digital Field Worker	Sharing Economy
Engage, Co-Create and Crowdsource	Connected Worker	Circular Economy	Connected Service and Maintenance	Smart Asset Planning	Smart Supply Chains
The Digital Organization	Intelligent Devices	Shared Transport Capacity	Transformed Digital Aftermarket	Energy Aggregation Platforms	Talent Management
Flexible, Predictive, Precise Content		Shared Warehouse Capacity	Automotive Data Marketplace	Real-time Supply and Demand Platform	Smart Factories
			Connected Infrastructure	Real-time Network Controls	
OTT and OTT 2.0	Virtual Care	Digitally Enhanced Cross-Border Platforms		Connected and Interoperable Devices	Hyper-personalization in Goods
Communities of Content	Connected Home	City Logistics	Assisted Driving		Products to services and experiences
IP Frameworks for the Digital Age		Same-day Delivery	Self-driving	Living Services	Health and Well-being goods and services

Growth through digitalization
customer facing revenue generation

Efficiency through digitalization
internally facing profit generation

Digital experience
combination of growth and efficiency

As technology becomes ubiquitous and accessible to the wider population, it is having a profound impact on how customers behave and the expectations they have. Customers across the B2C and B2B worlds are developing an insatiable demand for speed, convenience, contextualization and non-stop connectivity. Further, as newer generations are raised as "digital natives", they are not only harder to surprise, but can also imagine for themselves how technology can be used to improve their lives. It is possible that children born today may never need to drive a car due to autonomous-driving technologies. It is even possible that humans will colonize Mars within a generation.

Digital transformation provides industry with unparalleled opportunities for value creation from expanding profit pools, creating new revenue models and enabling unprecedented access to global markets. It used to take Fortune 500 companies an average of 20 years to reach a billion-dollar valuation; today's digital start-ups are getting there in four.

In Phase 1 of our analysis, we identified more than 65 digital initiatives across six industries that are leveraging digital technologies to deliver significant value for society and industry (see Figure 2).

Our analysis found that digitalization can produce benefits for society that equal, or even surpass, the value created for industry. Digital initiatives have the potential to improve environmental sustainability, create employment and make our lives safer. For instance, the mass adoption of autonomous vehicles and usage-based car insurance could save 1.1 million lives over the next decade.

The importance of realizing the combined value of digital transformation cannot be overstated, given digitalization's central role in tackling many of the challenges we face today. For instance, the world's energy usage is unsustainable, with emissions from the energy sector doubling over the three decades to 2012. The world's population is forecast to keep growing, increasing pressure on food supplies and natural resources. Maintaining the current trend of rising life expectancy will become more taxing, as overburdened health systems struggle to cope with ageing populations.

No Guarantee: Action Is Needed to Realize Societal and Industry Value

The value of digitalization will not accrue automatically to industry or society. There is a risk that the promise offered by the digital transformation of industries will go unfulfilled. There are barriers to realizing both industry and societal value. Here, we highlight some of the most important ones:

1. **Lack of collaboration for societal gains.** At present, incentives primarily focus on meeting profit targets, undermining collaboration and the potential for maximizing societal benefits. Investors are not yet adequately rewarding public companies for the benefits they produce for society in addition to the profits they earn.

Case study

The introduction of usage-based insurance for cars clearly illustrates how unaligned incentives can derail societal gains. Our value-at-stake analysis estimates that usage-based insurance can save more than 150,000 lives by 2025. However, it is not being widely rolled out in countries such as the United States because the profits and costs from the service are being unevenly distributed. In a low-margin environment, it is not mandatory for car manufacturers to install the telematics equipment that is needed for usage-based insurance. This is because the cost cannot be easily passed onto consumers, so insurers are currently reaping the benefits with optional add-ons. Accurately priced insurance means lower costs to consumers, fewer accidents and reduced crash costs for all stakeholders. A win-win-win for customers, industry and society that is not yet in place – much like seat belts were not mandated in cars when originally conceived.

2. **Regulation and protection of consumer interests.** Innovation is taking place at a far greater speed than regulation can keep up with. Regulatory frameworks that were originally put in place to protect consumers are no longer always appropriate. Possible new frameworks, such as self-regulation through customer reviews, include substituting legacy legislation. For example, the logistics industry alone contributes 13% to global emissions, but stakeholders need to act quickly to develop safe and trustworthy approaches to unlocking benefits from digital technologies such as drones. With the promise of reducing emissions by up to 90% and costs by 25% in last-mile deliveries, drone technology is ready but regulation is not.
3. **The innovator's dilemma.** Publicly listed incumbents are being held back from radical innovation, as a result of a conservative corporate culture and the short-termism of investor interests. For instance, some technology companies are taking a revolutionary approach to building driverless cars (e.g. Google Lidar), while some car manufacturers are taking an evolutionary approach (e.g. GM SuperCruise) through assisted driving technologies. In the electricity industry, despite the societal benefits of decentralized renewable energy, few utilities are actively cannibalizing their existing business to offer subsidized renewable technologies such as solar. Clayton Christensen's theory continues to hold true: the pace and scale of societal gains from digital will be slower through disruption by new entrants than through innovation led by incumbents.
4. **Skills for tomorrow's workforce.** Significant skills gaps exist today and are projected to grow in the future for digital roles. STEM (science, technology, engineering and mathematics) skills are often a focus, but robots lack the qualities of creativity and empathy that are crucial for many roles in the labour market. For example, Cisco has identified 1 million unfilled digital security roles globally. Likewise, Brazil faces a shortage of 360,000 engineers and technical workers. Digital skills are not just for front-line employees, as the boardroom is a critical hotspot for improving digital literacy. One example is Clara Shih, the 33-year-old CEO of Hearsay Social, who was recently appointed to the board of Starbucks. However, multi-generational and digitally literate boards like Starbucks's are the exception, not the rule.

Digital is having a profound effect on business, fundamentally changing how customers behave and disrupting the competitive dynamics of industries, requiring incumbents to become more agile to stay ahead of evolving customer expectations. Moreover, organizations do not always understand what impact their digital initiatives will have on different aspects of society – from employment to the environment and beyond – or what responsibility they should bear for addressing any unintended consequences of digitalization. Much of this is covered in the wider work that the World Economic Forum is initiating around the Fourth Industrial Revolution and will be covered in greater detail in the Digital Transformation of Industries initiative in 2016.

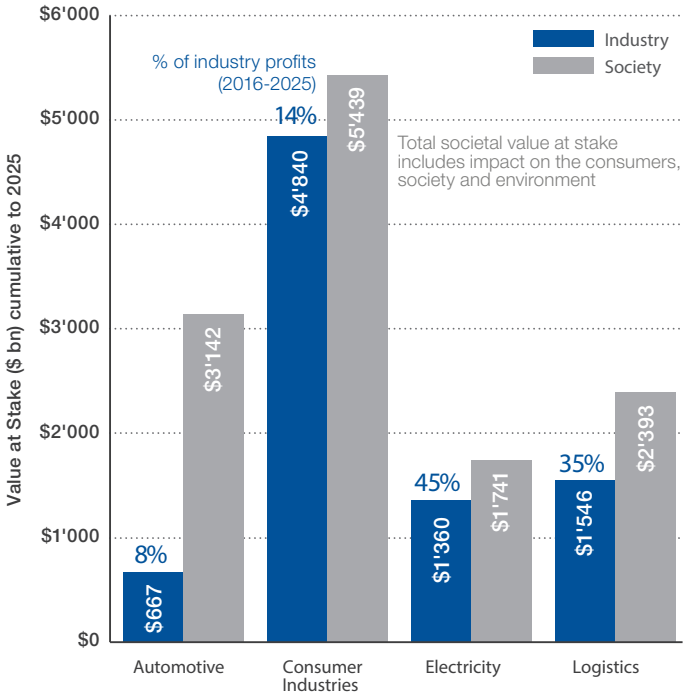
Digital Transformation: Value at Stake for Society and Industry

How can enterprises deliver $100 trillion of combined value, maximizing benefits both for industry and society?

To help answer this question we have sought to provide an evidence-based insight into the potential value of digitalization for both industry and wider society. We have so far conducted a detailed quantitative analysis of the value at stake from the digital transformation of four industries (automotive, consumer, electricity and logistics) and are continuing to do this across another dozen.

Our analysis suggests that the potential cumulative value to society and industry is more than $20 trillion to 2025 from the digitalization of just these four industries. Our analysis also identifies significant differences in the impact across industries, as illustrated in Figure 3. Digital transformation could impact electricity operating profits by nearly 50%, whereas we estimate the effect could be less than 10% for automotive. The differences between industries are primarily a function of the maturity of digital disruption in the industry and the pace at which initiatives have a significant impact. For example, driverless cars will be significant in automotive in the long term, but even with falling technology costs, adoption rates make it unlikely that autonomous vehicles will form a major proportion of car sales within the next decade – especially given that the average age of a car in the United States is over 11 years.

Figure 3. Digital transformation has greater value at stake4 for society than industry



Scaled up beyond these four sectors, the prize from the digital transformation of industries could be as much as $100 trillion.

Our value-at-stake analysis focused on the digital themes that were identified during in-depth research into each of these four industries. Our insights are explained in full in industry-specific white papers,[5] but here is an overview of the analysis for these four industries plus two industries (healthcare and media) where quantitative analysis is in progress:

Automotive

We have identified the connected traveller, autonomous driving, and digitizing the enterprise and ecosystem as themes that will be central to the digitalization of the automotive industry. Our analysis suggests that there is a $0.7 trillion opportunity to create value from the digital transformation of the automotive industry, through initiatives such as channel migration to virtual purchases, value-added subscriptions and next-generation servicing. The value created for society is likely to be even higher – up to $3.1 trillion – through reduced crash costs, lower insurance premiums, fewer road casualties and lower carbon emissions.

There are, however, barriers to realizing this value. First, regulatory constraints exist in some markets, preventing, for instance, original equipment manufacturers (OEMs) from operating as direct-to-market dealers. Second, without democratizing the flow of profits from usage-based insurance, the telematics solutions that underpin this business model are unlikely to be installed as standard in most cars. As a consequence, efforts to reduce the global death toll from road accidents (currently 1.25 million people a year) are being held back. Finally, the innovator's dilemma discourages incumbents from going beyond incremental innovation or partnering with technology companies to deliver more innovation.

We pose three questions to the automotive industry to address these opportunities:

- What incentives can cities and governments provide to prioritize self-driving and multimodal integration (to catch up with leading cities such as Gothenburg and Singapore)?
- How can the automotive industry collaborate with stakeholders in the private and public sector to save lives, for example, by offering mandatory telematics solutions bundled with car sales and insurance?
- How can the automotive industry create a greater democratization of the flow of profits from data platforms to accelerate societal benefits such as reduced fatalities and lower emissions?

Consumer

Consumer industries touch people's lives in a way that few other industries can match. Every day, 2 billion people – almost a third of the world's population – use the products of just one global consumer products company. Consumer industries in aggregate are also the largest industry with a global market size of over $15 trillion, from agriculture to retail.

We have identified four digital transformation themes – consumer data flow and value capture, experience economy, omni-channel retail and digital operating model – that we expect to play an important role in the future evolution of consumer industries. The single largest theme we have assessed so far has been omni-channel retail. We estimate nearly $5 trillion in societal impact can be found through cost savings and productivity improvements for consumers and society. Time savings from shopping online and fewer single-driver cars on the road, coupled with alternative last-mile delivery options such as drones, can have a significant impact on emissions.

We pose two questions to the consumer industry to address these opportunities:

- With over $600 billion at stake for industry and $2.8 trillion for society, e-commerce is the single largest digital initiative we have identified across industries so far. Internet access and last-mile delivery are critical to realizing this value, so how can consumer, telecoms and logistics industries collaborate to realize this potential?
- The sharing economy is estimated to have over $2 trillion of societal impact. What innovative business models can incumbents deploy to increase second-hand goods sales while also fueling 'new demand' growth?

Electricity

The electricity sector is ripe for realizing value from rapid digital transformation; we estimate that there is more than $1.3 trillion of value for industry with a further $1.7 trillion for society to be captured globally from 2016 to 2025. Five initiatives are worth more than $100 billion over the next 10 years and should be prioritized for investment. These include asset performance management, energy solution integration, energy storage integration and real-time network clouds. Initiatives that play "beyond the electron" could not be quantified and are excluded from the value at stake analysis. Nevertheless, big wins in customer value are expected for those that move such services quickly to market.

Value creation for both industry and society has become a win-win and electricity players have an important role to play in capturing the societal benefits of digitalization. Our estimates of the societal benefits are modest and include just three factors: value creation to customers (worth nearly $1 trillion), reduction in carbon emissions (approximately $750 billion) and net job creation (about $270 billion).

We pose three questions to the electricity industry to address these opportunities:

- How do you reimagine the design of the energy system, given near-term digital and technological innovations which include predictive forecasting and energy storage? What infrastructure and systems are required to meet tomorrow's energy demand?
- In economies transitioning to a lower carbon, more decentralized energy system, what incentives can be created by regulators and policy-makers to optimize the electricity system and create a better functioning market?
- What business- and operating-models are pre-requisites for energy companies to gain a greater share of the future industry profit pools beyond the electron – for instance, from connected home, smart car, buildings and cities and industrial services?

Logistics

We have identified that information services, logistics services, delivery capabilities, circular economy and shared logistics capabilities are central to the digitalization of the logistics industry.

Our analysis indicates there is $1.5 trillion of value at stake for logistics players, with the potential for a further $2.4 trillion worth of societal benefits, as a result of digital transformation over the next decade. The largest impact of digitalization to the logistics industry is likely to come from crowdsourcing. It will allow newer entrants to grab a share of the market from existing players. At the same time, it will allow smaller trucking companies to improve their utilization levels by as much as 20%, which could provide an uplift to their bottom line. As these platforms offer better rates, convenience and real-time tracking, it could lead to savings of $789 billion to the customers. For society, the largest improvement will come through better utilization rates. We also estimate that emissions could be reduced by as much as 3.6 billion metric tons over the next decade. Digital in logistics alone has the opportunity to reduce emissions by 10-11% by 2025.

We pose three questions to the logistics industry to address these opportunities:

- Should the larger industry players continue to invest in scaling their existing closed platforms or should they be adding new business models such as crowdsourced platforms and analytics as a service?
- How can logistics stakeholders incentivize faster implementation of shared warehouse and transportation capacity to reap significant societal and customer benefits?
- Logistics contributes 13% of all emissions globally. In light of the COP21 agreement in Paris, how can industry stakeholders quickly agree on developing safe and trustworthy approaches to more environmentally friendly technologies such as autonomous trucks and drones?

Media

Personalization and contextualization, content fragmentation, and partnerships and industrialization are the themes that we believe will underpin the digital transformation of the media and entertainment industries over the next decade.

The media industry is already more digital than many other industries, having been transformed by several waves of innovation – desktop internet, mobile, social and now, the Internet of Things. Digitalization has unleashed an explosion of content that is fragmented across multiple channels and platforms. There are significant opportunities for media enterprises if they can successfully personalize their content and adverts to engage the user, create new services that bridge the physical and digital words, and industrialize their content production and monetization processes.

The sector also faces some significant barriers to realizing value from digitalization. Notably, intellectual property and regulatory frameworks have not kept pace with customer behaviour, forcing the industry to make a choice between defending outdated frameworks (for example, by prosecuting copyright infringers) and evolving legal and commercial frameworks to better meet the needs of customers.

Healthcare

Today's model of healthcare provision is becoming increasingly unsustainable. To deliver continued improvements to the world's health, healthcare will need to be transformed, with digital playing a central role.

Although few industries have the potential to be changed so profoundly by digital technology as healthcare, the challenges facing innovators should not be underestimated. Our analysis of healthcare and digital trends highlights some of the regulatory barriers, economic hurdles and difficulties in effectively digitizing patient data awaiting those who wish to launch pioneering services.

We have identified four digital themes – smart care, care anywhere, empowered care and intelligent healthcare enterprise – that will be of crucial importance to the digital transformation of healthcare over the next decade.

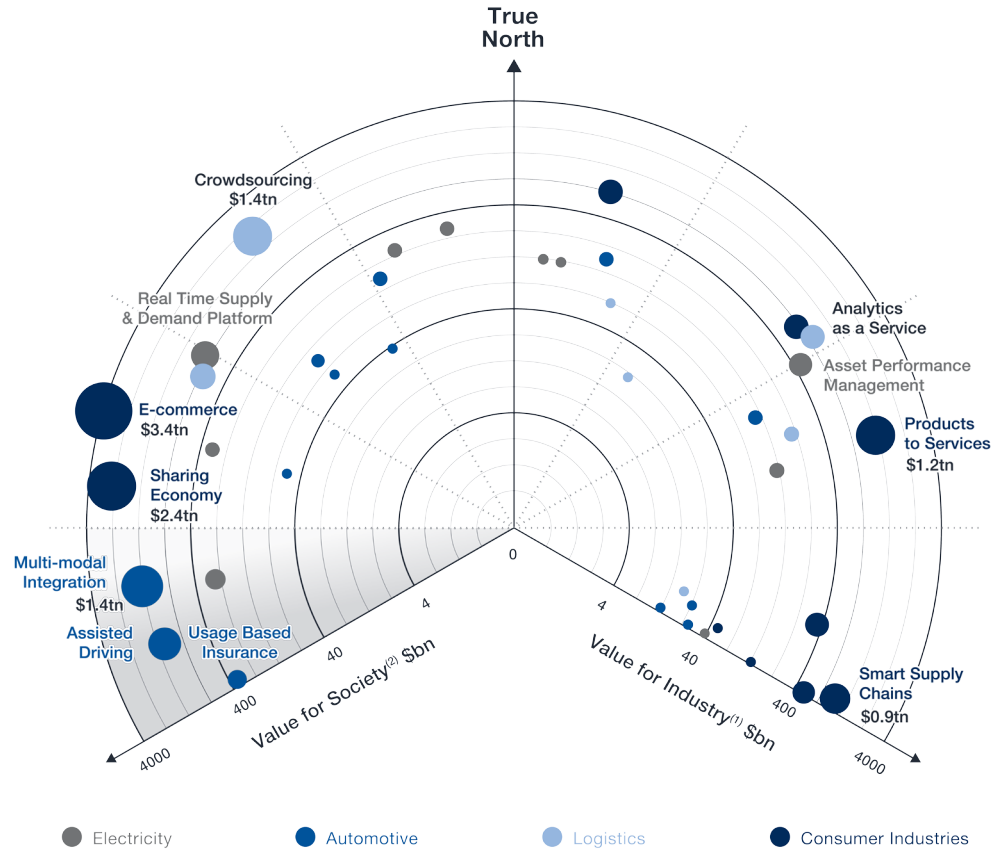
Our recommendations for businesses include formulating an outside-in strategy (through shifting the focus from managing inputs to delivering medical outcomes), creating a culture of iterative innovation and championing the customer experience. For governments and policy leaders, recommendations include liberating data sources, investing in data standards and infrastructure, and establishing interoperability requirements on a global level.

Projecting the value of digitalization to society and industry

For the four industries we have quantified so far, we have projected the potential value digital transformation could deliver to industry and society over the next decade.

As Figure 4 illustrates, some digital themes are set to deliver benefits to both society and industry, while other initiatives will need multistakeholder collaboration to align industry value with societal benefits (above the dotted line). In our societal implications white paper, we outline some key actions that organizations can take – either independently or in collaboration with industry peers, policy-makers, regulators and NGOs – to ensure that key challenges facing society move into the 'sweet spot' of alignment between market forces and societal value.

Figure 4. Value to society and industry from digital themes in the automotive, consumer, electricity and logistics industries



Notes: (1) We use a logarithmic scale for the value for Industry and Society with Industry value represented by cumulative operating profit from 2016-25; (2) Total Societal Value at Stake includes impact on the consumers, society and environment; (3) Bubble size indicates the combined business and societal annual impact in 2025. Impact on external industries has not been considered. Sources: World Economic Forum, Accenture Analysis

What Can all Industries Learn from Digital Transformation?

Our industry-specific research and value-at-stake analysis have helped us identify the four cross-industry themes to focus on in the first year of the DTI project. For the first three themes, we have published white papers on the World Economic Forum website. For the fourth theme, platform governance, we have curated a selection of insights into the issue, which will also be available on the website.

Digital consumption

The relentless pace of technological progress is contributing to a constant reshaping of customer expectations. At the same time, expectations now transcend traditional industry barriers, with customers expecting levels of personalization, on-demand access and accessibility that match the leaders in customer experience. The race for companies to deliver what digital, on-demand customers want has sped up dramatically.

We identify three new battlegrounds where enterprises will need to compete to win over the "digital customer":

Products and services to experiences. A number of companies are using digital technologies to offer customers unique and unforgettable experiences, as enterprises are seeing customer experience as an increasingly important differentiator. One example is how Monsanto is offering targeted intelligence to farmers in real time, helping them maximize yields in any weather and soil conditions. The offering also feeds back to Monsanto by using the weather and yield data to develop better farming products and offer a more personalized experience to farmers.

Hyper-personalization. Customers increasingly expect personalized and highly relevant interactions, catering to their individual contexts. Digital technology is enabling companies to meet these expectations by delivering personalization to large numbers of customers at low cost. One example is Ginger.io, which uses artificial intelligence in its mobile app for mental health patients that safely and securely uses data from a patient's everyday mobile usage. The app in several cases can predict signs of depression for individual patients up to two days before outward symptoms manifest. Currently, it offers programmes to help people with chronic conditions such as bipolar disorder, depression, schizophrenia and anxiety.

Ownership to access. Customers are attracted by the convenience of on-demand access, the prospect of financial savings and its potential to improve their quality of life. Companies traditionally engaged in ownership models are evaluating opportunities to cater to new expectations of access. BMW is an early example of a company adapting to the collaborative economy with its own sharing service. It gives users on-demand access to BMW i electric cars, based on the principle of "pick up anywhere, drop off anywhere". Customers are billed by the minute, with fuel costs, insurance and parking charges in public car parks included.

Digital enterprise

Building on the insights from the digital consumption theme, we offer some pragmatic recommendations about how enterprises can formulate and implement strategies to succeed in the battle to attract and retain digital customers.

We argue that, although disintermediation and disruption are happening, it is not too late for analog incumbents, which we define as successful enterprises that predate the digital revolution, to compete with digitally native start-ups. Analog enterprises need to digitize quickly, using their existing assets, such as vast volumes of customer data and invested capital, to radically remodel their business.

We focus on four areas:

Digital business models. Companies need to fundamentally change the way they identify, develop and launch new business ventures. One example is tire manufacturer Michelin. They have leveraged the IoT to shift from a business of selling tires to selling outcomes, a performance promise backed by a money-back guarantee. EFFIFUEL is a comprehensive ecosystem including sophisticated telematics and training in eco-driving techniques, while EFFITIRES is an optimized tire-management system. The service can lead to a reduction in fuel consumption of 2.5 litres for every 100 kilometres driven, representing an average annual saving of $3,300 for long-haul trucks (equivalent to at least a 2.1% reduction in total cost of ownership for truck fleet operators). The fuel savings also cut eight tonnes of CO_2 emissions.

Digital operating models. We identify operating model archetypes designed for the digital era and outline the steps needed to implement them. Digital leaders follow a lean approach to both core and support functions. One example is Xiaomi, a low-end Android smartphone manufacturer and also the second most valuable unicorn. In 2014, it

sold 61 million handsets, bringing in annual revenues of more than $12 billion. Xiaomi promotes an entrepreneurial culture, fostering a family-like setup, focused on mentoring, collaboration and adhocracy. Xiaomi's flat structures consist of its core founders, department leaders and 4,300 employees with an intense focus on performance and quality. The company engages customers in an informal way by involving fans in discussions on product design, product development and promotions.

Digital talent and skills. We look at how enterprises can attract, retain and develop the right digital talent. We also highlight the imperative for organizations to encourage millennials to join their workforce and adapt to different ways of working, whether it's integrating robots or on-demand workers. One example is at Zappos, an online clothing retailer. Zappos believes that "the best ideas and decisions are made from the bottom up". Soon, Tony Hsieh may not carry the title of CEO but become another employee with no title. Holacracy, a management structure based on the tasks a company needs to accomplish, rather than a standard reporting structure, is at the core of Zappos culture.

Digital traction metrics. We outline the digital traction metrics that matter and explain the importance of monitoring – and reacting to – them in real time.

Societal implications

Digital transformation is also starting to have profound societal implications. Our initial value at stake analysis suggests that the digital transformation of industries has the potential to deliver societal benefits that are greater than the value generated for industry. However, organizations looking to realize that societal value face some substantial challenges, which can only be overcome through collaboration with other businesses, regulators and policy-makers.

We highlight three issues:

Employment. Overall, there is huge uncertainty about the impact of digital transformation on jobs, with concerns also about its impact on wages and working conditions. But digital also has significant potential to create employment. A huge premium rests on the near-term ability of businesses to upskill employees and shape the next generation of talent for the machine age. An example of a multistakeholder approach to this challenge can be found in Italy, where the Ministry of Labor and Social Policy launched the project Growing Up Digital in collaboration with Google and Unioncamere in September 2015. The project offers the 84,000 young people who are members of the Youth Guarantee programme the opportunity to deepen their knowledge and skills of digital through 50 hours of free online training.

Environmental sustainability. We have so far failed to de-couple economic growth from emissions growth and resource use. Current business practices will contribute to a global gap of 8 billion tonnes between the supply and demand of natural resources by 2030; translating to $4.5 trillion of lost economic growth by 2030. Moving to a more sustainable world requires a number of hurdles to be overcome, not least relating to the adoption of new, circular business models and the environmental impact of digital technology itself. Some leading technology companies are already acting to shrink their environmental footprint. In fact, 27 technology companies now use 100% renewable energy in their operations, including Intel, Apple, SAP, Datapipe and Motorola. Similar action is needed across all sectors beyond technology.

Trust. Social media, RFID tags and user-generated websites have all been instrumental in increasing the transparency of businesses and overcoming information asymmetries. However, according to the Edelman Trust Barometer, trust in all technology-based sectors declined in 2015, with concerns over data privacy and security a key factor. Going forward, establishing new norms of ethical behaviour with digital technology and establishing higher levels of trust with stakeholders will be critical elements of successful digital transformation. One example of an attempt to build trust in technology is the search engine DuckDuckGo, which allows users to search anonymously without their profile being shared. In early 2013, it handled about 1.7 million queries per day. Following the Snowden revelations of government surveillance, the number of daily queries doubled in the second half of 2013. By early 2015, queries had reached more than 7 million.

Platform governance

The largest technology companies globally have grown rapidly over the last 10 years and these "super platforms" are beneficial to society in terms of the expansion in innovation, productivity, consumption and entrepreneurship. However, with the fast pace of technology developments, regulators are challenged to protect consumer interests on topics such as trust, security and fairness in a timely manner. We are seeing these challenges pronounced in public debate around national security, unfair competition (search and sequencing), usage of content and consent, and data protection. To tackle these challenges in the future, we posit four distinct governance models for the platform economy. Each model is characterized by the party that would be responsible for governance: no one; a government or set of governments; the platform itself; and a global, multistakeholder community. Critical questions for leaders to consider going forward include:

– What are some of the unintended consequences (both positive and negative) of platforms? How should consumer interests be protected?
– What adaptive frameworks for regulating platforms could be put in place to continue unlocking societal benefits?

Further research and analysis is due to be conducted on platform governance throughout 2016.

Digital Transformation of Industries: Implications for Industry and Society Leaders

"We learned this from the consumer internet world: by the time it's obvious, it's too late. What that means is, now is the time to act. That you've got to realize we're in the first two minutes of a soccer match; by halftime it's too late."

– Bill Ruh, Chief Executive Officer, GE Digital, USA

Digital transformation poses a formidable, multidimensional challenge for leaders. First, there is the difficulty of identifying where customer expectations and technology, which are both advancing at breakneck speed, will go next. Then there is the challenge of radically and rapidly reshaping a large enterprise, possibly cannibalizing its existing business, to compete with digitally native start-ups. Finally, leaders have an important role to play – in collaboration with others – in tackling the complex task of ensuring that the value of digitalization to both society and industry is realized as fully as possible.

From the industry and cross-industry deep dives that have been assessed this year, we have distilled our research and analysis down to a handful of key questions for leaders to consider and act on, to secure the $100 trillion value at stake for society and industry.

Questions for incumbent industry leaders addressing digital transformation:

Governance and license to operate

- Do you have a digitally literate supervisory and executive board? Is it multigenerational, diverse and with sufficient expertise to advise on fast-moving business and technology topics such as cybersecurity on a permanent basis? Is digital transformation driven at the CEO and board level in your organization?
- Can you tie a value multiple of the societal benefits arising from your digital activities to the economic benefits? Are you communicating this with external stakeholders?

Business and operating models

- Is digital central to your corporate strategy and do you use data for real-time decision making at scale? Are you working with industry clusters to create interoperability standards that address unmet customer needs?
- Do you have a platform business model strategy? Is it consistent with your role in the industry? Do you extend, maintain or change your role, and how will this affect your choices for creating a platform versus "plugging in" to others?
- Are you leveraging existing capabilities and making big bets in new and innovative digital business models? Is the risk-reward profile sufficiently ambitious to achieve top-quartile performance?

Talent and leadership

- Are you addressing both technical (e.g. data scientists) and creative (e.g. design thinking) digital skills in your talent strategy? Are you succeeding in recruiting the best talent and skills, flattening organizational hierarchies?
- As a CEO, are you frequently embedding digital into your online and offline interactions with employees? How do employees rate your effectiveness, and do you have an action plan to address dissatisfaction and remedy this in an open and transparent way?

Questions for governments/policy-makers addressing digital transformation:

Government/regulator operations

- Is your industry customer service model user-friendly, using open standards and easily accessible, in line with industry digital best practices?
- Do you provide a platform for rapid multistakeholder interaction and corporate consultation?
- Do you have clarity on the implications of global security, privacy and cross-border data flows in your industry? Do you have a timeline to coordinate and resolve challenges with industry stakeholders?

Government/regulator mission

- Do you understand the economic implications for industry when addressing societal opportunities? Are you implementing flexible policy frameworks to realize societal benefits in the short and medium term? What immediate changes could you consider for policies that are currently subject to legal challenge?
- What could you do to increase the relevance of regulations and policy frameworks to foster innovation while protecting customer interests?

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Endnotes

1 As referenced in *The Second Machine Age* (Brynjolfsson, McAfee, January 2014).

2 Arun Sundararajan, New York University, September 2015.

3 Artificial intelligence device names relate to Amazon (Alexa), iOS (Siri) and Microsoft (Cortana).

4 A detailed explanation of the value at stake methodology is available at http://digital.weforum. org

5 All white papers are available at http://digital.weforum.org. We also identified digital themes for the healthcare and media industries but have not yet conducted a value-at-stake analysis for these industries.

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