Digital Transformation Initiative
In collaboration with Accenture

Unlocking $100 Trillion for Business and Society from Digital Transformation
FOREWORD

The world is being transformed by new technologies, which are redefining customer expectations, enabling businesses to meet these new expectations, and changing the way people live and work. Digital transformation, as this is commonly called, has immense potential to change consumer lives, create value for business and unlock broader societal benefits.

The World Economic Forum launched the Digital Transformation Initiative in 2015, in collaboration with Accenture, to serve as the focal point for new opportunities and themes arising from the latest developments in the digitalization of business and society. It supports the Forum’s broader activity around the theme of the Fourth Industrial Revolution. Since its inception, the Initiative has analysed the impact of digital transformation across 13 industries and five cross-industry topics, to identify the key themes that enable the value generated by digitalization to be captured for business and wider society. Drawing on these themes, we have developed a series of imperatives for business and policy leaders that look to maximize the benefits of digitalization. We have engaged with more than 300 executives (both from leading global firms and newer technology disruptors), government and policy leaders, and academics.

Every industry has its nuances and contextual differences, but they all share certain inhibitors to change. These include the innovator’s dilemma (the fear of cannibalizing existing revenue models), low technology adoption rates across organizations, conservative organizational cultures, and regulatory issues. Business and government leaders should continue to work towards addressing these challenges.

A notable outcome of this work is the development of our distinctive economic framework, which quantifies the impact of digitalization on industry and society. It can be applied consistently at all levels of business and government to help unlock the estimated $100 trillion of value that digitalization could create over the next decade. We have already started to leverage this framework for region-specific discussions with some governments.

We are confident that the findings from the Initiative will contribute to improving the state of the world through digital transformation, both for business and wider society.
GRATITUDE GOES TO OUR CEO CHAMPIONS FOR THEIR SUPPORT

Jonas Prising
CEO
ManpowerGroup

Jean-Yves Charlier
CEO
VimpelCom

Arne Sorenson
CEO
Marriott International

T.V. Narendran
CEO
Tata Steel

Bob Dudley
CEO
BP

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1. INTRODUCTION TO THE DIGITAL TRANSFORMATION INITIATIVE (DTI)

In a world where game-changing innovation has become the norm, the DTI provides a unique insight into the impact of technology on business and society over the next decade.

The past 12 months have brought a series of exciting technological breakthroughs. Self-driving Tesla cars can now be seen on the road; Uber is testing autonomous taxis in Pittsburgh; Google DeepMind’s Alpha Go demonstrated a leap forward in artificial intelligence with a famous victory at the board game Go; and augmented reality hit the mainstream with the success of Pokémon Go. Game-changing innovation has become the norm.

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.

This executive summary introduces the approach taken to unlocking the value of digitalization. Over the past two years, the DTI has developed a unique value-at-stake framework to support a consistent way of measuring technology’s impact on business and wider society. This is covered in the section on Unlocking Digital Value to Society: A New Framework for Growth.

The goal is for this framework to provide a base of evidence and a common language for public-private collaboration focused on ensuring that the benefits of digital transformation are fairly and widely shared.
THE COMBINATORIAL EFFECTS OF TECHNOLOGY ARE ACCELERATING CHANGE

The falling cost of advanced technologies is a defining characteristic of the digital revolution. It is playing a major role in accelerating innovation.

Cheaper and better technology is creating a more connected world: 8 billion devices are now connected to the internet; by 2030, that number is forecast to grow to 1 trillion.

As the cost of advanced technologies continues to fall, new applications will be opened for them, as well as opportunities to combine them in innovative ways. This unleashes "combinatorial" effects, where the capability of technologies working in tandem far exceed their capabilities when deployed separately.

Take, for example, continuous liquid interface production (CLIP): it can produce isotropic parts with mechanical properties and surface finish similar to injection-moulded plastics. Carbon, a Technology Pioneer of the World Economic Forum, is using CLIP, the cloud and analytics in a platform-based business model to significantly advance what used to be a prototype technology into high-quality, scalable and low-cost manufacturing.

The combinatorial effects of base technologies, such as mobile, cloud, sensors, analytics and the Internet of Things (IoT), are accelerating progress exponentially. Technology is the multiplier.

Examples of the falling cost of key technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Year 1</th>
<th>Cost per unit 1</th>
<th>Year 2</th>
<th>Cost per unit 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drones</td>
<td>2007</td>
<td>$100,000</td>
<td>2013</td>
<td>$700</td>
</tr>
<tr>
<td>DNA Sequencing</td>
<td>2000</td>
<td>$2.7 billion</td>
<td>2007</td>
<td>$10 million</td>
</tr>
<tr>
<td>Solar</td>
<td>1984</td>
<td>$30</td>
<td>2014</td>
<td>$0.16</td>
</tr>
</tbody>
</table>

* kilowatt hour

Source: World Economic Forum/Accenture analysis

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SEVEN TECHNOLOGIES ARE TRANSFORMING THE INDUSTRIES COVERED BY DTI RESEARCH

DTI research to date has identified seven key technologies that are expected to have the most impact among the industries analysed.

Note: This list is not comprehensive and does not include all the emerging technologies (e.g. blockchain) that were identified in only one or two use cases across DTI industries to date.

- Artificial intelligence
- Autonomous vehicles
- Big data analytics and cloud
- Custom manufacturing and 3D printing
- Internet of Things (IoT) and connected devices
- Robots and drones
- Social media and platforms
The sections that follow offer a summary of the research into the impact of digitalization on industry and wider society.

Over the past two years, DTI research has focused on understanding the impact of digital transformation in 13 industries and drawing insights from the cross-industry themes that came out of that analysis.

In section two of this summary, five cross-industry themes are introduced. Digital Consumption explains how the rapidly changing expectations of digital customers are forcing enterprises to reinvent themselves. Digital Enterprise looks at how companies can respond by rethinking every aspect of their businesses. Platform Economy focuses on the immense impact of one type of digitally enabled business model – business-to-business (B2B) platforms. The adoption of new digital business and operating models is having a profound impact on society, a theme analysed in Societal Implications. A quantitative analysis of the impact of digitalization on business and wider society is then introduced in the final cross-industry theme, Unlocking Digital Value to Society.

In section three, in-depth industry reviews are presented. Thirteen industries were analysed: Aviation, Travel and Tourism; Chemistry and Advanced Materials; Mining and Metals; Oil and Gas; Professional Services; Retail; Telecommunications; Automotive; Consumer; Electricity; Healthcare; Logistics; and Media.

Finally, drawing on these cross-industry themes and industry reviews, section four proposes a set of Opportunities to Improve the State of the World.
2. Cross-Industry Themes
DIGITAL CONSUMPTION: THREE BATTLEGROUNDS FOR THE DIGITAL CUSTOMER

Enterprises need to constantly reinvent their offerings to keep up with the rapidly evolving expectations of digital customers.

**Products and services to experiences**

Offering products and services is no longer enough: successful companies will be the ones focused on delivering the most compelling experiences. In fact, 56% of business leaders believe that customer experience is their top digital transformation priority.

**Hyper-personalization**

Customers expect and value increasingly personalized interactions at all points of their journey, and digital technology is enabling companies to deliver personalization economically at scale. The challenge companies face, however, is to understand how much personalization customers want, as 90% of consumers say they would limit access to certain types of personal data.

**Ownership to access**

Enabled by digital platforms, customers are substituting ownership of goods with access-based models. The global market for shared goods and services across five key sectors is expected to grow to $335 billion by 2025. Companies should evaluate opportunities to cater to customer preferences for access-based models, before competitors or start-ups sweep in.

Selected case studies:

- Amazon Business
- Disney (Magic Bands)
- Shopkick
- Macy's
- Ginger.io
- Moovel
- DriveNow

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Companies are recognizing that digital customers increasingly demand high-quality experiences and guaranteed outcomes, rather than just products and services. This development is leading to new, outcome-based business models.

A Focus on Outcomes

**AUTOMOTIVE**

The connected car is enabling outcome-oriented experiences, such as personalized apps to help electric-car drivers minimize their electricity bills.

**BANKING**

Self-checking, greater security, predictive services to enhance wealth creation, and payment platforms are likely to be key emerging themes in personal finance.

**CONNECTED HOMES**

Managing energy, shopping, security, environment, entertainment, our diaries and budgeting are all becoming possible with new advances in the connected home.

**EDUCATION**

Personalized, automated learning services will help deliver a tailored, individual approach based on unique needs, with the ability to monitor how much a student has learnt more effectively.

**HEALTHCARE**

Digital is expected to have a profound impact on health and wellness, enabling a shift from population-based diagnostics and prescriptions to those centred on individuals.

**RETAIL**

Personalized services and more interactive in-store digital experiences could help companies provide a more integrated approach to managing customer journeys.

**Why outcomes matter**

The low cost and easy availability of connected sensors, coupled with breakthroughs in data analytics, have enabled outcome-based services to become a reality. In many instances, companies are using digital technologies to identify and target the outcomes that customers care about, giving them powerful tools to improve customer satisfaction and enhance customer lives.

This trend becomes highly relevant in today’s world where customers tend to adopt products and services that deliver real value to them, but also use these experiences to define their expectations across all other industries.
Customers increasingly expected relevant, personalized interactions through every engagement channel. Advances in AI and other technologies are opening up new possibilities for hyper-personalization.

DIGITAL CONSUMPTION: HYPER-PERSONALIZATION

The hyper-personalization spectrum

Digitalization has enabled two main forms of hyper-personalization:

1. Giving customers control to customize their product/experience
   - EXAMPLES
     - Create your own suit
     - Customized shoes
     - 100+ drink choices and customization options
   - IMPLICATIONS
     - Lower requirement for access to customer data
     - Requires more direct engagement from the customer (opt-in) at point of sale
     - Robust and agile supply chains to provide convenience and choice

2. Providing more relevant interactions by analyzing customer data
   - EXAMPLES
     - Personalized in-store shopping recommendations
     - Mobile app using machine learning to monitor mental-health patients
     - Music tailored in real time to mood and location
   - IMPLICATIONS
     - Requires (repeat) access to customer data
     - Usage data can be captured without direct customer intervention
     - Analytical capabilities to tailor personalized offers and services

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DIGITAL CONSUMPTION: OWNERSHIP TO ACCESS

The concept of ownership to access has emerged across a wide set of markets

A preference for access rather than ownership is now mainstream, with more than 110 million people in North America already participating in the collaborative economy. This shift towards access-based consumption patterns holds important implications for businesses, especially for traditional revenue models.

Ownership to access can also generate value for society. It does so by creating an economic system of marketplaces and platforms that unlock the value of underused assets and improve resource efficiency.

Cohealo, a US-based technology company, allows hospitals to share equipment, reducing the need to buy assets and boosting utilization rates. Cohealo says that its service has saved hospitals $1 million to $2 million each.

Which sectors are most likely to be disrupted by access-based models (grouped by net asset value)?

Factors determining the extent of access-based business models include:

<table>
<thead>
<tr>
<th>Net asset value</th>
<th>Underutilized capacity</th>
<th>Shareability quotient</th>
<th>Regulatory environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Accommodation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Automotive</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Luxury Apparel</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical Equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sports Equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Personal Care Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Food and Beverage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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“Do not reinvent the wheel. Partner with experts who have a competitive edge – a team effort across industry is necessary.”

Aireen Omar
Chief Executive Officer,
AirAsia, Malaysia
DIGITAL ENTERPRISE: HOW TO SURVIVE DISRUPTION AND THRIVE IN THE DIGITAL AGE

Disruption may not be bankrupting incumbents, but to succeed in the digital era, they will need to become digital enterprises, rethinking every aspect of their business.

### Digital business models
Companies need to fundamentally change the way they identify, develop and launch new business ventures. A recent study forecast that 30% of industry revenues will come from new business models by 2020.

### Digital operating models
Digital leaders follow a lean approach to both core and support functions. With this in mind, 90% of companies have significantly adjusted operations in the past two years.

### Digital talent and skills
To attract, retain and develop talent, enterprises will need to embrace cultural change, focus on recruiting millennials and adapt to new ways of working. Companies need to prepare for greater automation, with 81% of managers believing that machines will make workers more effective.

### Digital metrics for success
Traditional key performance indicators are no longer effective at measuring the performance of a business in the digital age. Leading enterprises track the metrics that matter, and react to them in real time. Companies that understand digital transformation earn 26% more profit than others.

Selected case studies: Intel, Cisco, GE, MI, Glassdoor, P&G, Focus@will, General Atlantic

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Companies can choose from several options when implementing a digital business model. The following factors are likely to determine the path selected.

<table>
<thead>
<tr>
<th>Traditional approaches</th>
<th>Additional approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Build</strong></td>
<td><strong>Invest</strong></td>
</tr>
<tr>
<td>Might be the best route:</td>
<td>• Allows an established company to connect with the right skills and capabilities</td>
</tr>
<tr>
<td>• When the opportunity is related to the company’s core business</td>
<td>• Avoids hindering entrepreneurial forces with a set-up focused on internal governance and reporting, which would undermine the start-up’s agility</td>
</tr>
<tr>
<td>• If there is still time until the market's inflection point</td>
<td></td>
</tr>
<tr>
<td>• If the company can hire the necessary talent</td>
<td></td>
</tr>
<tr>
<td><strong>Buy</strong></td>
<td><strong>Incubate/Accelerate</strong></td>
</tr>
<tr>
<td>Usually most appropriate:</td>
<td>• Allows for a close relationship to the funding company, enabling internal capabilities, infrastructure and resources to be deployed to help the start-up</td>
</tr>
<tr>
<td>• When it is strategically imperative to “own” a market</td>
<td>• Benefits companies via increased deal flow in business models and technologies</td>
</tr>
<tr>
<td>• If the market inflection point is close, and hiring the right talent is not possible</td>
<td></td>
</tr>
<tr>
<td>• If the new opportunity bears little relation to the company’s current business model</td>
<td></td>
</tr>
<tr>
<td><strong>Partner</strong></td>
<td></td>
</tr>
<tr>
<td>When there is no strategic need to own:</td>
<td></td>
</tr>
<tr>
<td>• Learn more from a “digital native” about the market and the partner’s model</td>
<td></td>
</tr>
<tr>
<td>• Useful when deeper partnerships or future acquisitions are required</td>
<td></td>
</tr>
</tbody>
</table>

Source: World Economic Forum/Accenture Analysis

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Digital disruption is encouraging companies to re-examine their operating models. DTI research has identified five operating models for the digital age.

<table>
<thead>
<tr>
<th>Digital Operating Model</th>
<th>Organization</th>
<th>Process</th>
<th>People</th>
<th>Culture</th>
<th>KPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUSTOMER-CENTRIC</td>
<td>Decentralized</td>
<td>Front Office</td>
<td>Front-line empowerment</td>
<td>Client first</td>
<td>Net present value</td>
</tr>
<tr>
<td>EXTRA FRUGAL</td>
<td>Standardized</td>
<td>Supply and manufacturing; support functions</td>
<td>Process optimization</td>
<td>Less is more</td>
<td>Cost</td>
</tr>
<tr>
<td>DATA-POWERED</td>
<td>Centre of excellence / hub and spoke</td>
<td>Supported by deep analytics capabilities</td>
<td>Agile test and learn</td>
<td>Serendipity</td>
<td>Return on investment</td>
</tr>
<tr>
<td>SKYNET</td>
<td>Standardized</td>
<td>Manufacturing</td>
<td>Automation</td>
<td>‘Engineer’</td>
<td>Full-time employee ratio</td>
</tr>
<tr>
<td>OPEN AND LIQUID</td>
<td>Local</td>
<td>Constant dialogue with outside world</td>
<td>Collaboration / crowdsourcing</td>
<td>Sharing</td>
<td>Net present value</td>
</tr>
</tbody>
</table>

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DIGITAL ENTERPRISE: DIGITAL TALENT AND SKILLS

To stay relevant, companies should consider how their talent requirements need to evolve, to meet the skills and workforce challenges created by rapid digitalization.

Attract, retain and develop talent

• Be a great place to work for millennials. Formulate a multi-year engagement strategy. Empower and incentivize the workforce through development opportunities.

• Create a workforce with digital skills. Whether it’s developing training programs to obtain necessary skills or hiring digital natives, companies need to be aware of where talent is headed and how they can help.

Bring leadership into the digital age

• Leaders should hire people with digital mindsets and a willingness to change the status quo. Accept failure, and move away from the risk-averse mindset. Finally, embrace flatter structures and move away from hierarchies.

• Foster a digital culture from the top through communication, journey management, visible changes, and continuous change monitoring.

Adapt to different ways of working

• Create environments where humans and robots can work together successfully. Evaluate the value of automation, establish the extent to which automation will form the core of your business, and invest in developing internal automation capabilities.

• Prepare for the rise of the on-demand workforce but ensure that there is enough of a balance to maintain corporate culture.

The skills crunch

81% say they are looking for a wider mix of skills when hiring

73% of CEOs cite skills shortages as a threat to their businesses

Source: PwC, People Strategy for the Digital Age

Source: PwC, People Strategy for the Digital Age
DIGITAL ENTERPRISE: DIGITAL METRICS FOR SUCCESS

Many companies have discovered that traditional financial key performance indicators (KPIs) are no longer effective at measuring the success of a business. Digital traction metrics provide invaluable insights that complement financial reporting.

Why is digital traction important?
Being able to measure digital traction – and find ways to boost it – is important for both digital disruptors and established businesses for two key reasons.

1. In some scenarios, strong digital traction (e.g. a high NPS) means that the cost of marketing falls to zero and, in the case of a peer-to-peer business model, service costs could also approach zero.

2. Strong digital traction can boost company valuations as digital enterprises have more scalable, highly engaged customers than traditional companies. In a down market, these scale effects become more pronounced in investor valuations.
In a platform-driven world, enterprises and policy-makers need to collaborate on new initiatives to unlock the potential of B2B platforms to deliver value for society.

**Driving transformed business models**

Interactions drive scale through network effects in digital B2B platform business models. Emergent innovation and outcome-based strategies across platform participants support these models.

**Helping ecosystems expand**

Digital B2B platforms are blurring industry lines and reshaping industries into complex, interconnected systems. In a survey of 2,000 business and information technology executives, 81% believe industry boundaries will become dramatically less distinct.

**Creating a win-win for industry and society**

Platform-driven interactions are expected to enable approximately two-thirds of the $100 trillion value at stake from digitalization by 2025. In contrast to other technologies, society is expected to gain as much as industry through digital B2B platforms.

Incumbents and disruptors are creating new platform business models across industries and geographies:

- GE Healthcare
- Philips
- GM
- OpenPort
- RippleLabs
- Amazon
- Upwork
- Alibaba Group
- Slack
NEW STRATEGIES AND OPERATIONAL CAPABILITIES FOR SUCCESS IN THE PLATFORM ECONOMY

Platform strategies shape operational capabilities to deliver desired outcomes within a platform ecosystem.

- The traditional pricing approach will progress to outcome-based rewards sharing across ecosystem participants.
- Performance monitoring will need to transition to relevant new digital metrics (e.g. interactions) from traditional ones (e.g. customer conversions).
- To unlock value, existing organizational structures must adjust by adopting a "platform mindset".
- Enterprises will need to foster a "collaboration-first" culture to cooperate both internally (across different business units) and externally (with other enterprises and policy-makers).

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Digital transformation is generating a fierce debate among policy-makers, economists and industry leaders about its societal impact.

**Employment**

Current estimates of global job losses due to digitalization range widely, from 2 million to as high as 2 billion by 2030. This analysis suggests that digitalization can be a net job creator in some industries. But, with both winners and losers resulting from digital transformation, a huge premium rests on the near-term ability of businesses to upskill employees and shape the next generation of talent.

**Sustainability**

It has not yet been possible to decouple economic growth from an increase in emissions and use of resources. Current business practices will contribute to a global gap of 8 billion metric tons between the supply of and demand for natural resources by 2030, translating to $4.5 trillion of lost economic growth. The analysis suggests that digitalization could make a positive contribution to this challenge.

**Trust**

Social media, user-generated websites and other innovations have been instrumental in increasing transparency and overcoming information asymmetries. However, trust in all technology-based sectors declined in 2015. Beyond privacy and security concerns, broader ethical questions about the way organizations use digital technology threaten to erode trust in those institutions.

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The DTI value-at-stake framework and DVS metric developed here offer a distinctive approach to understanding – and unlocking – the value of digitalization for business and society.

**Value at stake**
The value-at-stake analysis assesses the impact of digital initiatives on industries, customers, society and the environment over the next decade (2016 to 2025). Over the past two years, more than 130 digital initiatives covering innovations as diverse as driverless cars, predictive analytics, remote healthcare and drones have been analysed.

**Notes on methodology:** Value at stake integrates all segments of an industry’s value chain, capturing about 80% of revenues and profits. It considers the total addressable market and adoption/penetration rates over the next 10 years, and is based on research, industry reports, existing use cases and interviews with experts. Value-driver trees are used to assess key drivers against areas of impact for industry and society.

**Digital value to society (DVS)**
A new framework, digital value to society (DVS), was created by aggregating the key performance indicators that relate to the impact of digitalization on health and safety, employment, the environment and customers. The graphic on the right illustrates how DVS maps to value at stake.

Value at stake and DVS are intended to provide an evidence-based framework to encourage collaboration between enterprises and policy-makers, and to unlock the societal benefits of digitalization.

**The components of value at stake and DVS**

<table>
<thead>
<tr>
<th><strong>Society and Environment</strong></th>
<th><strong>DVS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lives saved</td>
<td>• Net job creation</td>
</tr>
<tr>
<td>Carbon emissions</td>
<td>• Median income growth</td>
</tr>
<tr>
<td>Life expectancy</td>
<td>• Income disparity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Consumer Benefits</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time savings</td>
<td>• Value addition (from new products / services)</td>
</tr>
<tr>
<td>Cost saving on consumption</td>
<td>• Value migration (from shifting profit pools)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Labour</strong></th>
<th></th>
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<tbody>
<tr>
<td></td>
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</table>

<table>
<thead>
<tr>
<th><strong>Industry</strong></th>
<th></th>
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<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This distinctive economic framework helps business leaders, regulators and policy-makers to unlock the estimated $100 trillion of value that digitalization could generate over the next decade.

- The economic framework developed aims to quantify the impact of digital transformation on industry and broader society.
- The framework is new and will be iterated further over the next year, but it can already be applied at all levels of government and business, helping stakeholders to make the right decisions to deliver the full potential of digital transformation.
- It provides a consistent base of evidence and set of definitions for digital concepts, supporting a global, multistakeholder dialogue about digitalization and its implications.
- Proof of concept of the framework for 11 industries was achieved and its application successfully piloted on a national/state level (in the United Kingdom, Denmark, India, and the Indian state of Telangana).

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FOCUS ON DIGITAL DENMARK: UNLOCKING MORE THAN $50 BILLION OF VALUE OVER THE NEXT DECADE

Work has started with the Danish Ministry of Business and Digitization Council to identify and prioritize initiatives across major industry systems, including manufacturing, health, mobility, electricity and e-commerce.

The next step is to capitalize on public-private collaboration to unlock the trapped value of digital transformation, a focus for DTI in 2017.

Value at stake from digital transformation initiatives in Denmark (cumulative 2016-2025)

Initiatives are in the process of being assessed against converging industry systems

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Total Value at Stake</th>
<th>Trapped Value¹ (approx.)</th>
<th>Productivity Gains</th>
<th>Emissions Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E-commerce</strong></td>
<td>$34 billion</td>
<td>$33 billion</td>
<td>$16 billion</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>13% of Denmark’s GDP in 2015</td>
<td>97% of total</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Connected Travel Services</strong></td>
<td>$11 billion</td>
<td>$8 billion</td>
<td>$1 billion</td>
<td>0.3 million tonnes</td>
</tr>
<tr>
<td></td>
<td>4% of Denmark’s GDP in 2015</td>
<td>73% of total</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sharing Economy</strong></td>
<td>$6 billion</td>
<td>$4 billion</td>
<td>$1 billion</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>2% of Denmark’s GDP in 2015</td>
<td>66% of total</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Assisted Driving</strong></td>
<td>$3 billion</td>
<td>$2 billion</td>
<td>--</td>
<td>0.5 million tonnes</td>
</tr>
<tr>
<td></td>
<td>1% of Denmark’s GDP in 2015</td>
<td>75% of total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ Trapped value is the difference between societal value and business value, where societal value is greater than business value. It does not reflect any multiplier effects to either society or business, which are a factor of individual initiatives within each industry and market.
3. In-Depth Industry Reviews: Key Insights
AVIATION, TRAVEL AND TOURISM: DIGITAL THEMES AND INITIATIVES

The industry has been at the forefront of digital disruption in recent years, changing the way people travel. However, the sector should brace itself for another wave of digital transformation.

**Living Travel Experience**

Travellers will experience seamless journeys tailored to their habits and preferences, and travel will blend seamlessly with other everyday activities. Important initiatives are Travel Centricity, Seamless Customer Journey and End-to-End Propositions.

**Enabling Travel Ecosystem**

Digital platforms enabling ecosystem alliances will continue to emerge, as asset- and information-sharing become increasingly important from a B2B perspective. Key initiatives are Ecosystem Convergence, Battle for Customer Mindshare and Diffusion of Ownership.

**Digital Enterprise**

Innovations such as 3D printing, artificial intelligence, IoT, virtual reality and digital platforms will transform operations and the workforce. Key initiatives include Smart Manufacturing, Intelligent Assets and Next Generation Workforce.

**Safety and Security**

As identity management transitions to digital, a collaborative effort to boost cybersecurity and protect traveller data privacy will be crucial to maintain customer trust and public safety. Major initiatives are Data Dilemma, Modern Security Environment and Ubiquitous Tourist Safety.

To find out more about the DTI project, visit http://reports.weforum.org/digital-transformation

AVIATION, TRAVEL AND TOURISM: UNLOCKING VALUE

The digitalization of aviation, travel and tourism could unlock $1 trillion of value for the industry and society over the next decade. Societal benefits include cost and time savings for consumers and reduced environmental footprints.

### AVIATION, TRAVEL AND TOURISM:
Value at stake for industry and wider society, by digital theme (cumulative 2016-2025)

<table>
<thead>
<tr>
<th></th>
<th>Potential Business Impact ($ billion)</th>
<th>Potential Societal Impact ($ billion)</th>
<th>Total Value at Stake ($ billion)</th>
<th>Emissions Reduction (million tonnes CO₂)</th>
<th>Net Impact on Jobs (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Travel Experiences</td>
<td>100</td>
<td>165</td>
<td>265</td>
<td>--</td>
<td>270</td>
</tr>
<tr>
<td>Enabling Travel Ecosystem</td>
<td>105</td>
<td>380</td>
<td>485</td>
<td>107</td>
<td>(940)</td>
</tr>
<tr>
<td>Digital Enterprise</td>
<td>190</td>
<td>20</td>
<td>210</td>
<td>143</td>
<td>(100)</td>
</tr>
<tr>
<td>Safety and Security</td>
<td>10</td>
<td>140</td>
<td>150</td>
<td>--</td>
<td>(10)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>405</strong></td>
<td><strong>705</strong></td>
<td><strong>1,110</strong></td>
<td><strong>250</strong></td>
<td><strong>(780)</strong></td>
</tr>
</tbody>
</table>

### Unlocking Societal Value: End-to-End Propositions
End-to-end propositions are starting to overhaul traditional methods of booking elements of a journey separately. Fully integrated and personalized travel experiences can be booked more quickly and easily. It could even be possible to create a push model for booking travel, where travellers are sent a proposition, based on events in their calendar and past travel preferences, before even starting to search for airfares or accommodation. All operational tasks would be handled in a smart machine-learning environment, with feedback loops continuously improving the service.
CHEMISTRY AND ADVANCED MATERIALS: DIGITAL THEMES AND INITIATIVES

The industry’s contributions allow other sectors to turn innovations into sophisticated products that enable digitalization. Three themes are central to the sector’s own efforts to capture the value of digital transformation.

**Digitalize the Enterprise**

Advanced digital technologies, such as the Industrial Internet of Things, automation, analytics and artificial intelligence, will take core operational functions to the next level (e.g. research and development [R&D], manufacturing and supply chain), and will augment workforce capabilities. Key initiatives are Digital R&D, Digital Supply Chain, Digital Plant and Augmented Workforce.

**Go Beyond the Molecule**

Digitalization presents the industry with opportunities to launch new digitally enabled offerings, create outcome-oriented business models and improve customer interaction. Major initiatives are Digitally Enabled Offerings and Business Models, Advanced Customer Interaction, and Accelerated Circular Economy.

**Collaborate in Ecosystems**

Accelerated innovation cycles will drive the industry to build flexible and interconnected innovation ecosystems. Intense collaboration and data sharing along the value chain will help to better address customer requirements and manage volatility. Key initiatives include Innovation Ecosystem and Value Chain Collaboration.

Case studies:

[Images of company logos: zymergen, syngenta, carbon3D, AkzoNobel, BASF]

To find out more about the DTI project, visit http://reports.weforum.org/digital-transformation
Digitalization could unlock about $550 billion of value for the industry and wider society over the next decade. Positive societal impacts include reduced emissions and lower injury rates in the industry workforce. However, these were the smallest societal gains from the industries analysed.

Unlocking Societal Value:
Digital Plant

Further digitalizing assets and equipment with, for example, smarter sensors, allows companies to monitor asset condition and continuously process quality, throughput and emissions. Assets can send signals on their status and performance which, in combination with real-time analytics and in-memory computing, enable immediate intervention to prevent equipment failures and breakdowns. Combining real-time asset condition information with predictive analytics allows companies to predict the likelihood of asset failures and plan maintenance accordingly. This initiative can generate significant societal benefits, including reducing CO₂ emissions by up to 100 million tonnes.
The industry is embracing the opportunities of digital transformation and facing up to its challenges. Four themes will help players to capture value for the industry and wider society.

### Automation, Robotics and Operational Hardware
Digitally enabled hardware tools are going to perform or improve activities traditionally carried out manually or with human-controlled machinery. Major initiatives include Autonomous Operations and Robotics, 3D Printing and Smart Sensors.

### Digitally Enabled Workforce
Connected mobility, as well as virtual and augmented reality, can empower field, remote and centralized workers in real time. Key initiatives are Connected Worker and Remote Operations Centre.

### Integrated Enterprise, Platforms and Ecosystems
This theme concerns linking operations, IT layers, and devices or systems that are currently separate. Important initiatives are IT/OT Convergence, Asset Cybersecurity and Integrated Sourcing, Data Exchange, Commerce.

### Next-Generation Analytics and Decision Support
Algorithms and artificial intelligence can process data from sources within and beyond the traditional value chain to provide real-time decision support and future projections. Key initiatives are Advanced Analytics and Simulation Modelling and Artificial Intelligence.

**Case studies:**
- Rio Tinto
- Anglo American
- DAQRI
- TATA Steel
- Schneider Electric
- Teck
- Goldcorp
- Mira Geoscience
Digitalization could unlock more than $400 billion of value in industry and societal benefits, which include lives saved, fewer injuries and lower emissions.

### Unlocking Societal Value: Connected Worker

Connected worker technologies have numerous applications in the industry. For instance, equipping workers with connected, intelligent wearables and mobile devices allows mine and plant management to capture critical information in real time. This also enables seamless communication; immediate, remote expert assistance, diagnosis and real-time guidance; and "follow-complete-document" workflows that can be carried out directly in the field. Through better tracking of individuals, especially in dangerous events, it is estimated that up to 500 lives could be saved and more than 20,000 injuries prevented over the next decade.

| MINING AND METALS: Value at stake for industry and wider society, by digital initiative (cumulative 2016-2025) |
| --- | --- | --- | --- | --- |
| **Potential Business Impact ($ billion)** | **Potential Societal Impact ($ billion)** | **Total Value at Stake ($ billion)** | **Emissions Reduction (million tonnes CO₂)** | **Net Impact on Jobs (000s)** |
| **Smart Sensors** | 34 | 8 | 42 | 161 | (40) |
| **Autonomous Operations & Robotics** | 56 | 19 | 75 | 396 | (60) |
| **3D Printing** | -- | 3 | 3 | 35 | -- |
| **Connected Worker** | 85 | -- | 85 | -- | (201) |
| **Remote Operations Centre** | 77 | 7 | 84 | 16 | (12) |
| **Asset Cybersecurity** | 21 | -- | 21 | -- | -- |
| **Integrated Platforms** | 37 | 69 | 106 | -- | (5) |
| **Advanced Analytics** | 11 | -- | 11 | -- | (13) |
| **Total** | **321** | **106** | **427** | **608** | **(330)** |

To find out more about the DTI project, visit http://reports.weforum.org/digital-transformation
“Our ageing workers know the mines and our young guys know digital. When we have been able to have a cohesive cross-generational team, it has been stellar.”

Duncan Wanblad
Chief Executive Officer, Base Metals and Minerals, Anglo American, South Africa
The industry has a chance to move from incremental, digitally driven operational improvements to a broader embrace of digital technologies. Four themes will play a leading role in this transformation.

**Digital Asset Life Cycle Management**
Connecting end-to-end operations across the value stream can ensure that all systems, equipment, sensors and data are communicating and learning from actions. This will lead to increasing efficiency, productivity and compliance with health, safety and environmental standards. Key initiatives are *New Era of Automation*, *Advanced Analytics and Modelling* and *Connected Worker*.

**Circular Collaborative Ecosystem**
Digitalization will help with advanced and innovative collaboration models between producers, suppliers and society, as well as making operations transparent and driving out inefficient practices. Major initiatives are *3D Printing* and *Blockchain / Smart Contracts*.

**Beyond the Barrel**
Digital technologies open new avenues for customer engagement and provide additional services that help create new and innovative business models. Important initiatives are *Digital Customer Services* and *Omnichannel Retail and Experience-based Services*.

**Energizing New Energies**
Digitalization promotes new energy sources and carriers, and innovative models for the optimization and marketing of energy. The Oil and Gas industry must understand the full impact of this, and stay connected with millennials. Key initiatives include *Consumer Energy Choices*.

Case studies:
Digitalization could unlock up to $2.5 trillion of industry and societal value. Societal benefits include reduced emissions and $170 billion in cost savings for customers.

**OIL AND GAS: Unlocking Value**

Digitalization could unlock up to $2.5 trillion of industry and societal value. Societal benefits include reduced emissions and $170 billion in cost savings for customers.

### OIL AND GAS: Value at stake for industry and wider society, by digital theme (cumulative 2016-2025)

<table>
<thead>
<tr>
<th>Digital Theme</th>
<th>Potential Business Impact ($ billion)</th>
<th>Potential Societal Impact ($ billion)</th>
<th>Total Value at Stake ($ billion)</th>
<th>Emissions Reduction (million tonnes of CO₂e)</th>
<th>Net Impact on Jobs (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Asset Life Cycle Management</td>
<td>745</td>
<td>110</td>
<td>855</td>
<td>370</td>
<td>(114)</td>
</tr>
<tr>
<td>Circular Collaborative Ecosystem</td>
<td>30</td>
<td>0.5</td>
<td>31</td>
<td>2</td>
<td>--</td>
</tr>
<tr>
<td>Beyond the Barrel</td>
<td>100</td>
<td>27</td>
<td>126</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>Energizing New Energies</td>
<td>70</td>
<td>500</td>
<td>570</td>
<td>900</td>
<td>35</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>945</strong></td>
<td><strong>637</strong></td>
<td><strong>1,582</strong></td>
<td><strong>1,284</strong></td>
<td><strong>(57)</strong></td>
</tr>
</tbody>
</table>

**Unlocking Societal Value: Consumer Energy Choices**

The shift to new energy sources could reduce CO₂e emissions by 900 million tonnes. This initiative could also add about 35,000 jobs, as generation from renewables, rather than fossil fuels, tends to be more people-intensive. Several super majors are already taking steps to mitigate this trend's impact on their businesses by investing in green or alternative energy (but this has been excluded from our value-at-stake analysis).
Disruptive technologies are fundamentally changing the economics of Professional Services. Four themes will be central to capturing digital value for the industry and wider society.

**Business Model Transformation**

Digitalization empowers firms to change every facet of how they go to market, including their services, value proposition, target customers and prices. Key initiatives are **Enhancing Go-to-Market Strategy and Fostering a Digital Environment.**

**Intelligent Automation**

Emerging technologies such as blockchain, artificial intelligence and deep learning are augmenting professionals’ abilities to “do”, “think”, “learn” and “feel”. Major initiatives include **Modularizing Work and Augmenting Human Intelligence.**

**Digital Agility**

Companies with an agile work culture and smart infrastructure can react quickly and adapt strategies and processes to disruptive events. Important initiatives are **Developing a Flexible Workforce, Nurturing an Agile Culture and Investing in Smart Infrastructure.**

**Talent Empowerment**

In a digitalized world, there is a need to reimagine what it means to be an employee and revisit the employee value proposition for the workforce. Key initiatives include **Reimagining Hiring, Training Talent and Designing the Employee Experience.**

**Case studies:**

- McKinsey & Company
- KPMG
- BCG
- KENS
- PwC
- Eden McCallum
- Entelo
- Glassdoor

To find out more about the DTI project, visit http://reports.weforum.org/digital-transformation
PROFESSIONAL SERVICES: AUGMENTING HUMAN CAPABILITIES THROUGH NEW TECHNOLOGIES

Expertise is the primary product of Professional Services. Machines are augmenting key human capabilities so that expertise can be provided to clients more efficiently, using combinations of humans and machines.

TECHNOLOGIES ARE AUGMENTING PROFESSIONALS’ ABILITIES TO “DO”, “THINK”, “LEARN” AND “FEEL”

**THINK**
- Insight Generation
  - Kensho
- Creativity
  - Project Dreamcatcher, Rembrandt
- Cognition
  - Watson, DeepMind
- Memory
  - Robo Brain

**DO**
- Communication
  - Quill (Narrative Science), Amelia
- Presentation
  - BeamPro, Magic Leap
- Organization
  - Amy Ingram (x.ai)

**LEARN**

**FEEL**
- Relationship Building
  - Crystal, LinkedIn
- Empathy
  - Pepper
- Instinct
  - Uniquely human
- Appearance
  - Sophia

Note: The degree to which human capabilities are being augmented by technology is indicated by the ideograms next to each capability.
Technology will transform retail’s end-to-end value chain. The level of change in the next 10 years will far surpass what has been seen in the past 40 years.

**Maintain Engagement with the Empowered Customer**
Empowered consumers demand to be actively involved at every stage of their decision-making journey and expect increasing levels of choice, control and convenience.

**Rapidly Adopt Disruptive Technologies**
Eight emerging technologies* will be particularly disruptive over the next decade. Though the pace of their development will vary, all will impact the value chain, and rapid adoption will be critical.

**Evolve Business Models and Key Capabilities**
Emerging business models will fundamentally alter the retail landscape, impacting subcategories to varying degrees. The right capabilities will be needed to compete in this evolving environment.

**Manage Societal Impacts**
Transformation in the retail sector has implications for labour, the environment and local communities, which will need to be managed.

Case studies:
- Bonobos
- Amazon Go
- Carrefour
- Rebecca Minkoff
- Mall of the Emirates
- Amazon
- GlamSquad

* The eight technologies are the IoT, autonomous vehicles/drones, robotics, 3D printing, artificial intelligence (AI), augmented reality / virtual reality, digital traceability and blockchain.

To find out more about the DTI project, visit http://reports.weforum.org/digital-transformation
Empowered Consumers

- The consumer equation of **Cost + Choice + Convenience** is becoming more complex thanks to the additional dimensions of **Control + Experience**.
- Incumbents must **open up their value chain to consumers**, enabling them to participate and control a greater span of their experience.

Disruptive Technologies

- Based on their widespread application, resulting efficiencies and impact on labour, **AI / machine learning, autonomous vehicles / drones, IoT and robotics** will be the four **most transformational technologies** to the industry (among the eight assessed).

Transformative Business Models

- If current year-on-year growth is sustained, **e-commerce could reach penetration rates of more than 40%** in 2026 (in digitally developed markets), which will drive **$600 billion in value for business**.
- Four key business models will proliferate: Sharing Economy, Smart Replenishment, Curated Subscription, and Do It for Me. **Sharing Economy** will drive the highest value at stake, with **$1.7 trillion of value for society**.

Key Capabilities

- Intra- and extra-industry **partnerships** will be critical for developing ecosystems to remain competitive in the future.
- **Last-mile delivery** infrastructure currently comprises **25% of the total cost of delivery** and must become more efficient.

Societal Impacts

- **Public-private partnerships** will be critical for managing the impacts on the workforce, the environment and local communities.
“They (13-21 year olds, a generation I call generation K) do not know any different. This is their world – this digital ecosystem is their normality.”

Noreena Hertz
Author and Visiting Professor, University College London
TELECOMMUNICATIONS: DIGITAL THEMES AND INITIATIVES

The industry is a key enabler of digital transformation across industries, but the value of digitalization has so far eluded telecommunications operators. Four themes will be central to capturing it.

Networks of the Future

Amid rising demands on networks and associated cost pressures, operators are accelerating the development of "smart pipes" and new models of extending internet access. Key initiatives are Software-Differentiated Networks, Autonomous Networks, Cyber-resilience and Extending Connectivity.

Beyond the Pipe

Digitalization offers important opportunities to extend revenue streams beyond just connectivity. Important initiatives are Integrated on IoT, Digital Services, Winning the Battle of Ecosystems, and Reimagining Communication.

Redefining Customer Engagement

To win customer mindshare in a digital world, operators must change their approach to identifying and exceeding B2B and B2C customer expectations, while rethinking customer service. A key initiative is Delighting the Digital Customers.

Bridging the Gap on Innovation

The need to rapidly accelerate innovation cycles is forcing industry participants to look beyond in-house R&D and transform company culture to attract the best digital talent. A major initiative is Outside ‘In-novation’.

Case studies:

- AT&T
- Google
- Microsoft
- Qualcomm
- Comcast
- Spotify
- Singtel
- Telefonica
The digitalization of telecommunications could unlock $2 trillion of value for the industry and wider society over the next decade. By enabling the digital transformation of other industries, the sector also generates societal benefits.

**TELECOMMUNICATIONS:**

Value at stake for industry and wider society, by digital theme (cumulative 2016-2025)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Potential Business Impact ($ billion)</th>
<th>Potential Societal Impact ($ billion)</th>
<th>Total Value at Stake ($ billion)</th>
<th>Emissions Reduction (million tonnes CO₂)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Networks of the Future</td>
<td>440</td>
<td>580</td>
<td>1,020</td>
<td>183</td>
</tr>
<tr>
<td>Beyond the Pipe</td>
<td>650</td>
<td>290</td>
<td>940</td>
<td>106</td>
</tr>
<tr>
<td>Redefining Customer Engagement</td>
<td>30</td>
<td>2</td>
<td>32</td>
<td>--</td>
</tr>
<tr>
<td>Bridging the Gap on Innovation</td>
<td>160</td>
<td>1</td>
<td>161</td>
<td>--</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,280</strong></td>
<td><strong>873</strong></td>
<td><strong>2,153</strong></td>
<td><strong>289</strong></td>
</tr>
</tbody>
</table>

**Unlocking Societal Value: Extending Connectivity**

Technologies such as drones, satellites and balloons are extending affordable internet access in regions with low population densities. For telecom operators, these innovations can overcome significant cost barriers in reaching remote areas across developed and developing markets. The potential value to society of the Extending Connectivity initiative is $400 billion over the next decade, or almost half of the sector’s potential overall societal impact, but concerted public-private action will be needed to capture this value fairly and at scale. Considerations include affordability, regulations that ensure fair competition, digital skills, cultural acceptance and accountable institutions.
AUTOMOTIVE: DIGITAL THEMES AND INITIATIVES

The car – the pre-eminent consumer product of the Industrial Revolution – is facing what may be its greatest moment of change. Three digital themes will be central to this transformation.

Connected Traveller

The car is becoming a digital hub for real-time two-way wireless data transfer. The human and the vehicle are moving towards total connectivity across devices, databases and objects. Key initiatives are Infotainment, Usage-based Insurance and Multimodal Integration.

Autonomous Driving

Digitalization will usher in the era of autonomous vehicles. Manufacturers already offer Assisted Driving technologies, such as lane-warning crash avoidance and automatic parking assistance. These technologies could eventually transform the industry with Self-Driving vehicles.

Digital Enterprise

Digital initiatives could drive substantial improvements to the value chain. They include Connected Supply Chains, Digital Manufacturing, Disrupted Retail, Connected Service and Maintenance, Transformed Aftermarkets, Automotive Data Marketplaces and Connected Infrastructure.

Case studies:

JAGUAR  Apple  UbiGo  VOLVO  GM  MICHELIN  TESLA  AUDI

To find out more about the DTI project, visit http://reports.weforum.org/digital-transformation
Digitalization could unlock $2 trillion of value for the industry and society over the next decade. Positive societal impacts include efficient traffic management, reduced congestion and fewer crashes.

Unlocking Societal Value: Multimodal Integration
Multimodal integration seamlessly links all forms of road, rail and ferry travel (including automobile driving and public transit), as well as walking and cycling. Full-scale integration could create more than $270 billion of societal and environmental benefits in the form of time savings from more efficient traffic management, reduced congestion, fewer crashes and lower emissions. It could also deliver consumer benefits worth nearly $1 trillion through lowering the cost of car ownership. Realizing these benefits requires concerted public-private collaborations bringing together original equipment manufacturers (OEMs), suppliers, regulators, and government planning and tax authorities.

To find out more about the DTI project, visit http://reports.weforum.org/digital-transformation
CONSUMER INDUSTRIES: DIGITAL THEMES AND INITIATIVES

Digital innovation is shifting power from brands to consumers, and transferring value from traditional players to digital insurgents. Four key themes will drive value creation for business and wider society.

**Consumer Data Flow and Value Capture**

Digitalization helps companies use consumer data to innovate and improve customer experiences. The growing importance of data will draw increased scrutiny and activism from consumers and regulators, as society puts an even higher premium on data privacy and transparency.

**Experience Economy**

Products will evolve into services, and services into experiences, with data as the backbone of their delivery. Hyper-personalization brings new revenue models in an environment where revenue is more closely linked to outcomes for individuals and society.

**Omnichannel Retail**

With online purchases growing in most categories, traditional stores must change to stay relevant. Omnichannel strategies will play an important role. Consumer-products companies will also need effective strategies to compete in e-commerce and capture value in the sharing economy.

**Digital Operating Model**

Smart supply chains and factories will enable mass customization of products and omnichannel experiences. A firm’s ability to manage consumer experiences will be central to gaining a competitive advantage.

**Case studies:**

Luxottica, ITC Limited, Nike, Samsung, Argos, Nordstrom, Coca-Cola, Amazon
The digitalization of consumer industries could unlock more than $10 trillion in industry and societal value over the next decade. E-commerce is expected to drive much of the societal value.

**Unlocking Societal Value: E-commerce**

Greater e-commerce penetration is changing the retail landscape, handing pricing power from manufacturers to online retailers. It is also levelling the playing field, helping smaller and niche players compete against the dominant large brands. E-commerce has a potential societal impact of $2.7 trillion as it reduces commute time by more than 250 million hours and gives access to a broader variety of products and lower prices. B2B and cross-border platforms could further increase e-commerce’s societal impacts.

Note:
1Bubble size indicates the combined industry and societal value at stake in 2025. Total societal value at stake includes impacts on consumers, society and the environment. The impact on external industries has not been considered, and the impact on lives saved has not been quantified.

Source:
World Economic Forum/Accenture analysis
“Digitalization is creating new types of economic disruption … technological progress may leave some people – perhaps even a lot – behind.”

Erik Brynjolfsson
Professor of IT and Director, MIT Initiative on the Digital Economy
The electricity sector is ripe for realizing value from rapid digital transformation. Value creation across the industry and broader society will be driven by four major themes.

**Asset Life Cycle Management**

Real-time, remote-controlled or predictive maintenance extends the life cycle or operating efficiency of generation, transmission or distribution assets and infrastructure. Key initiatives are Asset Performance Management, Digital Field Worker and Smart Asset Planning.

**Grid Optimization and Aggregation**

Grid optimization is possible through Energy Aggregation Platforms, Real-time Supply and Demand Platforms, Real-time Network Controls, and Connected and Interoperable Devices – enabled by connected assets, machines and devices, and advanced monitoring capabilities.

**Integrated Customer Services**

Digitally enabled products and services relating to energy generation and energy management can be bundled into an integrated customer service. Key initiatives are Energy Storage Integration, Digital Customer Model, Energy Solution Integration and Energy Management.

**Beyond the Electron**

Hyper-personalized connected services go beyond the electricity value chain and adapt to the consumer. In this way, electricity stops being a commodity and becomes an experience. The three initiatives are Living Services, Industrial Services and Municipal Services.
The digitalization of electricity could unlock $3.1 trillion in industry and societal value over the next decade. Societal benefits stem from value creation for customers and a reduction in emissions.

**Unlocking Societal Value: Real-time Supply and Demand Platforms**

By monitoring and communicating real-time supply and demand, and pairing it to a discriminatory pricing framework, these platforms change behaviours through tariffs, localized pricing signals and interconnectivity. New behaviours could save customers $559 billion over the next decade. They could also lower peak-demand situations, thus reducing CO₂ emissions by 1 billion tonnes. For this initiative to be successful, system operators must put in place the necessary infrastructure.
HEALTHCARE: DIGITAL THEMES AND INITIATIVES

Demographic, market and technology trends make digital transformation increasingly critical to the future of healthcare. Four themes will drive new value for the industry and wider society.

**Smart Care**

Recent technological and scientific breakthroughs have propelled medicine into a new era of smart care. Precision Medicine, Robotics and Medical Printing are making healthcare smarter and more personalized.

**Care Anywhere**

Shifting care closer to home can broaden access to healthcare and reduce the strain on overstretched health systems. The technology that has enabled the IoT to proliferate will open up the possibility of "Care Anywhere" through the Virtual Care and Connected Home initiatives.

**Empowered Care**

The digital economy can now deliver a wide range of "living services" – intelligent digital services that respond contextually to the user’s needs. These increase Patient Engagement at Scale and empower citizens to manage their own healthcare, preventing the onset of chronic conditions, such as diabetes.

**Intelligent Health Enterprises**

Advances in data collection, storage and analytics have been accompanied by the proliferation of data – e.g. from sensors and devices, clinical information systems and electronic health records. Key initiatives are Accessible Intelligence, Connected Worker and Intelligent Devices.

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

Click to download White Paper

Source: World Economic Forum/Accenture analysis
Digitalization threatens to disrupt logistics, but could also reduce its inefficiencies and shrink its environmental impact. Four themes will help deliver value for both the industry and wider society.

**Information Services**

Initiatives such as *Logistics Control Towers and Analytics as a Service* put data at the heart of logistics businesses, helping to reduce operating costs while improving operational efficiency.

**Logistics Services**

Global trade will increase through *Digitally Enhanced Cross-border Platforms*. Logistics firms can also satisfy growing demand for faster *Same-day Delivery*, and promote the concept of *City Logistics*, which will help them operate in "megacities".

**Delivery Capabilities**

The need to move physical goods from A to B endures, but delivery methods are changing. *Crowdsourcing*, and innovations in manufacturing (*3D Printing*) and technology (*Drones, Autonomous Trucks*) have widened the range of options and opened up logistics markets to new players.

**Shared Logistics Capabilities**

Shared warehouse and shared transport capabilities are expected to gain prominence among logistics firms, increasing asset utilization in the near future.

Case studies:

- KUEHNE+NAGEL
- WEFT
- LightInTheBox.com
- Amazon
- DHL
- Telogis
- COYOTE

To find out more about the DTI project, visit [http://reports.weforum.org/digital-transformation](http://reports.weforum.org/digital-transformation)
Over the next decade, digital transformation of logistics has the potential to unlock $4 trillion of value for industry and society.

**Unlocking Societal Value: Crowdsourcing**

Crowdsourcing platforms – the "Uber" of logistics – can be a game changer. By helping smaller firms raise utilization levels, they will make the industry more competitive and bring societal benefits, such as reductions of $800 billion in logistics costs for customers. They could also reduce CO₂ emissions by 3.6 billion tonnes, while generating additional income for consumers who decide to use their own vehicles to deliver goods while on personal trips. Clear regulation will be needed to promote these platforms and increase adoption.

**LOGISTICS: Value at stake for industry and wider society, by digital initiative (cumulative 2016-2025)**

- Information Services
- Logistics Services
- Delivery Capabilities
- Shared Logistics Capabilities

Note:  
1 Bubble size indicates the combined industry and societal value at stake in 2025. Total societal value at stake includes impacts on consumers, society and the environment. The impact on external industries has not been considered, and the impact on lives saved has not been quantified.

Source: World Economic Forum/Accenture analysis

To find out more about the DTI project, visit http://reports.weforum.org/digital-transformation
“Customers are empowered by digital; they have new behaviours and new expectations that are pushing us to evolve. We have to be more reactive and more agile; we need to listen to what our customers expect and also track how our digital environment is evolving.”

Benedicte Javelot
Chief Strategy Officer, Orange Group
MEDIA: DIGITAL THEMES AND INITIATIVES

Changing consumer behaviour and expectations are driving the transformation of media. Three themes are central to addressing these changes and creating industry and societal value.

**Personalization and Contextualization**

Marketers and content creators will need to produce Personalized Content and Personalized Advertising to engage consumers facing information overload.

**Content Fragmentation**

Broadcasters should exploit the growing popularity of the “second screen” by creating integrated second-screen services. Communities of Content on instant-messaging and social platforms, as well as Over the Top (OTT) Services, look like fertile ground for advertisers. Intellectual Property Frameworks for the Digital Age is another important initiative.

**Partnerships and Industrialization**

Technology enables enterprises to partner with their audiences, and to fund or co-create innovative content. Technology must be at the heart of The Digital Organization. Key initiatives are Engagement, Co-creation and Crowdsourcing and Flexible, Predictive, Precise Content Creation.

Case studies:

- datacoup
- PANDORA
- netflix
- WeChat
- Vox Media
- Upworthy

To find out more about the DTI project, visit http://reports.weforum.org/digital-transformation
The digital transformation of media represents a $1.3 trillion opportunity for industry and society.

Unlocking Societal Value: OTT and OTT 2.0

OTT services such as Netflix and Hulu are revolutionizing media. The proliferation of OTT is a $300 billion opportunity in terms of value to society. Its advantages include access to cheap unbundled content leading to cost savings; lower emissions due to digital viewership; and wider access to educational resources from open-source platforms, such as YouTube and Coursera. Collaborations between different OTT players and telecom companies, and clear regulations around net neutrality, can accelerate the development of OTT and OTT 2.0 services.
SUMMARY OF OVER 130 INITIATIVES IMPACTING 12 INDUSTRIES OVER THE NEXT DECADE (1 OF 2)

<table>
<thead>
<tr>
<th>Aviation, Travel and Tourism</th>
<th>Telecommunications</th>
<th>Professional Services</th>
<th>Mining and Metals</th>
<th>Oil and Gas</th>
<th>Chemistry and Advanced Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffusion of Ownership</td>
<td>Reimagining Communication</td>
<td>Fostering a Digital Environment</td>
<td>Artificial Intelligence</td>
<td>Consumer Energy Choices</td>
<td></td>
</tr>
<tr>
<td>Battle for Customer Mindshare</td>
<td>Winning the Battle of Ecosystems</td>
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</tr>
<tr>
<td>Smart Manufacturing</td>
<td>Outside ‘Inovation’</td>
<td>Modularizing Work</td>
<td>Smart Sensors</td>
<td>New Era of Automation</td>
<td>Digital R&amp;D</td>
</tr>
<tr>
<td>Intelligent Assets</td>
<td>Software-differentiated Networks</td>
<td>Developing a Flexible Workforce</td>
<td>Autonomous Operations and Robotics</td>
<td>Advanced Analytics &amp; Modelling</td>
<td>Digital Plant</td>
</tr>
<tr>
<td>Next Generation Workforce</td>
<td>Autonomous (Zero Touch) Networks</td>
<td>Training Talent</td>
<td>3D Printing</td>
<td>Connected Worker</td>
<td>Digital Supply Chain</td>
</tr>
<tr>
<td>Traveller Centricity</td>
<td>Cyber-resilience</td>
<td>Reimagining Hiring</td>
<td>Asset Cybersecurity</td>
<td></td>
<td>Accelerated Circular Economy</td>
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<tr>
<td>Seamless Customer Journey</td>
<td>Transforming for a Digital Workforce</td>
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<td>IT/OT Convergence</td>
<td>Omnichannel Retail and Experience-based Services</td>
<td>Digitally Enabled Offerings and Business Models</td>
</tr>
<tr>
<td>End-to-end Propositions</td>
<td></td>
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<td></td>
<td>Advanced Customer Interaction</td>
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<tr>
<td>Modern Security Environment</td>
<td>Extending Connectivity</td>
<td>Augmenting Human Intelligence</td>
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<td>Value Chain Collaboration</td>
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</tr>
<tr>
<td>Ubiquitous Tourist Safety</td>
<td>Delighting the Digital Customer</td>
<td>Nurturing an Agile Culture</td>
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<tr>
<td>Data Dilemma</td>
<td>Brand Atomization</td>
<td></td>
<td>Integrated Sourcing, Data Exchange, Commerce</td>
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</tr>
</tbody>
</table>

Growth through digitalization (customer facing, e.g. revenue generating)  
Efficiency through digitalization (internally facing, e.g. profit generating)  
Digital experience (the combination of growth and efficiency)

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# SUMMARY OF OVER 130 INITIATIVES IMPACTING 12 INDUSTRIES OVER THE NEXT DECADE (2 OF 2)

<table>
<thead>
<tr>
<th>Media</th>
<th>Healthcare</th>
<th>Logistics</th>
<th>Automotive</th>
<th>Electricity</th>
<th>Consumer</th>
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</thead>
<tbody>
<tr>
<td>Personalized Advertising</td>
<td>Patient Engagement at Scale</td>
<td>Logistics Control Towers</td>
<td>Infotainment</td>
<td>Energy Storage Integration</td>
<td>Data as an Asset</td>
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<tr>
<td>Personalized Content</td>
<td></td>
<td>Analytics as a Service</td>
<td>Usage-based Insurance</td>
<td>Digital Customer Model</td>
<td>Data Privacy and Transparency</td>
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<tr>
<td>Data Privacy and Transparency</td>
<td></td>
<td>Multimodal Integration</td>
<td>Energy Solution Integration</td>
<td></td>
<td>Data to Improve Experience</td>
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<tr>
<td>Reform</td>
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<tr>
<td>Phygital: Digital Media Becomes Physical</td>
<td>Precision Medicine</td>
<td>Drones</td>
<td>Energy Management</td>
<td></td>
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<tr>
<td>&quot;Advicetising&quot;: Advertising as Advice</td>
<td>Robotics</td>
<td>Autonomous Trucks</td>
<td>Connected Supply Chain</td>
<td>Industrial Services</td>
<td>Physical Store Transformation</td>
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<td></td>
<td></td>
<td>3D Printing</td>
<td>Digital Manufacturing</td>
<td>Municipal Services</td>
<td>E-commerce</td>
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<tr>
<td></td>
<td></td>
<td>Crowdourcing</td>
<td>Disrupted Retail</td>
<td>Asset Performance Management</td>
<td>Sharing Economy</td>
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<tr>
<td></td>
<td></td>
<td>Connected Worker</td>
<td>Connected Service and Maintenance</td>
<td>Digital Field Worker</td>
<td>Smart Supply Chains</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shared Transport Capacity</td>
<td>Transformed Digital Aftermarket</td>
<td>Smart Asset Planning</td>
<td>Talent Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shared Warehouse Capacity</td>
<td>Automotive Data Marketplace</td>
<td>Energy Aggregation Platforms</td>
<td>Smart Factories</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Connected Infrastructure</td>
<td>Real-time Supply and Demand Platforms</td>
<td>Hyper-personalization in Goods</td>
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<tr>
<td>OTT and OTT 2.0</td>
<td>Virtual Care</td>
<td>Digitally Enhanced Cross-border Platforms</td>
<td>Real-time Network Controls</td>
<td>Products to Services and Experiences</td>
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</tr>
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<td>Communities of Content</td>
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<td>City Logistics</td>
<td>Assisted Driving</td>
<td>Connected and Interoperable Devices</td>
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<td>IP Frameworks for the Digital Age</td>
<td>Same-day Delivery</td>
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<td>Living Services</td>
<td>Health and Well-being Goods and Services</td>
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- Growth through digitalization (customer facing, e.g. revenue generating)
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4. Opportunities to Improve the State of the World
The Fourth Industrial Revolution is under way. Digital innovation can benefit society by creating jobs, saving lives and reducing emissions. But these gains are not guaranteed – they depend on the decisions taken today.

Having reviewed the opportunities and challenges presented by digital technology across many industries, one thing has become clear: the world is at a crossroads. New technologies are opening up opportunities to increase economic growth, reduce inequality and promote inclusivity. At the same time, the world is deglobalizing, with civil wars and political populism driving uncertainty about international relations.

An important choice must be made: between a more open, inclusive and interconnected world, or one that is closed, siloed and unequal.

Digitalization is inextricably linked to the societal and economic forces fuelling these conflicting world views. Digital innovations can, for example, drive society towards the UN Sustainable Development Goals, and shore up the three pillars on which they are built: improving quality of life, fostering equitable growth and protecting the environment. But inhibitors such as inadequate regulation, limited innovation, and uneven adoption of technology all undermine the opportunities that digitalization presents.

The digital revolution provides a once-in-a-generation chance 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.
### UNLOCKING $100 TRILLION FOR BUSINESS AND SOCIETY FROM DIGITAL TRANSFORMATION

Across 10 industries, the value-at-stake methodology identifies trillions of dollars in value for both society and industry. Scaled up across all industries, and including externalities, the estimated net benefits will be greater than $100 trillion over the decade to 2025.

<table>
<thead>
<tr>
<th>Industry</th>
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<tr>
<td>Chemistry</td>
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(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; (4) Aviation refers to Aviation, Travel and Tourism; Mining to the Mining and Metals industries and Chemistry refers to Chemistry and Advanced Materials.

Source: World Economic Forum/Accenture analysis

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# BARRIERS TO REALIZING BOTH INDUSTRY AND SOCIETAL VALUE

Overcoming the inhibitors to transformation will unlock significant value for business and society.

<table>
<thead>
<tr>
<th>Key Inhibitors</th>
<th>Examples</th>
</tr>
</thead>
</table>
| **1. Lack of collaboration for societal gains**                               | • Telematics is not yet mandatory in new cars or trucks. Insurers are providing optional add-ins, but the penetration rates are still relatively small.  
• While digital technology is increasing farming yields, not all technology is passing on benefits to farmers and workers. |
| **2. Regulation and protection of consumer interests**                        | • Legal frameworks around intellectual property need to be revisited for the new generation of on-demand media consumers. 
• Issues have arisen with regulations on drones.                              |
| **3. Cannibalization of existing revenue streams**                            | • Utilities fail to lead with decentralized renewable energy products and services. 
• Telcos have been "strengthening the pipe", while digital businesses such as Skype, WhatsApp and Facebook have transformed communications. |
| **4. Skills for tomorrow's workforce**                                       | • From top management to front-line managers, trust in the advice provided by intelligent systems is rapidly declining. 
• Various technologies have the potential to augment and/or replace human capabilities. |
| **5. Technology adoption rates**                                              | • Bluetooth and radio frequency identification technologies (RFID) have existed for nearly 20 years, but have only recently become ubiquitous. |
How can business leaders change their organizations to be ready for digital impacts?

| New Business Model | Create new digital business models or digital offerings  
This can be done by refreshing, building, buying, partnering, investing and incubating to get ahead of disruption. Internally, legacy systems need to transform or connect into agile interoperable platforms to enable plug-and-play interactions among the ecosystem’s partners. This will help with asset sharing and generate new, seamlessly integrated products. |
| Develop Ecosystems via Partnerships | Identify attractive partners inside and outside the industry  
Identify and understand network partners, dynamics in the network, and the role partners want to play within the relevant innovation, supply and distribution, and offering ecosystems. This will provide consumers with a seamless experience and generate value for the companies involved. An attractive ecosystem of partnerships helps to promote loyalty among customers and users. |
| Cultural Shift | Reinvent, even if this requires short-term disruption  
Digital should be owned by the CEO and challenge the status quo, from board room to the front line. Driving a strong sense of purpose and a diverse, high-digital-quotient workforce are critical. Leadership needs to release people’s creativity and apply lean start-up methodologies, such as hackathons and design thinking. |
| Skills of the Future | Equip the workforce with tools to succeed  
Reskilling current employees through continuous learning and training will support the transition of the workforce. At the same time, educational institutions must be empowered to design curricula that prepare the next generation to work collaboratively with intelligent technology. |
| Data Security and Privacy | Protect against attack  
Increased connectivity requires companies to invest funds, skills and capabilities to protect their data. Spending on cybersecurity is expected to increase from an average of less than 1% of revenues to approximately 3% over the next decade. |
Revise regulations to encompass digital
Regulations will need to change in an age of cross-industry collaboration and consolidation around digital services and platforms.

Protect intangible assets
Data security needs to be a priority as more transactions occur on digital channels. Much more consumer information will be collected in the future, and data will be far more robust. Regulations need to keep pace with advancements in data.

Empower individual relevance
The changing nature of jobs demands that individuals develop new skill sets to remain relevant. How can regulatory bodies, organizations and employees work together to ensure a smooth transition of skills? What options are there for governments to work with industry to de-risk investments in areas that promise high societal and industry value, such as the IoT and digital infrastructure?

Enable societal value creation
How new incentive structures and technologies augment the coverage, quality, affordability and relevance of digital communications needs to be determined. This will create tangible steps for governments to follow and provide the “analogue complements” for creating societal value.

Localize efforts
The impact of digitalization can be substantial at the local level. For example, as stores close and the physical retail real-estate footprint shrinks over the next decade, what can government at all levels do to preserve local communities and mitigate negative impacts?
LOOKING FORWARD TO 2017

The overall goal is to catalyse public-private multistakeholder dialogues that drive actionable, informed and inclusive decisions and outcomes.

- Unlocking societal value and realizing impact at the macro (regional, country and state), industry, system and enterprise levels
- Using the operational efficiency imperatives of Enabling the Digital Enterprise (going from strategic direction to implementation)
- Conducting an in-depth review of the B2B platform economy from a policy perspective

Using detailed industry and cross-industry perspectives, and its unique value framework, the Digital Transformation Initiative will focus on three themes in 2017.

To find out more about the DTI project, visit http://reports.weforum.org/digital-transformation
All materials are available on http://reports.weforum.org/digital-transformation, including detailed White Papers and case studies from this executive summary.

**Key features**
- Mobile-responsive, platform-agnostic site
- 13 industry White Papers
- 5 cross-industry White Papers
- 13 SlideShare summaries of White Papers
- Over 60 video snippets and mini documentaries
- Online case-study repository
- 4 animations on digital challenges
5. Acknowledgements
The World Economic Forum would like to acknowledge and extend its sincere gratitude to a broad community of contributors across Partner companies, technology start-ups, academics and experts, some of whom are mentioned below.
ACKNOWLEDGMENTS (CONTINUED)

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KLM
Klockner
KPN
LetMeShip
Level 3
Liberty Global
Lockheed Martin Corporation
LVNL (Air Traffic Control Netherlands)
Mahindra
Majid Al Futtaim Holdings
Marriott International
MasterCard
Matrixx Software
Matternet
Mayo Clinic
Microsoft
Millicom
MIT Center for Digital Business
MIT Energy Institute
Mitsubishi Chemical Holdings Corporation
Mjunction Services
Monsanto Company
Nanosight
National Aviation Services
National University of Singapore
Nestlé
Newmont Mining Corporation
New York University Leonard N. Stern School of Business
NIelsen
Nokia
Nokia Networks
Novozymes
Nucor Corporation
O3B Networks
OEM Insights and Solutions
Omnicom Group
OneWeb
Ooredoo
Orange
Pearson
Pemex
Persistent Systems
Philips
PhosAgro
Platform Strategy Labs
Prospectors & Developers Association of Canada (PDAC)
Proteus
Publicis Groupe
QIAGEN
Qualcomm
Qualcomm Life
REMA 1000
RESOLVE
Reverse Logistics Group
Rio Tinto
Robert Wood Johnson Foundation
Royal Philips
Royal Vopak
RWE
Salesforce.com
SAP
Saudia Basic Industries Corporation (SABIC)
Saudia Telecom Company
Schneider Electric
Severstal
Sharing Economy
Shell
Shopkick
Sibur
Sight Machine
SiGNa Chemistry
Solvay
Song Saa Group
Southeast Asia
Statkraft
Statoil
Stratasys
Suncor
Swarovski
Swiss
Synthace
Tata Communications Limited
Tata Consultancy Services
TATA Consulting Services
Tata Steel
Technogym
Teck Resources
Telecom Italia
Telefonica
Telenor
Telia Company
The New York Times
Thomson-Reuters
Transport Intelligence
Travelport
Trip38
TrueCar
Tufts University
Turkcell
Unilever
United Nations Development Programme (UNDPs)
United Nations Economic Commission for Africa (UNECA)
United Nations Population Fund (UNFPA)
United States Steel Corporation (USS)
University of Pennsylvania
University of Queensland
UPL Limited
UPS
US Government
US Health & Life Sciences Industry
USC Marshall School of Business
USM Holdings Limited
Vale International
Vattenfall
Verizon
VimpelCom
Visa
Voxel8
Walmart
Wellness Holdings SRL
World Steel Association
WPP
Wynadom Hotels
Zebra Medical Vision
Zymergen
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