Unlocking Digital Value to Society: A new framework for growth
The Digital Transformation Initiative

The Digital Transformation Initiative (DTI) is a project launched by the World Economic Forum in 2015 as part of the System Initiative on Shaping the Future of Digital Economy and Society. It is an ongoing initiative that serves as the focal point at the Forum for new opportunities and themes arising from latest developments in the digitalization of business and society. It supports the Forum’s broader activity around the theme of the Fourth Industrial Revolution.

To find out more about the DTI project, visit http://reports.weforum.org/digital-transformation
Remarkable advances in technologies such as artificial intelligence, data analytics, autonomous vehicles and cloud computing are transforming our world. Digital transformation is redefining industries, making new business models possible and providing businesses with unparalleled opportunities for value capture. Its impact, however, will not be limited to business; it is already dramatically changing how we live, work and relate to one another. Digitalization has the potential to deliver immense benefits for consumers, society and the environment, and to unleash unintended consequences that may have a profound effect on society.

But a key question remains unanswered. What is the real value to society of digital transformation? This white paper aims to fill that gap with a novel framework to support policy-makers and businesses address the societal implications of their digital policies and investments, and to begin a broader dialogue on how we refine and use that approach. This report is an effort to ensure that the digital revolution and its benefits accrue to all.

The World Economic Forum is committed to helping leaders understand the implications of digital technologies and supporting them on the journey to shape better opportunities for business and society. The Digital Transformation Initiative (DTI) is a project launched by the World Economic Forum in 2015 to serve as the focal point for new opportunities and themes arising from latest developments in the digitalization of business and society. It supports the Forum’s broader activity around the theme of the Fourth Industrial Revolution.

Our research has generated a wealth of insights, two of which are particularly significant. First, digitalization has the potential to generate immense value, with around $100 trillion at stake for industry and wider society over the next decade. Second, the vast majority of this value is likely to accrue to society, rather than business. Unfortunately, it is by no means guaranteed that the full value to society of digitalization will be captured, as a new paradigm to assess value is needed and barriers have to be addressed. These include outdated and complex regulatory frameworks, infrastructure gaps, a lack of public trust in innovative technologies and a lack of incentives to realize societal value.

To support efforts to maximize the value that digitalization could deliver, we have developed a unique economic framework which aims to quantify the impact of digital transformation on industry and wider society. Our framework is pioneering and will be further iterated and refined over the next year. However, it can already be applied at all levels of government and business, helping stakeholders make the right decisions to deliver the full potential of digital transformation. By providing a consistent evidence base and library of digital initiatives, it will help to foster a global, multistakeholder dialogue about digitalization and its implications. We have achieved proof of concept of the framework at an industry level and successfully piloted its application at a national and state level (in the United Kingdom, Denmark, India and the Indian state of Telangana). Our focus will now be to put the value-at-stake framework at the heart of a public-private dialogue on digital transformation. We plan to move from conceptual rigour to practical application and learning, and we welcome collaboration from all areas of business and society to support this effort.

This white paper on Societal Value and Policy Imperatives was prepared in collaboration with our professional services partner, Accenture, who we would like to thank. We are also grateful to the Danish Ministry of Business and the State of Telangana for their collaboration. Moreover, we would like to acknowledge the contribution of the more than 50 experts from business, government, academia and the Forum’s Industry Partners who were involved in shaping the insights and recommendations.

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

In a world where game-changing innovation has become the new normal, the World Economic Forum’s Digital Transformation Initiative (DTI) provides a unique insight into the impact of technology on business and society.

Digital innovation is reshaping industries by disrupting existing business and operating models. But it is also having a profound impact on society, presenting a series of opportunities and challenges for businesses and policy-makers.

Over the past two years, DTI has developed a unique value-at-stake framework, to support a consistent approach to measuring the impact of technology on business and wider society. It is a pioneering approach that quantifies the impact of digitalization on society and the environment, in terms of lives saved, time and cost savings for consumers, job creation and displacement, emissions reductions and other metrics.

In light of the accelerating pace of technology-driven change, leaders need both a radar and a compass to navigate digital transformation. Our value-at-stake methodology provides both. Its 10-year time horizon offers insights on fast-approaching opportunities and inhibitors; its quantification of the costs and benefits for industry and wider society of specific digital initiatives provides business leaders, regulators and policy-makers with tools and direction to identify and maintain the best course. Our goal is for the framework to serve as an evidence base and common language for public-private collaboration focused on ensuring that the benefits of digital transformation are fairly and widely shared.

The immense potential benefits that digitalization offers society will not be delivered overnight but over years and even decades. As the next step on the long journey ahead, we are expanding the scope of our DTI work by developing an open and flexible value-at-stake model, which different stakeholders can customize to their own requirements. We will also identify and share best digital practices to accelerate progress towards unlocking the true value of digital transformation for business and society.

We invite business leaders and policy-makers to work with us, to apply, challenge, strengthen and scale our analysis, with the shared purpose of maximizing the potential of the digital revolution to bring prosperity for all.

Bruce Weinelt
Head of Digital Transformation
World Economic Forum

Peter Lacy
Managing Director,
Accenture Strategy
Executive Summary

Building a digital future to serve us all

The world appears to be at a crossroads. New technologies are opening up opportunities to boost economic growth, reduce inequality and promote inclusiveness. But we also see the world de-globalizing, with civil wars and political populism driving uncertainty about international relations. We have an important choice to make: between a more open, inclusive and interconnected world and one that is closed, siloed and unequal.

Digitalization is inextricably linked to the societal and economic forces fuelling these conflicting world views. Our research at the Digital Transformation Initiative (DTI) has focused on understanding and quantifying the impact of digital transformation on both business and wider society. We found that digitalization has immense potential to generate value for society (e.g. lives saved from improved safety, savings for customers and reduced emissions).

Digital innovations can, for example, drive progress towards realizing the UN Sustainable Development Goals and shore up the three pillars on which they are built: improving people’s quality of life; fostering equitable growth; and protecting the environment. Inhibitors such as de-globalization and rising protectionism, inadequate regulation, a lack of innovation and uneven technology adoption all limit our ability to grasp the opportunities that digital transformation presents.

This paper aims to promote discussion of the impact that digitalization is having on society, and, most importantly, also help to unlock the immense societal benefits it can generate. In a world facing the challenges of closing borders and widening gaps in terms of distribution of income, wealth, technological adoption, just to name a few, we have an important opportunity to shape digital transformation so that it serves us all.

Unlocking value for society

Our value-at-stake framework and Digital Value to Society

Our value-at-stake analysis assesses the impact of digital transformation initiatives on industries, customers and consumers, society and the environment over the next decade (2016-2025). Over the past two years, we have analysed the potential for digital innovations as diverse as 3D printing, autonomous vehicles, predictive maintenance, remote healthcare and drones to create value for different industries and, more broadly, the society. We have also created a new metric – Digital Value to Society (DVS) – by aggregating the Key Performance Indicators (KPIs) that relate to the impact of digitalization on health and safety, employment, the environment and consumers (see Figure 1). DVS offers a consistent approach to understanding how digital transformation creates value for business and wider society.
Unlocking Digital Value to Society: A new framework for growth

How value at stake and Digital Value to Society can help

Our value-at-stake framework takes a pioneering approach, which we believe provides a solid baseline for assessing the impact of digitalization. It offers a foundation and common language for a private-public dialogue about unlocking the value of digital transformation.

- **For business.** Digital enables transparency and speed. The world has a front-row seat to business decisions and operations; no company can make decisions that are unacceptable to public opinion without scrutiny, severe penalty or – in the most extreme cases – extinction. Our framework helps companies account for their potential impact on wider society and reduce the risk of creating a public backlash.

- **For government.** Policy-makers are facing challenges to find the right investments to realize the benefits of digital transformation. Our framework can provide guidance in identifying and prioritizing digital initiatives, by incorporating the appropriate KPIs and offering a consistent way to calculate societal return on investment (ROI).

Regional findings on Digital Value to Society

In 2016, the DTI team analysed how DVS can be unlocked in a large developed economy (the United Kingdom), a smaller developed economy (Denmark) and a large emerging economy (India), as well as in the Indian state of Telangana. We focused on initiatives with the potential to create significant value for society.

**United Kingdom**

Thanks to its fast-growing digital industry, the United Kingdom is one of the most digitally ready countries in the world. Despite these advantages, barriers to further increasing the adoption rates of digital technologies exist. These include connectivity challenges, a digital skills gap and an unclear return on investment in technology. A significant opportunity remains to maximize DVS. We estimate the cumulative value of digital transformation to the UK economy, combining benefits to both industry and wider society, will be more than $1 trillion (£800 billion) over the next decade. Our analysis suggests that just six digital initiatives could unlock $335 billion (£270 billion) of value for industry and society in the same period. This represents approximately 13% of the national GDP in 2015.

**Denmark**

Denmark is a highly advanced digital economy and scores well in comparison with other EU nations across a range of metrics. It is ranked first in the EU on the Digital Economy Index, with a high proportion (93%) of the Danish population online regularly. We analysed four digital initiatives, which could unlock $54 billion (DKK 380 billion) for business and wider society over the next decade, equivalent to around 20% of the country’s GDP in 2015.
India
Expanding at an annual rate of 7.6%, India has emerged as one of the fastest-growing major economies in the world. Despite this strong growth, around half of the rural population does not have access to basic connectivity. We estimate that broader access to digital technologies has the potential to generate approximately $5 trillion (INR 340 trillion) of value for India over the next 10 years. Our analysis focused on four digital initiatives, which could generate as much as $1.2 trillion (INR 81 trillion) of value for industry and society over the next decade, representing about 40% of national GDP in 2015.

Telangana
Formed only two years ago, Telangana is India’s newest state. Its Digital Telangana programme aims to enhance digital connectivity, improve digital literacy, digitalize government processes, and promote innovation and support growth in start-ups. Our research in Telangana is ongoing and this white paper includes our preliminary findings.

Recommendations
For business
Business leaders need to consider the growing importance of DVS. It is a helpful metric for measuring, creating, optimizing and communicating the societal impact of their digital investments. Companies that focus only on generating value for industry are falling short, as they generate asymmetrical benefits and risk attracting a public backlash. We plan to develop an innovative framework and toolset collaboratively with governments and business leaders, to advance the use of non-financial metrics, valuation and the reporting of digital benefits to society.

For government
The indicators of societal value used in our analysis capture several objectives that have traditionally been the concern of government leaders, regulators and civil servants: reducing carbon emissions, enhancing productivity and saving lives. Our value-at-stake framework potentially gives policy-makers an additional tool to track progress in tackling perennial challenges and to measure ROI from digital at a national level. The analysis also lifts the lid on the huge societal benefits that digital transformation can deliver, putting the focus on how policy-makers can create the conditions for new digital initiatives to flourish. Policy-makers may also need to rethink how they measure economic growth (particularly as GDP often fails to capture the benefits of digitalization); convene stakeholders to overcome disincentives blocking societal benefits; and address the citizens’ concerns about emerging technologies.

The path forward
As we look ahead to 2017, the DTI intends to build on our analysis so far to maximize the future impact of our insights. Testing our value-at-stake framework and putting it into practice will be at the heart of our work in 2017. Our priorities will be to broaden the geographic scope of the initiative, empower policy-makers to run their own analysis, and identify and share best practices.

With the overall objective of catalysing public-private multistakeholder dialogues to drive to actionable, informed, inclusive decision and outcomes, our aim is to help ensure, through new concepts and their practical application, that we, as a global community, deliver a digital revolution that unlocks new levels of prosperity for all.
At a Crossroads: What Kind of Digital Future Will We Create?

The digital revolution provides a once-in-a-generation opportunity to drive radical change across the global economy. But this transformation will not happen by itself and its negative, unintended consequences must be managed. Collaborative action is needed today to bend the curve of digital transformation towards a more prosperous tomorrow.

Building a digital future to serve us all

What sort of digital future do we want to create? The answer may seem obvious, but it is far from guaranteed. Economic value creation is transforming into something radically different that we are yet to fully understand. We are only beginning to understand the full implications of the digital revolution for a country’s competitiveness, its citizens, the nature of industries, and companies.

The world appears to be at a crossroads. New technologies are opening opportunities to increase economic growth, reduce inequality and address environmental degradation. However, we also see that the world risks de-globalizing, with civil war and political populism driving uncertainty. Digital transformation itself is raising concerns about its potential negative impacts, such as job loss, an erosion of trust and cybercrime, which threaten the pace of technological development.

For the first time in its brief history, perhaps, the continued growth of a trend that once seemed irresistible is now open to question. Will the digital revolution deliver a more prosperous global economy quickly and inclusively, or will it become mired in mistrust, regulatory fragmentation and a popular backlash?

Our research over the past two years has focused on understanding and quantifying the impact of digital transformation on both business and wider society. We found that digitalization has immense potential to generate benefits for society, but these gains are not guaranteed and digitalization also poses its own challenges. Most importantly, the gains will not be sustainable without choosing an entirely new pathway for technological and economic development. History is littered with examples of technological innovations that have floundered because their potential benefits were not articulated clearly enough – or because the causes of public resistance were not adequately addressed. However, the potential gains of this industrial revolution are too great to risk letting history repeat itself.

The opportunities: how digitalization can help realize the UN’s Sustainable Development Goals

The UN Sustainable Development Goals (SDGs) are the international community’s most broadly shared and accepted ambitions for the future. Passed in September 2015 by 193 UN member states, the 2030 Agenda has 17 goals with a combined 169 targets, presenting a bold...
economic growth and, ultimately, living standards. But, over a longer period, this approach weakens industries, visa restrictions, exchange rate management and subsidies measures. – Despite an increasing number of refugees into Europe, – Global capital flows have dropped to just 5% of global important indicators are trending downwards: no time for complacency as some of globalization's most has contributed significantly to this growth story. But this is notable share of the world population has been lifted out of have hardly been distributed equally between and within countries, but a notable share of the world population has been lifted out of poverty. According to World Bank estimates, that figure was below 10% in 2015. Globalization promotes prosperity and has contributed significantly to this growth story. But this is no time for complacency as some of globalization's most important indicators are trending downwards:

- Between 1990 and 2014, world trade increased about fivefold and global per-capita income grew by nearly 250%. However, weak demand and import barriers resulted in trade declining from 60% of global gross domestic product (GDP) in 2008 to 55% today, adversely impacting growth and productivity.
- Global capital flows have dropped to just 5% of global GDP, from a peak of more than 20% in 2007.
- Despite an increasing number of refugees into Europe, net migration from developing to developed countries decreased from 17 million in 2006-2010 to 12 million in 2011-2015.

The trend of de-globalization is framed by protectionist measures. Tariffs, quotas and/or import taxes, alongside visa restrictions, exchange rate management and subsidies for local firms, can create jobs and growth in the short term. But, over a longer period, this approach weakens industries, economic growth and, ultimately, living standards.

2. Regulation and government insufficiencies in the enabling environment

Much of a company’s competitive advantage lies outside the firm itself, in the political institutions and the regulatory and enabling environment under which it operates. Regulation is an important way of addressing market inefficiencies to deliver better and fairer outcomes, but it can burden companies and citizens and hamper growth and innovation. Many countries have established institutions to assess and balance the outcomes of regulatory measures (e.g. the UK’s Regulatory Policy Committee or Germany’s Normenkontrollrat). Research covering 172 economies from 2006 to 2010 indicates that each additional business regulatory reform is associated with an average increase of 0.15% in economic growth.

In addition many other factors such as quality of education, infrastructure, taxes and transparency contribute to creating the right enabling environment. Despite notable progress in some of these areas, more needs to be done. According to the World Economic Forum’s Global Competitiveness Index, business leaders in advanced economies considered government bureaucracy, tax rates and restrictive labour-market policies as the most problematic issues, both in 2007 and in 2015. In those same years, leaders from emerging countries rated access to finance, corruption and government bureaucracy as their top three challenges.

3. Lack of innovation and uneven technology adoption

The link between technological innovation and prosperity has been well-established through multiple studies. Today, innovation is understood as an ecosystem conducive to the generation and dissemination of new ideas into processes, products and services. As economic data supports a mood of long-term pessimism, innovation is increasingly seen as the key enabler to turning the tide. Jason Furman, Chief Economic Advisor to President Obama, famously stated “Before turning to concerns about some of the possible side effects from AI [artificial intelligence], I want to start with the biggest worry I have about it: that we do not have enough of AI.” Although investments in R&D continue to increase, barriers persist. Dynamic businesses, the right talent and an enabling environment are key prerequisites. Even if all these factors are in place, dissemination and spillover effects of innovation into the wider economy (including small and medium enterprises) are the basis to achieve growth. This continues to be a major challenge and, consequently, total factor productivity is trending down. But it is adoption that matters. Technology adoption, however, is uneven due to the human factor.

Key questions to be addressed

- How can we make the decisions today that will realize the full potential of digital transformation to improve the state of the world?
- How can we initiate a global, multistakeholder dialogue based on a consistent set of definitions and evidence about digital’s impact on society?
Unlocking the Value for Society

Digital innovation can benefit society with new jobs and saved lives; protect the environment by reducing CO$_2$ emissions and water consumption; and help consumers through cost and time savings. But these benefits are not guaranteed – there is work to be done first.

a. Introducing value at stake and Digital Value to Society

Value at stake

As part of our work on the Digital Transformation Initiative (DTI), we have created a new framework for valuing the costs and benefits of digitalization, which we call "value at stake". Our value-at-stake analysis assesses the impact of digital transformation initiatives on industries, customers, society and the environment over the next decade (2016 to 2025). Over the past two years, we have analysed the potential for digital innovations as diverse as 3D printing, driverless cars, predictive maintenance, remote healthcare and drones to create value for different industries and society more broadly. We have calculated value at stake from digitalization in 11 industries, considering the impact on the industry itself, external sectors, customers and consumers and wider society and wider society. Our assessment of value to industry is based on quantifying the global industry operating profits that depend on digital transformation. Our model of value to society takes into account the environmental benefits (e.g. emissions reductions), improvements in safety (e.g. injuries avoided), benefits for consumers (time and cost savings), and impact on employment (i.e. net jobs created or displaced) that digitalization can generate.

Figure 3: Defining Value at stake

What is value at stake?

For industry = Value addition + Value migration

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<td>Value addition +</td>
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<td>Value migration</td>
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<td>e.g. new products or services</td>
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For society = Consumers + Labour + Environment

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<td>e.g. CO$_2$ emissions reduced</td>
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Digital value to society (DVS)

Our value-at-stake methodology assesses the impact of digitalization at an individual industry level. For example, when we looked at digital transformation in the electricity sector, we analysed how it creates value for the industry, its customers, external sectors and wider society. To do this, we used a combination of industry-agnostic and industry-specific KPIs (see Figure 3).

We have created a new metric – Digital Value to Society (DVS) – by aggregating the KPIs that relate to the impact of digitalization on health and safety, employment, the environment and customers. Although the exact KPIs that it is based on may vary by industry, DVS offers a consistent approach to understanding how digital transformation creates value for society and supports a harmonized discussion across industry and the public sector. Our goal is to create a flexible, open-source model for stakeholders to adapt and develop further.

A comparison of value for business and for society reveals a spectrum of different scenarios, of which we highlight three here:

- Greater value for business than society. An example of this scenario is the use of predictive analytics for maintenance of assets in the electricity sector. We estimate around 75% of the $400 billion of cumulative value unlocked by this digital initiative will accrue to the industry (between 2016 and 2025). The remaining 25% represents benefits to society, primarily from reduced CO$_2$ emissions.

- Similar value for business and society. Hyper-personalization of products and services in the consumer industries is a digital initiative that we expect to create value for business and society in approximately equal measure. We estimate that hyper-personalization could generate around $300 billion in value addition and migration for consumer goods companies while unlocking approximately $230 billion for society through time and cost savings for customers and reduced CO$_2$ emissions.

The following section provides an introduction to our value-at-stake framework; a full explanation of the methodology and specific, tangible examples can be found in the Appendix to this report.

2 Automotive; Aviation, Travel and Tourism; Chemistry and Advanced Materials; Consumer; Electricity; Logistics; Media; Mining and Metals; Oil and Gas; Retail; Telecommunications
Greater value for society than business. Digital initiatives that fall under the first two scenarios can unlock significant value for society. The following case study gives an insight into why unlocking these societal benefits can be challenging.

Case study: Using alternative telecommunications technologies to connect the ‘unconnected’

More than half of the world’s population, living predominantly in emerging markets, do not have access to the internet (global internet penetration in 2015 was 43%). With digitalization becoming a priority for policy leaders and companies alike, we expect to see an increasing push to connect the unconnected. There will, however, be some challenges. As these untapped markets often exist in small clusters in remote regions, extending traditional network access is uneconomical for network operators because using existing technologies in low-density areas leads to a high cost per bit and it can be difficult to monetize data usage.

Our value-at-stake analysis suggests that expanding access to broadband through alternative technologies, such as drones (Facebook Aquila), balloons (Google Loon) and satellites (OneWeb), could be worth $490 billion to the wider economy and society. Broadband expansion has the potential to be the single largest contributor to global employment over the next decade, supporting the creation of around 50-200 million jobs, with the majority in developing markets. To unlock this value, governments, technology companies and telecommunication operators will need to collaborate. Possible solutions to expanding internet access include government subsidies, new business models (such as advertising to incentivize operators), new operating models where technology companies provide the backhaul (bandwidth on a wholesale basis) and telcos keep the customer relationships, or outcome-based business models in which providers are rewarded by the achieved internet penetration rate.

It should be noted that although access to lower-cost networks has the potential to empower millions of people, these societal benefits will not be realized merely by extending network access. Initiatives will be needed to address challenges around affordability, skills and locally relevant content.

There are no guarantees that the full value of digitalization will be captured. Some significant barriers stand in the way, such as outdated and complex regulatory frameworks, gaps in digital infrastructure (e.g. broadband) and skills, and a lack of public trust in some emerging technologies. Where companies can boost their profits from digitalization, they have a clear incentive to break through these barriers and innovate, collaborating with governments and regulators where necessary. In contrast, where a digital initiative is expected to create far more value for society than business, a lack of appropriate incentive structures is one of the barriers that prevents societal benefits from being realized. As a result, the potential windfall for society from digitalization becomes "trapped" value (as Figure 4 illustrates). Governments and civil society cannot unlock this value without support from business. We define trapped value as the combined value at stake for society (including value for consumers, environment and society) discounted by the value for industry.

Source: World Economic Forum/Accenture analysis
Unlocking Digital Value to Society: A new framework for growth

Digital innovations, such as social media, are reducing the distance between corporations and society. If a company is not fully exhaustive attempt (e.g., it does not include taxes or welfare) and we expect its effectiveness to only increase through iteration and refinement.

1. For businesses
Digital has changed the rules of competitiveness, as operating models, business models and even whole industries are being transformed – and, in some cases, disrupted. Today, businesses are facing more competitive pressures than ever before and the most successful in this new world will be those that work towards a new model of corporate strategy. However, Digital Value to Society is not just another mandatory corporate social responsibility (CSR) activity; it is something to be fully integrated into a company’s way of working. Academic research and business experience prove that embedded sustainability efforts have a positive impact on business performance. Positive effects include improved risk management, flourishing innovation, enhanced financial performance and increased customer loyalty. Between 2006 and 2010, the top 100 sustainable global companies experienced significantly higher mean sales growth, return on assets, and profit before taxation and cash flows from operations in comparison to control companies in some sectors. Therefore, to the old pillars of the successful company – growth and profitability – two more might be considered: sustainability and trust.

Case study: Comcast – unlocking Digital Value to Society by delivering advanced customer services
Communications companies have been struggling to provide satisfying customer services. Therefore, Comcast, a major US cable and media company, recently changed its operating model to deliver digital customer services. An app gives customers the power to automatically calibrate their set-top box if they lose signal or are having difficulties with their service. If the self-service model does not work, technicians can be summoned and customers can even change the time slot for the engineer visit in real time up to the last minute, using similar resource- allocation technology to Uber. There have been occasions when technicians arrived at residential properties in less than half an hour because another customer made a last-minute cancellation, thereby opening up a slot. Digital is adding speed and transparency, which, in turn, is driving growth, profitability and customer trust. DVS is unlocked through reduced CO₂ emissions from route optimization and reduced downtime for technicians thanks to the availability of real-time customer information.

The world has a front-row seat to business decisions and operations; no company can make decisions that are unacceptable to public opinion without scrutiny, severe penalty or – in the most extreme cases – extinction. Digital innovations, such as social media, are reducing the distance between corporations and society. If a company

How can the value-at-stake framework help?

Our value-at-stake framework is novel and pioneering. We believe that it provides a solid baseline for assessing the impact of digitalization. It provides a foundation and common language for a private-public dialogue about unlocking the value of digital transformation. The framework is an initial and

2. For governments
It is vital that policy-makers continually ask themselves a set of questions to guide their approach to digitalization. These questions include:

- Do I want to be a leader in digital transformation or a follower?
- What are the most crucial industries in my country now, what will they be in the future and what role does digital play in that evolution?
- What prevents us from realizing the full potential of digital?

Governments and regulators need to adapt. In the past, policy-makers struggled to find the right investments to realize the benefits of digital transformation. Our framework can offer guidance in identifying and prioritizing digital solutions.
initiatives by incorporating the appropriate KPIs and providing a consistent way to calculate ROI. But policy-makers also need to ensure that they are highly digitally literate; they must understand the broad range of factors that can influence public opposition to innovation and new technologies; and they should acknowledge that GDP is not always the best performance indicator to study.

**Case study: ParkBoston – balancing income from parking tickets with convenience for citizens**

Parking tickets can be a considerable source of income for a city, so there may be little motivation to improve parking conditions or utilization rates for fear of losing a significant revenue stream, albeit one that many drivers resent. New parking apps, such as ParkBoston, may reduce the likelihood of a parking ticket being issued, but cities such as Boston are starting to experiment with using them. Boston has approximately three million daily commuters using cars, so they have started to take a cut of the 15% commission that ParkBoston charges to offset the drop in income the city is receiving from issuing fewer parking tickets as a result of more efficient digital parking solutions. This innovation is making citizens happier and more productive as they spend more time at work (which indirectly bolsters employment and brings in extra tax revenue) rather than circling around looking for a parking spot. Their parking costs have also shrunk by 25% to 40%. The arrangement demonstrates another way in which a government can share in the proceeds of the digital economy.

**How to use the value-at-stake framework and DVS**

We are offering the value-at-stake framework and the Digital Value to Society (DVS) metric as an opportunity for stakeholders at all levels to engage and create their own DVS assessment, which can then be used in their strategic planning processes or to ensure that their organization’s digital transformation benefits all stakeholders.

We want to use the framework to initiate and trigger a multistakeholder dialogue and engagement around the societal challenges that stem from digital transformation. We consider this an ongoing journey and we are only just at the start.

**b. Comparing value at stake across industries**

The building blocks of our value-at-stake analysis are digital initiatives, which are bundles of (digital) technologies – such as sensors, the cloud and big data analytics – in which we see the potential to deliver significant value for industry and wider society. We have quantified business and societal benefits at an initiative level in 11 industries, encompassing about 135 digital initiatives. The potential benefits of these initiatives vary because of differing levels of industry adoption, which are driven by factors such as the maturity of the technologies being used or the presence of regulatory barriers.

**Figure 5: The potential impact of digital initiatives by industry**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Cumulative Value 2016-2025 to Society and Industry ($ billion)</th>
<th>Reduction in CO₂ Emissions (million tonnes)</th>
<th>Jobs (000s)</th>
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<td>Consumer</td>
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</tr>
<tr>
<td>Media</td>
<td>274</td>
<td>-151</td>
<td>NA</td>
</tr>
<tr>
<td>Mining</td>
<td>106</td>
<td>608</td>
<td>-330</td>
</tr>
<tr>
<td>Chemistry</td>
<td>2</td>
<td>60</td>
<td>-670</td>
</tr>
</tbody>
</table>

(1) Total societal value at stake includes impact on customers, society and the environment; the impact on external industries has not been considered; (2) Excludes the Extending Connectivity digital initiative; (3) Reduction in emissions for Oil and Gas refers to reduction in CO₂e emissions

Source: World Economic Forum/Accenture analysis

(²) Net impact on jobs considered (full externalities which could result in job creation where the effect is currently negative not fully taken into consideration).
The chart presents not the full picture of the value that digitalization can unlock for industry and wider society. This is because our value-at-stake analysis has not covered some sectors (e.g., banking and insurance, healthcare or the public sector) where digital transformation could lead to significant value for society (boosted further by the multiplier effect).

**Case study: Usage-based car insurance – an unrealized opportunity to reduce accidents and save lives**

The story of usage-based car insurance shows how unaligned incentives can derail societal gains. Our value-at-stake analysis estimates that usage-based insurance could save more than 150,000 lives by 2025. However, it has not been 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 on to consumers, so insurers are currently reaping the benefits with optional add-ons. Accurately priced insurance would mean lower costs to consumers, fewer accidents and reduced crash costs for all stakeholders. Some manufacturers are introducing telematics equipment but the overall adoption rate remains relatively low, and a win-win-win for customers, industry and society is not yet in place.

**Figure 6: Top 15 initiatives to generate Digital Value to Society**

E-Commerce, Sharing Economy and Connected Travel Services are the DTI initiatives with the highest societal value

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer Industries</td>
<td>E-commerce</td>
<td>623</td>
<td>2,767</td>
<td>608</td>
<td>-</td>
</tr>
<tr>
<td>Consumer Industries</td>
<td>Sharing Economy</td>
<td>593</td>
<td>2,070</td>
<td>464</td>
<td>-</td>
</tr>
<tr>
<td>Automotive</td>
<td>Connected Travel Services (Multi-modal)</td>
<td>1,246</td>
<td>319</td>
<td>116</td>
<td>95</td>
</tr>
<tr>
<td>Automotive</td>
<td>Assisted Driving</td>
<td>1,040</td>
<td>223</td>
<td>217</td>
<td>902</td>
</tr>
<tr>
<td>Logistics</td>
<td>Crowdsourcing</td>
<td>426</td>
<td>723</td>
<td>284</td>
<td>3,629</td>
</tr>
<tr>
<td>Electricity</td>
<td>Real Time Supply And Demand Platform</td>
<td>591</td>
<td>148</td>
<td>1,031</td>
<td>-</td>
</tr>
<tr>
<td>Logistics</td>
<td>Digitally Enhanced Cross Border Platforms</td>
<td>566</td>
<td>124</td>
<td>(1,132)</td>
<td>-</td>
</tr>
<tr>
<td>Logistics</td>
<td>Shared Warehouse Capacity</td>
<td>642</td>
<td>(53)</td>
<td>102</td>
<td>1,379</td>
</tr>
<tr>
<td>Oil and Gas</td>
<td>Consumer Energy Choices</td>
<td>450</td>
<td>(73)</td>
<td>108</td>
<td>900</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Extending Connectivity</td>
<td>58</td>
<td>(3)</td>
<td>58</td>
<td>(3)</td>
</tr>
<tr>
<td>Automotive</td>
<td>Usage Based Insurance</td>
<td>96</td>
<td>134</td>
<td>96</td>
<td>134</td>
</tr>
<tr>
<td>Aviation and Travel</td>
<td>Enabling Travel Ecosystem</td>
<td>81</td>
<td>107</td>
<td>81</td>
<td>107</td>
</tr>
<tr>
<td>Electricity</td>
<td>Connected and Inter-operable Devices</td>
<td>323</td>
<td>60</td>
<td>701</td>
<td>158</td>
</tr>
<tr>
<td>Electricity</td>
<td>Smart Asset Planning</td>
<td>307</td>
<td>65</td>
<td>6,334</td>
<td>-</td>
</tr>
<tr>
<td>Consumer Industries</td>
<td>Hyper-personalization</td>
<td>334</td>
<td>311</td>
<td>120</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: 1 Total value at stake includes impact on industry, customers, society and environment. Impact on external industries has not been considered; 2 Emissions includes CO2 equivalents; 3 Jobs includes jobs created in the broader external industries
Source: World Economic Forum / Accenture Analysis

Source: World Economic Forum/Accenture analysis
c. Regional findings on Digital Value to Society (DVS)

In 2016, the DTI team drilled down further into our value-at-stake data to develop insights that can be implemented at a national – rather than global – level, with the goal of making our findings more relevant and tangible. We have analysed how Digital Value to Society (DVS) can be unlocked in a large developed economy (the United Kingdom), a smaller developed economy (Denmark) and a large emerging economy (India), as well as in the Indian state of Telangana. We have summarized the findings and highlights in the following chapter. Our work with the governments of the United Kingdom, Denmark and Telangana is ongoing and continues to evolve at the time of publication of this white paper. In coming years, the World Economic Forum also plans to assess DVS in additional countries and regions.

United Kingdom

Thanks to its fast-growing digital industry, the United Kingdom is one of the most digitally ready countries in the world – 55% of large businesses are adopting digital technologies and 90% of the population is regularly online. Despite these advantages, barriers to further increasing the adoption rates of digital technologies include connectivity challenges, a digital skills gap and an unclear return on investment in technology. The UK government has already taken steps to boost digital skills and reform the education system, broaden the provision of digital public services and move towards data-driven legislation. A significant opportunity remains, however, to maximize DVS.

We estimate that the cumulative value of digital transformation to the UK economy, combining benefits to both industry and wider society, will be more than $1 trillion (£800 billion) over the next decade. For several of these initiatives, the digital value to the society far exceeds the value expected to accrue to the industry. We term this value differential “trapped value”.

Our analysis suggests that just six digital initiatives could unlock $335 billion (£270 billion) of value for UK industry and society over the next decade. These initiatives span a range of industries and have been chosen because of their strong potential to create DVS. The UK is expected to accrue proportionally higher value to society from these six initiatives than the global average. An important reason for this is likely to be that the median income and the cost of healthcare in the UK are relatively high compared with other countries.

Figure 7: Six digital initiatives could generate $335 billion of value for the UK economy

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Total value at stake</th>
<th>Trapped value</th>
<th>Emissions reduction</th>
<th>Lives saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-commerce</td>
<td>$195 billion</td>
<td>$144 billion</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Assisted Driving</td>
<td>$40 billion</td>
<td>$34 billion</td>
<td>6 million tonnes</td>
<td>1,554</td>
</tr>
<tr>
<td>Products to Services to Experiences</td>
<td>$36 billion</td>
<td>N/A</td>
<td>8 million tonnes</td>
<td>-</td>
</tr>
<tr>
<td>Connected Travel Services</td>
<td>$26 billion</td>
<td>$20 billion</td>
<td>5 million tonnes</td>
<td>93</td>
</tr>
<tr>
<td>Crowdsourcing</td>
<td>$24 billion</td>
<td>$13 billion</td>
<td>40 million tonnes</td>
<td>-</td>
</tr>
<tr>
<td>Real-Time Supply and Demand Platform</td>
<td>$15 billion</td>
<td>$12 billion</td>
<td>6 million tonnes</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: World Economic Forum/Accenture analysis
In the consumer industries, B2C retail e-commerce, a combination of price savings on the average shopping basket and reductions in visits to physical stores could create $100 billion (£80 billion) of savings for consumers. Increased convenience and improved price and product transparency could generate time savings each year of eight hours per person, leading to a productivity increase of $75 billion (£60 billion).  

In the automotive and transport sector, the benefits of advanced driver assistance systems (ADAS) could save consumers $25 billion (£20 billion), of which 60% is likely to come from reduced insurance premiums. Improved safety could bring an 8%-9% reduction in road fatalities each year, while better route efficiency helps motorists shrink their carbon footprint. Integrated mobility solutions that seamlessly link all forms of transport and on-demand mobility solutions could lower costs for consumers by $15 billion (£12 billion), reduce CO₂ emissions by 5 million tonnes, increase productivity by $4 billion (£3 billion) and reduce the number of road accidents. Furthermore, ADAS paves the way for fully autonomous vehicles, which, combined with integrated mobility solutions, could lead to exponentially higher benefits for consumers.

In the UK logistics sector, platforms connecting small logistics providers directly with customers would increase the utilization rate of trucks by optimizing their return trips (75% of trucks are empty on return journeys). This initiative could help consumers save $11 billion (£9 billion).

In the electricity sector, integrating customer and grid-asset data enhances matching of customer usage and electricity supply and could save consumers about $3 billion (£2 billion), thanks to a 1% reduction in electricity consumption per capita. Energy “prosumers” who sell power back to the grid could benefit from $10 billion (£8 billion) in additional income, equivalent to a $1,000 (£800) gain per household. Real-time supply and demand platforms are already boosting energy efficiencies, but a faster and more ambitious transition to renewable energy sources would unlock far greater benefits to society and the environment in terms of quality of life and emissions reductions.

**Case study: Nissan and Enel – integrating electric vehicles into the grid**

Nissan and Enel are planning to connect 100 vehicle-to-grid units across the United Kingdom in the first trial of electric vehicles as mobile energy storage. The technology allows owners to charge their vehicles at times of low demand, with the option of either selling the power stored directly back to the grid or using it when electricity costs are higher. It is estimated that these 100 vehicles could generate an output of 1 megawatt, enough to power about 700 homes.

However, there are a few barriers that need to be overcome to realize the potential value of these six digital initiatives:

- **Low adoption rates of digital technology by UK small and medium enterprises (SMEs).** In 2015, around 36% of small businesses did not yet have a website.
- **Shortage of digital talent and digital capabilities.** Many businesses are yet to develop digital skill training programmes, even though 35% of the 12.6 million people without basic digital skills are employed.

**Suggestions for UK government to unlock trapped value include:**

- **Encourage public-private collaboration.** How can public-private collaboration be leveraged to maximize DVS? Can working groups be set up to explore topics associated with interoperability of data, creation of digital infrastructure and the implementation of recommendations emerging from public consultations?
- **Digitalize SMEs.** How can small businesses be incentivized to adopt digital technologies? How can training be provided to expand understanding of the dynamics of digital transactions, especially in the consumer goods and logistics industries?
- **Develop new regulatory frameworks across industries.** How can business model changes and new value chain participants be factored into the development of forward-looking policies?

**Denmark**

Denmark is a highly advanced digital economy and scores well in comparison with other EU nations across a range of metrics. It is ranked first in the EU on the Digital Economy Index, with a high proportion (93%) of the Danish population online regularly. Danish citizens use a variety of digital services: 88% use e-banking, 82% shopped online in the past year, and 71% use e-government services. Around a quarter of Danish SMEs sell their products and services online.

Over the past 15 years, the Danish government has implemented several digital growth strategies. These have mainly focused on using digitalization as a tool to rethink processes, modernize services for citizens and businesses, and to make the public sector more efficient. The strategy for 2016 to 2020 aims to shape the digital Denmark of the future and ensure that the public sector can seize technological opportunities to add value, boost growth and improve efficiency, while maintaining the confidence and trust of citizens in the digital society. The new strategy should also provide a framework for future growth. As part of our value-at-stake pilot project for Denmark, we chose four initiatives from our DTI research in 2015.

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4 Only B2C e-commerce has been considered within scope of our analysis. The value from e-commerce is likely to be higher if B2B e-commerce were included.

5 The productivity increase is based on the assumption that a portion of the time saved will be spent working.
As Figure 8 shows, significant trapped value was identified, with the highest value derived from the e-commerce initiative.

- In consumer industries, B2C e-commerce platforms could unlock $34 billion (DKK 230 billion) of value over the next decade. Digital value to society derives from cumulative 0.9 billion hours of time savings (or 118 million hours in 2025), equivalent to an average of 6.6 days (or 20 hours in 2025 alone) per person; and $1 billion (DKK 6.8 billion) in price savings, equivalent to $0.40 per purchase. We also expect a $16-billion (DKK 100-billion) boost to productivity. Expanded e-commerce will also broaden access to new products for rural customers and to new markets for SMEs. For local SMEs (e.g., retailers or manufacturers) to benefit, it is critical to encourage these local businesses to invest in online and omnichannel capabilities. Additionally, these SMEs should get support (e.g., in sharing best practice or forming joint ventures) so that they can better compete against global e-commerce players.

**Case study: Waremakers – making luxury accessible online**

This Danish company blurs the boundaries between luxury magazine and luxury retailer. Each item on its website is carefully curated and comes with a “what’s the story” article, which provides an in-depth description of the product’s origin. Purchases take place through the Waremakers website.

- The Sharing Economy digital initiative, which includes the rental economy and used goods economy, driven by digital platforms, is expected to generate customer benefits through time savings by 2025 of around 6 million hours a year.

- Connected Travel Services simplify travel by seamlessly linking all forms of road, rail and ferry travel, including both public and private transport. They could generate significant societal benefits over the next decade, including time savings of 0.12 billion hours (equivalent to 0.9 days per person) and $0.3 billion (DKK 2 billion) in reduced costs for customers relating to traffic accidents. We also estimate a $0.3 billion (DKK 2 billion) reduction in parking infrastructure costs. The environment would benefit from a reduction of 0.5 million tonnes of CO$_2$ emissions.

**Case study: INTERFACE PLUS – providing integrated travel services and improving people’s lives**

This European Union project, which concluded in 2015, made life easier for travellers between Germany and Denmark. Ticketing was integrated so that passengers could buy one pass (the InterCombi ticket) for their entire journey across buses and ferries on both national transport systems. Live data was shared across borders to give passengers real-time journey information. The project also developed portlink.eu, an online portal for public transport between ferry terminals and city centres, currently covering 15 destinations. After selecting a port, the user sees an interactive map with details of routes and distances between the terminal and public transport. The portal also supplies information such as timetables, prices, distance, duration and access for people with reduced mobility. Total investment for the projects INTERFACE and INTERFACE PLUS was around €4.4 million.

- The Assisted Driving digital initiative covers assistance systems that enable semi-autonomous driving and thus paves the way for self-driving vehicles. Its DVS could be significant, with these technologies expected to save 92 lives and avoid 932 serious injuries over the next decade. They would also help reduce CO$_2$ emissions by 0.3 million tonnes and save $0.7 billion (DKK 4.4 billion) in costs relating to traffic accidents. The next level of

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1 Only B2C e-commerce has been considered; the B2B aspect of e-commerce has been excluded.
assisted driving – the integration of fully autonomous driving and connected mobility services – could lead to an exponential increase in DVS, as a result of time savings and reduced emissions driven by reduced traffic congestion in cities such as Copenhagen. The Danish government should, therefore, work on an ambitious vision and growth plan to make autonomous vehicles – and the appropriate transport infrastructure to end the traditional model of car ownership by individuals – a reality on the streets of Denmark.

India

Expanding at an annual rate of 7.6%, India has emerged as one of the fastest-growing economies in the world. Despite this strong growth, 67% of the population still live in rural areas; 60% do not have access to basic sanitation; and about 50% of the rural population do not have access to basic connectivity as measured by “teledensity” (telephone connections per 100 individuals). The Indian government has launched several digital projects to address these challenges. Aligned to the UN Sustainable Development Goals, the Digital India initiative aims to create digital infrastructure as a utility for every citizen, including universal access to mobile connectivity, broadband connections for all, financial inclusion driven by digital finance and digital literacy training for 60 million people living in rural areas.

Home to nine unicorns (start-ups valued at more than $1 billion) and more than 4,500 other start-ups, India is currently ranked as the third largest start-up base in the world. Many of these start-ups are addressing real social needs and so contributing to DVS. One example is RailYatri, an app to ease the navigation of the railway system. It uses GPS data, advanced algorithms, artificial intelligence (AI) and mobility solutions to enhance travel experiences by providing accurate timely information and increasing travel safety.

Case study: JAM Trinity – broadening financial inclusion to empower people

By launching a biometrically enhanced unique identifier (Aadhar), creating bank accounts for the unbanked (Jan Dhan Yojana) and boosting mobile connectivity, the government has saved approximately $4 billion (INR 270 billion) over the past two years. This has been done by eliminating middle-men and duplicate beneficiaries, and directly transferring government subsidies to bank accounts. With 40% of the subsidies previously being misdirected, the initiative is a move in the right direction but is still in its early stages.

The value of digital in India is huge, but unlocking trapped value requires a multistakeholder approach

We estimate that broader access to digital technologies has the potential to generate approximately $5 trillion (INR 340 trillion) of value for India over the next 10 years through the multiplier effect. Our analysis of value at stake in India focused on four digital initiatives (see Figure 9), each with significant potential to generate DVS. We have found

![Figure 9: Four digital initiatives could generate $1.2 trillion of value for the Indian economy](source: World Economic Forum/Accenture analysis)

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9 JAM Trinity refers to the consolidation of three critical spokes, i.e. Prime Minister Jan Dhan Yojana (PMJDY), Aadhaar and mobile connectivity (JAM).
that the trapped value in some digital initiatives is as high as 98% of the total value. There are significant barriers trapping this societal value, including current industry incentive structures, low digital literacy rates, limited understanding of DVS, and regulatory boundaries that require a multistakeholder approach.

– In Digital Payments and Finance, the multiplier effect of access to financing by underbanked SMEs could create $410 billion (INR 30 trillion) of DVS and approximately 4.9 million jobs across industries. Access to new revenue streams, lower costs and increased convenience could generate $30 billion (INR 2.0 trillion) of savings for consumers, who would also enjoy the benefit of time savings of approximately four hours per person per year from reduced visits to ATMs. We expect faster transactions and easier access to cash to lead to $85 billion (INR 6 trillion) of productivity gains for society. Digital value to society is further multiplied by a reduction in the shadow economy and corruption.

Case study: Paytm – facilitating financial transactions “anytime, anywhere”

Paytm, a digital payments platform, helps 155 million active users and 600,000 registered merchants to conduct financial transactions “anytime, anywhere”. It boosts financial inclusion and facilitates the move towards a cashless economy, while providing flexibility and increased convenience to users.

– In consumer industries, the economies of scale and lower marketing costs that B2C e-commerce platforms enable could translate into $75 billion (INR 5.1 trillion) of savings for consumers. A reduction in visits to physical stores could save consumers five hours per person per year, translating into productivity gains of $110 billion (INR 7.4 trillion). SMEs are also likely to benefit from access to new markets.

– Connected travel services enable consumers to switch from exclusive car ownership to on-demand taxi services, self-drive rentals and seamless public transport. Such a transport system has the potential to create $115 billion (INR 7.8 trillion) of value for society and consumers through a combination of reduced spending on maintenance, time savings, lower emissions and increased productivity.

Case study: Ola – boosting flexibility for customers and drivers through on-demand taxis

Present in over 75 cities with a driver base of 550,000, Ola’s affordable on-demand taxi service has increased flexibility and convenience for consumers while lowering costs. At the same time, Ola’s driver partners have seen a growth in income and achieved more work-life flexibility. Ola claims its sharing platform has reduced CO₂ emissions by approximately 4,500 tonnes.

There are several inhibitors that must be overcome to realize DVS in India

– Limited access to infrastructure. Approximately 70% of India’s population does not have access to the internet and only 20% of India’s SMEs are “technology-ready”. This lack of infrastructure is cited as a drag on India’s growth by the Global Competitiveness Index (in which India is ranked 68th for infrastructure).

– Regulatory frameworks. Regulations have lagged innovation and technological advances, meaning that existing regulations have been force-fitted on to new digital business models. Tax regulations have been rated as the most significant obstacle to doing business in India.

“There is a lot of catch-up that needs to happen with respect to infrastructure – historically it has been built for the past without a view on the future.”

Vineet Agarwal, Managing Director, Transport Corporation of India

Our recommendations for policy-makers and governments include:

– Accelerate infrastructure growth. Can a national infrastructure plan be developed to accelerate infrastructure growth? How can an independent infrastructure unit, with wide-ranging responsibilities, be established and empowered?

– Develop forward-looking policies. How can new digital business models and innovation be factored into forward-looking policies? Can the government avoid force-fitting existing regulations on to new businesses?

Our recommendations for companies include:

– Foster a supportive environment: How can a positive environment that encourages start-ups to grow be developed? Can leading industry players nurture innovative and disruptive start-ups?

– Develop public-private partnership: How can the industry be involved in improving the digital literacy of the workforce?

*Only B2C e-commerce, excluding travel and tourism, has been considered within scope for this analysis.*
Telangana

Formed just two years ago, Telangana is India’s newest state. It has already been named as the easiest state in which to do business. This is partly a result of policies launched by the state government, such as the ambitious Digital Telangana programme, which aims to enhance digital connectivity, improve digital literacy, digitalize government processes, and promote innovation and support growth in start-ups.

“Digital is a key underlying factor in policy-making and almost all schemes being undertaken by the Government of Telangana have this integrally. We believe that widespread adoption of digital can accelerate the pace of economic growth. Not just that, we view digital as a powerful tool to close the rural-urban gap as it empowers the masses through financial inclusion, enhances standard of living, empowers people and, at the same time, increases efficiency of government services at the last mile.”

KT Rama Rao; Cabinet Minister for IT E&C, MAUD, Industries & Commerce, Mines & Geology, Public Enterprises and NRI Affairs, Government of Telangana

While the state government has taken steps to encourage digital adoption, successfully unlocking trapped societal value across industries will require it to work collaboratively with those industries to provide access to digital infrastructure, transform mindsets and develop policies to maximize the value of digitalization for society.

Based on priority sectors identified by the Telangana government and synergies with the DTI, the current phase of analysis (up to December 2016) focuses on a select set of initiatives:

- Virtual Care and Telemedicine (Healthcare)
- Integrated Sourcing, Data Exchange and Commerce Platforms (Mining and Metals)
- Shared Logistics Capacity/Crowdsourcing (Logistics)

Our partnership with the Telangana government analyses trapped value and identifies inhibitors to unlocking that value through interviews and field visits. We are also developing a policy-maker toolkit through collaboration with the state government, the public sector and the relevant industries for the above initiatives.
Implications for Business and Government Leaders

To date, businesses and governments have tended to act individually to realize the societal benefits of digitalization. This chapter proposes how they can work together to maximize the societal value of digital transformation.

a. Implications for business

Shareholders and stakeholders now expect leading companies to be growth-led, agile with their cost base, sustainable and trustworthy. These are the new table stakes for competing successfully.

Business leaders need to consider the growing importance of Digital Value to Society (DVS). It is a helpful metric for measuring, creating, optimizing and communicating the societal impact of their digital investments. Companies that focus only on generating value for industry are falling short as they generate only asymmetrical benefits. If it becomes widely known that organizations are investing in new technologies such as analytics and artificial intelligence solely to maximize their own profits, they risk attracting media criticism and a public backlash. To balance these two goals – i.e., to maximize profitability while delivering societal benefits – it is crucial to understand their interdependencies.

As we continue our DTI work in 2017 we plan to develop an innovative framework and toolset collaboratively with governments and business leaders, to advance the use of non-financial metrics, valuation and the reporting of digital benefits to society. It is our goal to achieve authentic win-win situations. Detailed guidelines for how business leaders can calculate their DVS and their value to business from digital can be found in the Appendix. The following case studies are non-exhaustive examples of companies that have already used digital technologies already to arrive at win-win situations that do not only benefit industry.

Case study: Coyote Logistics – using advanced technologies to reduce CO₂ emissions

Founded in 2006, Coyote Logistics is a successful start-up that matches demand for client shipments with available carriers. The system specializes in scheduling shipments to travel on carriers’ return trips (backhaul). Currently, trucks travel empty on up to half (and even 75% in the United Kingdom) of all return trips, so the potential to improve efficiency is huge. Coyote says that in 2014 it eliminated 31 million “empty” miles, avoiding 56,300 tonnes of CO₂ emissions thanks to its advanced algorithms. Publicly committed to securing local jobs, it has earned a spot on the Chicago Tribune Top Workplaces list four years in a row. In August 2015, UPS acquired Coyote for $1.8 billion, a figure that reflects the merits of an asset-light business model in a mature industry.73

Our analysis of value at stake at national level revealed that sharing economy models in consumer industries can generate vast DVS. As the following example shows we are increasingly seeing access-based models spreading to new sectors in both the B2C and B2B worlds.

Case study: Cohealo – sharing medical equipment to reduce the costs for healthcare systems

As healthcare costs rise, today’s model of healthcare provision becomes increasingly unsustainable. To help meet certain aspects of this challenge, the United States-based technology company Cohealo has created an innovative platform offering on-demand access to medical equipment. This is a pioneering example of an access-based model being used in the B2B world. Cohealo allows health systems to share equipment across hospitals, reducing the need to buy assets and boosting profit and utilization rates. With one study finding the average utilization rate of hospital equipment at 42%, Cohealo aims to boost this to 80%. Cohealo is now being used by healthcare providers serving approximately 15% of the US population. Cohealo says that its service has saved hospitals $1 million-$2 million each and claims that this could rise to $7 million if they use the service for longer.74

Another case study from our analysis of the Oil and Gas industry shows that, despite initial job losses, the adoption of new technologies can produce a net benefit to society.

Case study: Remote Operations Centres (ROCs) – reducing emissions and improving the quality of jobs in the Oil and Gas industry

Remote Operations Centres (ROCs) are expected to become much more common and more capable. By 2025, close to 30% of shelf and deep-water operations, and 25% in other areas, might use ROCs that enhance remote control of operations. ROCs could detect issues early, resulting in increased production. They also reduce the costs associated with fly-in, fly-out workers, leading to an estimated 5% reduction in accidents and injuries at oilfields and platforms. This initiative would reduce the need for employees to travel to and from sites and lower emissions of CO₂ equivalents (by 19 million tonnes over the next decade). There will be a reduction in jobs for fly-in, fly-out employees, but these losses should be partially offset by the creation of new jobs providing higher-quality work in ROCs. DVS could be approximately $100 billion.
Industry associations also play a crucial role in unlocking DVS. Their efforts need to be harmonized with activities initiated by companies and governments.

**Case study: GSMA – building a collaborative approach to connecting ‘the unconnected’**

A trade body representing the interests of more than 1,100 mobile operators worldwide, the GSMA supports the exchange of ideas about how to unlock digital access and foster closer cooperation to connect “the unconnected”, especially in developing markets. Its Connected Society programme works with operators in several markets to develop commercially sustainable models for expanding coverage. Governments can also play an enabling role by promoting infrastructure sharing and releasing a low-frequency spectrum to the mobile industry on reasonable terms. In developed countries, the GSMA works with operators on initiatives on affordability, digital literacy and online content to help individuals to get online.

Beyond public-private partnerships, effective private-private or cross-industry partnerships can address and accelerate the achievement of DVS, as the following four examples show.

**Case study: Google and RailTel in India – creating a public-private partnership for infrastructure**

In one of the world’s largest public Wi-Fi projects, Google has partnered with the state-run RailTel Corporation of India to equip 400 railway stations in India with high-speed Wi-Fi networks. RailTel will provide the fibre-optic infrastructure to Google, which will then supply Wi-Fi access through its radio access points.71

**Case study: Establishing a cross-industry partnership to address AI-related challenges**

In 2016 Facebook, Amazon, Alphabet, IBM and Microsoft launched a partnership to research and promote best practices around AI. This partnership can be viewed as an example of self-regulation and is intended to provide a formal structure of communication. All the parties have made a strong commitment to keep the public informed about the latest developments in AI research. They also plan to expand the partnership by including non-profit organizations, ethicists and activists, and, in this way, accommodate diverse sources of expertise.

**Case study: BITAG – collaborating to improve the security and privacy of IoT**

The technology industry is trying to boost cybersecurity standards for IoT devices. The Broadband Technical Advisory Group (BITAG), whose members include Google, Cisco, AT&T, T-Mobile, Comcast, Mozilla and others, recently released a report on the topic, which recommended best practices. The report includes security and privacy recommendations to reduce the risk of distributed denial of service (DDoS) attacks, unauthorized access or control, induced device or system failures.77

**Case study: Roche and Qualcomm – a cross-industry partnership for remote patient monitoring**

Roche, a Swiss life sciences firm, and Qualcomm, a mobile technology company headquartered in the United States, have collaborated to improve the remote monitoring and management of patients with chronic diseases. Data is transmitted from patient devices (anti-coagulation meters) made by Roche, to monitor the prescribed treatment. Qualcomm handles the secure data transmission to a Roche cloud-based server, from where it is sent in real time to the patient’s doctor. Qualcomm ensures compliance with data privacy rules and makes sure that data is encrypted and stored in accordance with local regulations.78

### b. Implications for government

*Our value-at-stake analysis offers a new perspective on the potential societal benefits of digitalization. For policymakers, regulators and civil servants, the question is: how can this framework be used to enable better policy and, ultimately, help drive growth and prosperity?*

The indicators of societal value used in our analysis capture several objectives that have traditionally been the concern of government leaders, regulators and civil servants: for example, saving lives, enhancing productivity and reducing carbon emissions. We used parameters that apply across industries and are commonly understood and accepted. It’s a living tool and can be adjusted easily. The value-at-stake framework therefore gives policy-makers an additional tool with which they can tackle perennial challenges. Perhaps more importantly, the analysis also lifts the lid on the huge societal benefits that digital transformation can deliver, putting the focus on how policy-makers can create the conditions for new digital initiatives to flourish. These twin imperatives – priming the pump for digital transformation and using the framework as the basis for providing new insights on policy-making – are explored in this section.

#### 1. Creating the right enabling environment for digital growth

Government leaders, regulators and civil servants have a significant opportunity to support the adoption and dissemination of new technologies, using the key levers available to them: setting the appropriate policies, regulations and national strategy for digital, while also transforming government agencies into hotbeds of innovation. Other important success factors include enhanced collaboration, both nationally and internationally, and the ability to engage the whole ecosystem of government, business and civil society.

**Setting strategy and regulation**

Some governments are already taking steps to create a favourable environment in which digital initiatives can thrive. For example, the government of the Indian state of Telangana has launched an ambitious programme that aims to empower the population, simplify the lives...
of citizens and encourage innovation and the adoption of digital technologies across industries, attracting start-ups through forward-looking digital policies. Denmark’s 2020 Digital Strategy lays the foundations for the Danish public sector of the future and is supported by a committee to advise the government on how the country can grasp the opportunities presented by the Digital Revolution. The committee consists of business leaders, policy-makers and representatives from trade unions, and it places emphasis on making visible the opportunities for Denmark that digitization and new technologies offer.

A key enabler of digital transformation will be the education system. Policies and strategies that address the changing dynamics of demand and supply in labour markets can help workers stay relevant to employers. Such approaches will involve close collaboration with the private sector, given the importance of being able to develop new skills alongside day-to-day employment. For example, in the United States, the United Kingdom and Germany, 68% of 2016 university graduates surveyed by Accenture Strategy are seeking more agile on-the-job training to further their career, compared with just 50% who expect more traditional, formal employer training.79

As far as regulation is concerned, the challenge of applying traditional approaches to disruptive technologies is increasingly well-documented. The pace and scale of digital innovation, which cuts across industry and geographic boundaries, provides a particular headache for policy-makers (see example below).

“Regulation can be considered a roadblock impeding growth of the self-drive rental market in India. Things are complicated by the existence of far too many stakeholders, as for example governments at various levels, different ministries, with wide-ranging regulations to deal with. Doors need to open to fully realize benefits for business and society, otherwise further scaling the business or launching similar businesses will be difficult.”

Sakshi Vij, CEO and Founder of Myles Cars (Indian’s largest self-drive car-sharing company)

The challenges of regulation in a digitalized economy

As technologies such as the internet of things (IoT) become more powerful and widely adopted, unified regulatory mechanisms to address the challenges of new and networked-object technologies are required. Today those are covered by more than a dozen separate federal agencies in the United States, e.g., the Food and Drug Administration, the National Highway Traffic Safety Administration and many more. As industry boundaries become more and more blurred, digitalization is touching many industries across every sector of the economy. However, the jurisdictional issues relating to the IoT are not yet solved and, without greater coordination, they threaten the continued deployment of this technology and the benefits it can deliver.

Sparking innovative ways of working

Beyond setting strategy and developing new policy, forward-thinking governments are also experimenting with new ways to make themselves drivers of innovation. For instance, Denmark’s government launched MindLab, a cross-governmental innovation unit that involves citizens and business in inventing new solutions for society. It covers broad policy areas that affect the daily lives of virtually all citizens. Entrepreneurship, digital self-service, education and employment are some of the major areas. The unit uses methodologies such as design thinking and user journeys to come up with new ideas.80 It is estimated that there are currently 35 experimental organizations in the government.81

In the United States, the Defense Advanced Research Projects Agency (DARPA) has led the way over the past 60 years in researching beyond-the-horizon ideas. Scientists have received funding to explore novel concepts without needing a clear sense of their commercial value; the focus is on long-term transformation rather than short-term profits. DARPA has been responsible for ground-breaking innovations such as the internet, GPS, semiconductors, and even self-driving cars. In San Francisco, the Mayor’s Office of Civic Innovation has launched a Startup in Residence programme to address some of the most pressing issues confronting the city.82

Case study: Greater Copenhagen – using data to build a more sustainable city

Deploying smart technologies in Copenhagen to tackle the challenges of urbanization and climate change is a clear political priority. Support from city authorities and the national government has enabled Copenhagen to become a living laboratory for testing smart-city technologies at scale in a real-world environment. Approximately 250 companies are involved in smart-city activities, which is aiming to become the world’s first carbon-neutral capital by 2025.83 At the heart of the Copenhagen smart city and urban services programme is a citywide data exchange being built by Hitachi, which provides access to data from smart-city initiatives (e.g., intelligent building management, smart lighting and sensor-based traffic management) which would otherwise be siloed. The exchange enables the sale, purchase and sharing of a wide variety of data among all types of users in a city – citizens, city government and businesses.84
2. Providing a new perspective on policy-maker challenges

Tracking progress towards societal objectives
The value-at-stake framework and analysis potentially provides policy-makers, regulators and civil servants with a new tool that they can deploy to track progress towards existing policy targets, including:

- Employment growth; number of jobs by sector or region
- KPIs on consumer, worker and citizen safety
- Time savings for customers and assumptions about productivity improvements
- Targets relating to CO₂ emissions, pollution and congestion

By mapping the future growth of specific digital initiatives at the level of the national economy to their likely societal benefits, governments can begin to focus support on those areas that could deliver the greatest impact. At a time when many governments are under pressure to reduce budgets while also increase effectiveness, such an exercise can help to prioritize resource allocation to where it can add most value.

Rethinking economic growth
Critiques of GDP as the primary measure of economic progress are not new, but they are made more relevant by digital transformation – GDP struggles to account for today’s intangible assets such as services, insights and networks. Consider, for example, the negative impact on GDP that the reduced cost of and increased access to products and services through sharing models (example) may in many instances generate. In this context, our value-at-stake analysis can help to start a more informed debate about the additional measures that are needed to track economic growth and prosperity in a digital age.

Why GDP does not capture the benefits of the digital economy
The sharing economy (i.e., business models that allow people to hire a product rather than buy it) has been supercharged by digital platforms that can more effectively match supply and demand. One estimate forecasts that the sharing economy could reach $335 billion in revenues by 2025. However, looked at through the lens of traditional measures of economic growth, there is a great deal of value in the sharing economy that is simply not captured. Examples include better resource usage, an improved sense of personal well-being or community, and increased willingness to pay for a “public” asset. Intangible assets such as intellectual property, organizational capital, user-generated content and human capital are also not taken into consideration by official GDP figures. Moreover, the increasing volume of free goods and services in the digital economy is not accounted for in GDP calculations.

Conclusion
Governments and businesses know they need to embrace digital technology as a source of growth and increased competitiveness. By understanding and measuring the potential value to society from digital technology, they can begin a collaborative dialogue, based on evidence that will give them a closer approximation of the “true” value coming from digitalization. Our value-at-stake framework gives policy-makers a new tool that they can use to develop ambitious, collaborative, digital-growth strategies, in concert with the private sector, while also identifying where policy interventions may be required. However, the adoption of any new technology involves a process of social learning. Ultimately, the public must feel comfortable with the new technology for the market to develop. Hence, government leaders should focus on communicating the immediate benefits of innovations and ensure those advantages are as widely accessible as possible to their citizens.
Unlocking Digital Value to Society: A new framework for growth

As we look ahead to 2017, we intend to build on our analysis so far to maximize the impact of the initiative in helping to shape a fair and sustainable digital revolution. Testing our value-at-stake framework and putting it into practice will be at the heart of our work this year, with three major areas of focus:

1. Increase the scope of the analysis to include further stakeholders (enterprises and countries). In 2016, we have been fortunate to work with policy-makers in Denmark, India and the United Kingdom to validate the value-at-stake concept through insight development and its application in the real world. Our quantitative analysis so far of 135 digital initiatives (based on conservative assumptions about the adoption rates and benefits of different technologies) lays the foundation for public-private discussion about how to measure effectively the value of digitalization for business and wider society. We look forward to continuing this process in 2017 at national, regional and state levels, both in developed and emerging countries. We welcome expressions of interest from other governments, companies and stakeholders who may wish to collaborate.

2. Develop an open and flexible model that can be adapted to the needs of stakeholders. In 2017 we intend to implement some of the digital best practices that we have seen and experiment with more innovative approaches to syndicating our research. Our aspiration is that, through an open-source, digitally enabled platform, we will be able to collaborate with a greater number of policy-makers and enable them to run a value-at-stake assessment for their own region. In this way, we can reach a scale and speed of testing and adoption that will strengthen the value-at-stake framework and help it become a tool of choice for 21st-century policy-makers and industry leaders. We plan for the framework to become a standard tool for stakeholders to actively shape the impact of digital transformation on the world.

3. Identify and share best practice. As we move from “proof of concept” to “proof of application”, a major focus in 2017 will be the development of innovation hubs, especially in emerging markets, where the value-at-stake framework can be applied to bring about real-world change. Examples could include helping local governments to prioritize spending on digital skills training in the areas that can deliver the greatest DVS or highlighting where misaligned incentives between industry players and policy-makers are blocking the societal benefits of digitalization. We are building a library of real-world case studies and best practice that can further encourage policy-makers around the world to engage with the framework and improve it.

With the overall objective of catalysing public-private multistakeholder dialogues to drive to actionable, informed, inclusive decisions and outcomes, our aim is to help ensure, through new concepts and their practical application, that we, as a global community, deliver a digital revolution that unlocks new levels of prosperity for all.

As such, this programme is very much the “end of the beginning” rather than the “beginning of the end”: its longevity and success will depend on willing partners to challenge, strengthen, apply and scale our analysis. Our aspiration is that this body of work represents a helpful contribution to a debate that will shape how the world lives and works for generations to come.

One of the central aims of the Digital Transformation Initiative has been to create a shared understanding of the world through digitalization. Until now, value has The Path Forward
Appendix: Value-at-Stake Methodology and Digital Initiatives

Our value-at-stake framework is designed to assess the impact of digital transformation of industries on customers, society, industry and the environment.

usually been measured either in monetary terms (e.g. GDP at a macroeconomic level or operating profits at an enterprise level) or in terms of the social impact generated. Consequently, it has been difficult to hold a consistent public-private dialogue to prioritize industry action on issues such as improving regulation or protecting consumer interests.

Our unique methodology provides a common language for industry leaders and policy-makers to navigate some of the challenges and opportunities posed by digital transformation. It provides a solid understanding of the value that digital can create for both industry and wider society. Our goal is to initiate and trigger a multistakeholder dialogue and engagement around the societal impacts of digital technology, so that we can build a digital revolution that benefits everyone.

As of January 2017, we have run the value-at-stake assessment across 11 industries:

1. Automotive
2. Aviation, Travel and Tourism
3. Chemistry and Advanced Materials
4. Consumer Industries
5. Electricity
6. Logistics
7. Media and Entertainment
8. Mining and Metals
9. Oil and Gas
10. Retail (as an additional deep dive based on the consumer industries work)
11. Telecommunications

Additionally, we have piloted the value-at-stake assessment for select digital initiatives across four countries or states in developed and emerging markets:

– Denmark
– India
– United Kingdom
– The State of Telangana (India)

Throughout 2016 we have also refined the methodology based on conversations with leading economists, academic leaders and industry subject matter experts.

Our value-at-stake methodology

Our value-at-stake analysis for each industry is based on quantifying the impact on business and wider society of a series of digital initiatives. These digital initiatives form part of larger digital themes that relate to some of the major trends powering digitalization.

What is a digital initiative?

As part of our DTI research, we have identified 135 digital initiatives across 13 industries over the past two years (but only valued initiatives in 11 industries). We define an initiative as a bundle of innovative (digital) technologies, such as sensors, cloud, 3D printing, big data analytics or artificial intelligence. These are often deployed in combination with new business models that are expected to have a significant impact on the industry’s value chain, workforce, adjacent industries or the environment and broader society. We have selected digital initiatives that we expect to deliver a significant value for business and wider society.

We have calculated value to industry and society in the following ways:

Digital value to industry

Value at stake for an industry comprises two elements:
– The potential impact on an industry’s (pre-tax) operating profits that will be generated as a result of implementing digital initiatives (value addition/dilution).
– Operating profits that will shift between different industry players (value migration).

Digital value to society

Value at stake for society includes three elements: customers, society and the environment. Each element is measured as follows:

– Value impact for customers: the potential gain to customers (B2C) in the form of cost and time savings and discounts.
– Value impact for society: the impact (both financial and non-financial) of digital initiatives, e.g., productivity gains, jobs, traffic congestion and lives saved (these vary by industry).
– Value impact on the environment: the estimated impact of digital initiatives on increasing or reducing emissions of CO₂ and other gases (these vary by industry).

For a few industries, we have also calculated impacts from external sectors, e.g. for the telecommunications or automotive industries in the case of telematics and usage-based insurance. Given the vast number of externalities, we have been unable to consistently measure all factors, but this is an area that can be developed over time.

Approach

Value at stake has been calculated using a top-down
Figure 10: Our approach to calculating value at stake for industry and society

<table>
<thead>
<tr>
<th>Assumptions used across the initiative</th>
<th>Total addressable market (TAM)</th>
<th>TAM based on factors e.g. GDP, technology adoption, infrastructure, income level</th>
<th>Adoption / market penetration rate of initiative</th>
<th>Adoption / market penetration rates identified through research and expert interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL VALUE AT STAKE FROM INITIATIVE</strong></td>
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<tr>
<td><strong>Value for industry</strong></td>
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<tr>
<td><strong>Value Migration</strong></td>
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<tr>
<td><strong>Value Addition</strong></td>
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<tr>
<td><strong>Customers</strong></td>
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<tr>
<td><strong>Value for society</strong></td>
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<tr>
<td><strong>Society</strong></td>
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<tr>
<td><strong>Environment</strong></td>
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<tr>
<td><strong>Value Migration</strong></td>
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<tr>
<td><strong>Revenue shift</strong></td>
<td>Average operating margins</td>
<td></td>
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<tr>
<td><strong>Cost savings to the industry</strong></td>
<td>Increase in profits from incremental revenues</td>
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<tr>
<td><strong>Discounts and cost savings</strong></td>
<td>Economic impact of time savings</td>
<td></td>
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<tr>
<td><strong>Benefit to society from productivity improvement</strong></td>
<td>Net jobs created</td>
<td></td>
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<tr>
<td><strong>Lives saved</strong></td>
<td>Emissions reduction</td>
<td></td>
<td></td>
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<tr>
<td><strong>Environment</strong></td>
<td></td>
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</tbody>
</table>

Note: 1 Economic impact has not been calculated for lives saved and net jobs created. Source: World Economic Forum / Accenture analysis

approach involving three critical steps:

1. **Analyse the applicability and implications of a digital initiative** at an enterprise level and try to answer the following questions: Why is it important? Who are the main stakeholders? Which value chain segments are impacted most significantly?

2. **Understand one’s own baseline.** To analyse DVS and value to industry, organizations should first understand their own baseline. They need to consider the relevant line items from their financial statements and non-financial metrics impacting their enterprise and industry. They should ask questions such as: What volume of greenhouse-gas emissions does my organization create each year? What is the water or energy consumption of my enterprise? What is the occupational injury and illness rate at my company? What are the most important externalities in my industry or ecosystem? Businesses also need to consider forecasts for these metrics over the next decade, to 2025.

3. **Identify the total addressable market and technology adoption rates over the next 10 years** for each digital initiative, based on secondary research, existing use cases, primary research and interviews with technology and industry experts.

4. **Create a value tree to represent the different industry and societal value categories mentioned above.** It is important to note that our methodology does not put a price tag on the number of lives saved by digital initiatives. For carbon emissions, an economic value has been calculated using the average social cost per tonne of CO₂ emissions.

5. **Test, revise and validate assumptions and results** with academics, economists, DTI working-group members and select industry partners of the World
6. Continuously reiterate the approach to factor in new technology developments, increasing or decreasing adoption rates or the impact of policy changes.

Example 10: Aviation, Travel and Tourism – diffusion of ownership

An extension of the sharing economy, access-based platform business models enable the sharing and exchange of assets, employees, products and services between organizations in the travel ecosystem. The B2C sharing economy has had a proven impact, but sharing-economy models can also work between companies in a B2B context. As systems become more interoperable, it will become easier to connect and exchange assets, generating mutual benefits: the owning party reduces the costs of ownership, while the borrowing party can build a positive business case and gain on-demand access to assets. This initiative could generate significant value for society, which we estimate at $380 billion over the next decade. This is driven primarily by customer savings ($193 billion) from the use of short-term rental platforms rather than booking hotels and the economic surplus to homeowners ($182 billion) who share assets. We also expect a potential reduction in CO₂ emissions of 107 million tonnes, which we value at $5 billion and equates to around a 1.3% reduction in overall aviation emissions, if new aircraft sharing models are adopted in commercial aviation.

The value tree (Figure 11) and table (Figure 12) below outline the assumption and approach that have been used to calculate the value to industry and wider society of this initiative.

Example 2: Predictive Maintenance and Operations Optimization in Oil and Gas – value impact for society and the environment

Figure 11: Value tree showing how value at stake for the Diffusion of Ownership initiative (Aviation, Travel and Tourism) has been computed

<table>
<thead>
<tr>
<th>Value addition for industry</th>
<th>Value migration for industry</th>
<th>Value impact for customers</th>
<th>Value impact for society and environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private charters</td>
<td>Increased aircraft utilization</td>
<td>Cost savings</td>
<td>Environment</td>
</tr>
<tr>
<td>Airlines</td>
<td>Reduction in operating costs</td>
<td>Emissions savings</td>
<td>Economic surplus to homeowners</td>
</tr>
<tr>
<td>Short-term rentals</td>
<td>Revenue from platform transaction fees</td>
<td>Economic surplus to homeowners</td>
<td>Net impact on jobs</td>
</tr>
<tr>
<td>Hotels</td>
<td>Increased occupancy of hotel spaces</td>
<td>Savings on short-term rentals versus hotels</td>
<td>Societal</td>
</tr>
<tr>
<td>Migration from hotels to short-term rentals</td>
<td>Revenue destruction as demand</td>
<td>% room nights migrated to short-term rentals; cost savings per night booked (hotel ADR – short-term rental ADR)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Migrates from hotel rooms</td>
<td>Fuel savings from commercial aircraft sharing converted to CO₂ emissions; social cost of carbon emissions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operating margin loss for hotels as room nights cannibalized by short-term rentals</td>
<td>Jobs migrating away from hotels; job gains at short-term rental platforms</td>
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<tr>
<td></td>
<td></td>
<td>Booking revenues after platform fees; % margin for homeowners on rentals; nights / average listing</td>
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</table>
## Table: Tourist Rooms Migrated from Hotels to Vacation Rentals (2015-2025)

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<tbody>
<tr>
<td>AERIALS – ON-DEMAND JET CHARTERS</td>
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<tr>
<td>Adoption rate of on-demand charter</td>
<td>%</td>
<td>Assumption</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Charter flights market size</td>
<td>millions USD</td>
<td>IBIS</td>
<td>17,000</td>
<td>17,629</td>
<td>18,261</td>
<td>18,958</td>
<td>19,659</td>
<td>20,387</td>
<td>21,141</td>
<td>21,923</td>
<td>22,734</td>
<td>23,575</td>
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<tr>
<td>Total chartered flights</td>
<td>millions</td>
<td>Calculation</td>
<td>1.05</td>
<td>1.09</td>
<td>1.13</td>
<td>1.17</td>
<td>1.21</td>
<td>1.26</td>
<td>1.31</td>
<td>1.35</td>
<td>1.40</td>
<td>1.46</td>
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<tr>
<td>Portion of flights that are empty legs</td>
<td>%</td>
<td>Raconteur</td>
<td>45</td>
<td>45</td>
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<tr>
<td>Discount on empty legs</td>
<td>%</td>
<td>Fly Victor</td>
<td>75</td>
<td>75</td>
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<td>75</td>
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<td>75</td>
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<tr>
<td>Margin on private charter</td>
<td>%</td>
<td>Air Charter Service</td>
<td>2</td>
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<tr>
<td>AERIALS – COMMERCIAL AIRLINES SHARING AIRCRAFT</td>
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<tr>
<td>Adoption rate of commercial aircraft sharing</td>
<td>%</td>
<td>Assumption</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>13</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Average passenger load factor</td>
<td>%</td>
<td>IATA</td>
<td>80.40</td>
<td>80</td>
<td>80.10</td>
<td>80.17</td>
<td>80.09</td>
<td>80.12</td>
<td>80.11</td>
<td>80.12</td>
<td>80.12</td>
<td>80.12</td>
<td></td>
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<tr>
<td>Savings on fuel</td>
<td>%</td>
<td>Assumption</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
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<tr>
<td>Savings on labour</td>
<td>%</td>
<td>Assumption</td>
<td>5.00</td>
<td>5.00</td>
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<tr>
<td>Savings on other costs</td>
<td>%</td>
<td>Assumption</td>
<td>5.00</td>
<td>5.00</td>
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<tr>
<td>HOTEL WORKSPACE SHARING</td>
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<tr>
<td>Adoption rate of workspace sharing</td>
<td>%</td>
<td>Assumption</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
<td>55</td>
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<tr>
<td>Hotel food and beverage (F&amp;B) sales</td>
<td>millions USD</td>
<td>STEHOT</td>
<td>130,350</td>
<td>135,955</td>
<td>141,801</td>
<td>147,899</td>
<td>154,258</td>
<td>160,891</td>
<td>167,810</td>
<td>175,025</td>
<td>182,552</td>
<td>190,401</td>
<td></td>
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</tr>
<tr>
<td>Increase in F&amp;B</td>
<td>%</td>
<td>Assumption</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Margin on F&amp;B</td>
<td>%</td>
<td>STEHOT</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
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<td>SHORT-TERM RENTAL PLATFORMS</td>
<td></td>
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<tr>
<td>Global short-term rental room nights booked</td>
<td>millions</td>
<td>Cowen &amp; Company</td>
<td>1,153</td>
<td>1,253</td>
<td>1,333</td>
<td>1,423</td>
<td>1,509</td>
<td>1,595</td>
<td>1,680</td>
<td>1,762</td>
<td>1,845</td>
<td>1,926</td>
<td>2,012</td>
<td></td>
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<tr>
<td>Room nights booked through online travel aggregators (OTAs)</td>
<td>%</td>
<td>Phocuswright / Assumptions</td>
<td>41</td>
<td>46</td>
<td>51</td>
<td>55</td>
<td>59</td>
<td>63</td>
<td>65</td>
<td>68</td>
<td>71</td>
<td>73</td>
<td>75</td>
<td></td>
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<tr>
<td>Short-term rental ADR</td>
<td>$ USD</td>
<td>Cowen &amp; Company</td>
<td>89</td>
<td>92</td>
<td>95</td>
<td>98</td>
<td>100</td>
<td>103</td>
<td>106</td>
<td>108</td>
<td>110</td>
<td>112</td>
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<tr>
<td>Revenue Take Rate (% of Bookings)</td>
<td>%</td>
<td>Cowen &amp; Company</td>
<td>12.50</td>
<td>13.00</td>
<td>13.40</td>
<td>13.90</td>
<td>14.40</td>
<td>14.70</td>
<td>15</td>
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<td>15.90</td>
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<td>Margin on short-term rentals</td>
<td>%</td>
<td>Google Finance / Assumption</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
<td>4.0</td>
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<td>MIGRATION FROM HOTELS TO SHORT-TERM RENTALS</td>
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<tr>
<td>Global short-term / vacation rentals nights booked</td>
<td>millions</td>
<td>Calculation</td>
<td>1,153</td>
<td>1,253</td>
<td>1,333</td>
<td>1,423</td>
<td>1,509</td>
<td>1,595</td>
<td>1,680</td>
<td>1,762</td>
<td>1,845</td>
<td>1,926</td>
<td>2,012</td>
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<tr>
<td>Room nights migrated from hotels</td>
<td>%</td>
<td>Cowen &amp; Company</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
<td>52.5</td>
<td>55.0</td>
<td>57.5</td>
<td>60.0</td>
<td>57.5</td>
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<td>52.5</td>
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<tr>
<td>Global hotel room nights occupied</td>
<td>millions</td>
<td>STR / Calculation</td>
<td>4,017</td>
<td>4,057</td>
<td>4,098</td>
<td>4,139</td>
<td>4,180</td>
<td>4,222</td>
<td>4,264</td>
<td>4,307</td>
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<tr>
<td>Global hotel ADR</td>
<td>millions</td>
<td>STR</td>
<td>122</td>
<td>125</td>
<td>129</td>
<td>133</td>
<td>137</td>
<td>141</td>
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<td>150</td>
<td>154</td>
<td>159</td>
<td></td>
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<tr>
<td>Hotel margin</td>
<td>%</td>
<td>Capital IQ</td>
<td>7.0</td>
<td>7.0</td>
<td>7.0</td>
<td>7.0</td>
<td>7.0</td>
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Source: World Economic Forum/Accenture analysis
The example shows how a value tree has been used to evaluate the societal and environmental impact of these digital initiatives. A major area of interest for asset-heavy industries such as Oil and Gas relates to improving the productivity of assets. Predictive maintenance exploits real-time or historical data about equipment usage and maintenance to spot patterns about the performance and reliability of machinery and, ultimately, to create an optimized, bespoke maintenance programme for each type of equipment. However, predictive maintenance is not merely a powerful tool for reducing costs and boosting operational efficiency in the industry; the benefits for society and the environment are huge. We predict this initiative will reduce emissions of CO$_2$ equivalents by approximately 350 million tonnes, and emissions of sulphur dioxide and mono-nitrogen oxides by a further 0.15 million tonnes and 0.2 million tonnes respectively.

Another environmental benefit of predictive analytics is its role in reducing oil spills by 55,000 and 65,000 barrels in production and transport respectively by 2025. The value tree below gives an insight into how these benefits have been calculated.

**Digital Transformation Initiative Project Contributors**
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**Figure 13: Value tree showing value impact for society and environment in the Oil and Gas industry**

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Source: World Economic Forum/Accenture analysis
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Endnotes


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