
UNITING TO DELIVER TECHNOLOGY FOR THE GLOBAL GOALS

2030 **VISION**

Global Goals Technology Forum



THE GLOBAL GOALS
For Sustainable Development

PARTNERS

arm



THE WORLD NEEDS STRONG MULTI-STAKEHOLDER PARTNERSHIPS LIKE 2030VISION THAT FOCUS ON THE TECHNOLOGICAL INNOVATIONS REQUIRED TO ACHIEVE THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT...I WELCOME 2030VISION FOR ITS LEADERSHIP AND AMBITION TOWARDS ATTAINING OUR SHARED GOALS FOR PEOPLE AND PLANET BY 2030.

António Guterres,
Secretary-General, The United Nations



FOREWORD

In September 2015, more than 190 countries signed up to the 17 Sustainable Development Goals of the 2030 Agenda for Sustainable Development. The Agenda sets out a vision to end poverty, protect the planet and ensure prosperity for all. Delivering the Global Goals by 2030 will require collaboration across the private sector, governments and civil society, massive investment and innovation, as well as fresh thinking about economic paradigms and business models.

Achieving the Global Goals is unquestionably a moral imperative, but the task also presents a significant commercial opportunity, estimated at \$12 trillion a year in revenue and cost savings and 380 million new jobs by 2030¹. At Arm, we understand this opportunity, and believe business can and should make the relevant investments to unlock it.

Digital technology will be a critical enabler to the realization of this market opportunity. Analysis from the Global e-Sustainability Initiative (GeSI) and Accenture shows that digital technology could generate \$2.1 trillion additional annual revenue in 2030 from solutions with a positive impact on the Global Goals².

AT ARM, WE KNOW FROM EXPERIENCE THAT DIGITAL SOLUTIONS CAN ADDRESS THE GLOBAL GOALS AND DELIVER BUSINESS VALUE.

Achieving the Global Goals will require digital technologies to be deployed to address critical human needs. Digital is already supporting democratized and decentralized access to energy, finance and education. However, we do not know the scale of impact these transformations could have on production, employment, health and prosperity. Could artificial intelligence drive radical improvements in agricultural productivity and product design? Could sensors help eliminate overfishing and improve economic opportunity? How might blockchain revolutionize privacy, security and trust?

2030Vision will serve as a platform for dialog and collaboration to understand the potential for digital to deliver the Global Goals and to explore the role the technology sector can play supporting other industries' efforts. Arm is proud to have initiated 2030Vision and is pleased to support its future success.

2030Vision has commissioned this research to highlight the imperatives and opportunities for digital solutions to support a more prosperous and sustainable future while capturing new market opportunities and supporting economic prosperity across the globe.

Simon Segars
CEO Arm
Board member SoftBank Group

arm

INTRODUCING 2030VISION

In January 2017, the Business and Sustainable Development Commission highlighted the huge economic opportunity inherent in meeting the UN 2030 Sustainable Development Goals (the Global Goals).

THE PROJECTION?

A staggering

\$12tn

in revenue and cost savings
per year by 2030

along with

380m

new jobs¹

2030Vision believes

**DIGITAL
TECHNOLOGY***

will be a critical enabler
on this journey

The Global e-Sustainability Initiative (GeSI) and Accenture estimate that digital solutions with positive impact on the Goals could unlock

\$2.1tn

additional annual revenue for the
technology sector in 2030²

However enticing, this value will only be realized with unprecedented levels of private sector collaboration and innovation. Digital solutions need to be democratized and deployed across sectors including healthcare, agriculture, logistics, energy, finance, and education. The enabling conditions for digital technology, such as electricity and connectivity, need to be put in place. There is also a critical need for cross-sector dialog to understand the potential benefits that digital can deliver as well as the risks it may introduce.

* For the purposes of this paper, we define digital technology as the tools, systems and services that support the generation, storage, sharing and analysis of data. See page 6 for a fuller definition.

¹ Business & Sustainable Development Commission, "Better Business, Better World", 2017

² Global e-Sustainability Initiative & Accenture Strategy, "#SystemTransformation: How Digital Solutions will deliver Progress Towards the Sustainable Development Goals", 2016

2030Vision is a new partnership that connects businesses, NGOs and governments with the technology and expertise they need to realize the Global Goals. Founded and chaired by Arm, the partners are UN Global Compact, UNICEF, The New York Academy of Sciences, SustainAbility, Fauna & Flora International, Centre for Global Equality, Cambridge Judge Business School, British Council, Be He@lthy Be Mobile and Project Everyone. 2030Vision's ambition is to transform the use of technology so that all people can live their lives to their full potential by 2030.

This report provides a summary of key opportunities and challenges for digital technology and the Goals, as well as a detailed assessment of each of the 17 Goals.



THE WORLD IN 2030

**IF WE ACHIEVE THE VISION
PUT FORWARD BY THE
GLOBAL GOALS, OUR WORLD
WILL BE A RADICALLY
BETTER PLACE IN 2030.**



Forecasting the world in 2030 brings to mind a quote often attributed to physicist Niels Bohr: “Prediction is very difficult, especially if it’s about the future.”

GOING BACK TO THE YEAR 2004, FEW PEOPLE COULD HAVE IMAGINED WHAT 2017 WOULD LOOK LIKE:

MOBILE

The iPhone (2007) and Samsung Galaxy (2009) had not been invented; today, vast ecosystems of products and services are designed around each.

TECH GIANTS

Google announced its IPO in 2004; today it has morphed into \$600 billion company Alphabet with reach into a variety of sectors including transport and life sciences.

HUMAN GENOME

The first quality assessment of the human genome published in 2003 cost over \$2.7 billion. Today, a whole-exome sequence can be generated for less than \$1,000.

RENEWABLES

In 2004, the IEA predicted that the share of renewable energy for electricity would rise to 6% by 2030¹; we have blown past that prediction, hitting 23% in 2015².

HEALTH

The annual number of AIDS-related deaths peaked in 2005 at two million. Between 2005 and 2016, AIDS-related deaths per year fell by 48%.

Envisioning the world in 2030:

Organizations and individuals such as the World Economic Forum (WEF) and Bill and Melinda Gates have risen to the challenge of envisioning the world in 2030. Common themes include increasing urbanization, growing displacement from conflict and climate change, near universal access to the internet, the end of the internal combustion engine and less resource-intensive food systems. Earlier this year, Japan released its ‘Society 5.0’ blueprint which envisions a ‘super smart society’ in which digital tools solve challenges such as the nation’s aging workforce and global pollution.

If we achieve the vision put forward by the Global Goals our world will be a radically better place in 2030.



Achieving Goal 1 would free the 767 million people³ living below the international poverty line of \$1.90 a day to contribute to the global economy.



Reaching the gender equity prescribed by Goal 5 would multiply prosperity by allowing women to reach their full economic potential.



Meeting Goals 2 and 13 would mean that we have cultivated a food system able to feed nine billion people by 2050 without harming the environment.



Technology disrupting industries:

The exponential growth of digital technology could transform industries including manufacturing, agriculture, health, energy and mobility. SoftBank CEO Masayoshi Son envisions a future in which satellite networks span every inch of the Earth and a trillion connected devices continuously deliver data to the cloud to be analyzed by artificial intelligence. SoftBank’s \$93 billion Vision Fund invests in companies that will benefit from this new paradigm as they disrupt industries, such as Plenty (indoor farming) and Nauto (autonomous vehicles).

Channeling digital for the Goals:

To achieve the vision for 2030 set out in the Global Goals, it will be critical to channel digital technology to address the world’s most pressing needs and to mitigate the risk that it exacerbates inequality. Bill Gates envisions that technology can help Africa achieve food self sufficiency by 2030, but also warns against job loss due to automation. In considering solutions for less developed nations, we must address primary needs such as electricity, running water and basic banking services which are critical foundations for digital solutions. Building capacity to deploy and regulate digital technology will be vital. 2030Vision aims to foster dialog and collaboration to develop digital technologies which contribute to a more prosperous and sustainable world in 2030.

1 International Energy Agency, “World Energy Outlook 2004”, 2004

2 International Energy Agency, “Renewable Energy Medium-Term Market Report 2016”, 2016

3 UN “The Sustainable Development Goals Report 2017”, 2017

CRITICAL AREAS FOR INTERVENTION

According to the UN, the world made notable progress towards the Global Goals over the last decade, but the pace of progress is insufficient to meet the targets by 2030¹.

Each year, 2030Vision will focus on a selection of key themes which represent vital areas of intervention in support of the Global Goals. Three themes have been selected for 2018. Action in these areas, representing key societal needs and accounting for a significant portion of the global economy, will enable and support progress across the Global Goals.

2030VISION 2018 THEMES

GLOBAL GOAL AREAS

FOOD & AGRICULTURE



Hunger & malnutrition
Agricultural productivity & resilience
Food waste
Equitable global food markets
Water efficiency & integrated water resource management
Illegal, unreported & unregulated fishing
Habitats & biodiversity

TRANSPORT, INFRASTRUCTURE & LOGISTICS



Safe & affordable housing
Accessible & sustainable transport
Climate change adaptation
Clean & efficient energy
Sustainable use of resources
Resilient infrastructure
Skills & innovation for sustainable growth
Effective & accountable institutions

HEALTH



Social protection systems
Maternal & infant mortality
Infectious & non-communicable diseases
Safe water & sanitation
Road traffic accidents
Sexual & reproductive health
Violence, exploitation & trafficking
Empowerment & inclusion
Access to medicines

¹ UN "The Sustainable Development Goals Report 2017", 2017

THE BUSINESS IMPERATIVE FOR ADDRESSING THE GLOBAL GOALS

THE GLOBAL GOALS



The Business and Sustainable Development Commission estimates a potential economic benefit of \$12 trillion per year by 2030 for the private sector across four economic sectors: food and agriculture, cities, energy and materials, and health and well-being¹.

Market opportunities such as electric vehicles, telehealth and circular business models could generate work for more than 10% of the labor force in 2030. Businesses which work towards an environmentally stable and socially inclusive future will be less vulnerable to risks and better positioned to attract and retain talent, strengthen customer relations, secure investment and drive innovation.

COMMERCIAL, SOCIAL AND ENVIRONMENTAL 'HOT SPOTS' IN FOUR ECONOMIC SYSTEMS BY 2030

FOOD & AGRICULTURE

Potential economic opportunity:

\$2.3tn¹

Hot Spots:

Reducing food waste (\$155-\$405 billion)

Forest ecosystem services (\$140-\$365 billion)

Low-income food markets (\$155-\$265 billion)

Social impact:

Increase incomes of smallholder farmers by

30%¹

Environmental impact:

Reduce water use by (liters)

300tn²

HEALTH & WELL-BEING

Potential economic opportunity:

\$1.8tn¹

Hot Spots:

Risk pooling (\$350-\$500 billion)

Remote patient monitoring (\$300-\$440 billion)

Telehealth (\$130-\$320 billion)

Social impact:

Prevent

5m

premature deaths from non-communicable diseases³

ENERGY & MATERIALS

Potential economic opportunity:

\$4.3tn¹

Hot Spots:

Circular models - automotive (\$475-\$810 billion)

Expansion of renewables (\$165-\$605 billion)

Circular models - appliances and machinery (\$305-\$525 billion)

Social impact:

Provide

1.2bn

people access to electricity¹

Environmental impact:

Abate

5GtCO₂

through smart manufacturing and energy management

CITIES

Potential economic opportunity:

\$3.7tn¹

Hot Spots:

Affordable housing (\$650-\$1,080 billion)

Energy efficiency-buildings (\$555-\$770 billion)

Electric and hybrid vehicles (\$310-\$320 billion)

Social impact:

Provide

440m

households with access to safe housing¹

Environmental impact:

Abate

5.8 GtCO₂

through smart mobility and buildings

1 Business & Sustainable Development Commission, "Better Business, Better World", 2017

2 Global e-Sustainability Initiative, "Smarter2030: The Opportunity", Accessed September 2017 <http://smarter2030.gesi.org/the-opportunity/>

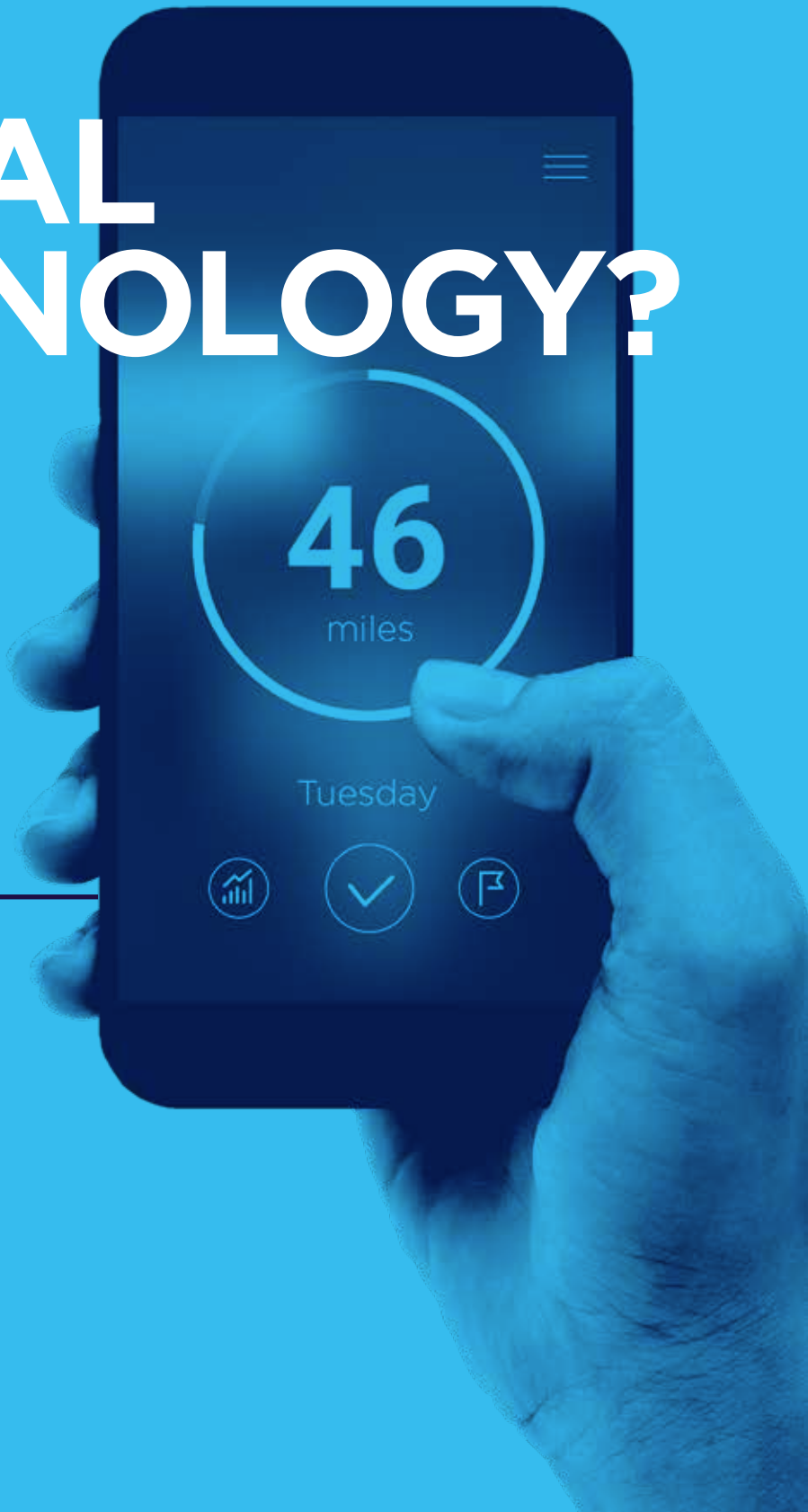
3 UN "The Sustainable Development Goals Report 2017", 2017

WHY DIGITAL TECHNOLOGY?

Digital technology describes the increasing information intensity and connectedness of physical resources.

It includes the tools, systems and services that support the generation, collection, storage, sharing and analysis of data.

Digital technology encompasses a range of 'enabling levers' including big data, data analytics, robotics, Internet of Things (IoT), artificial intelligence (AI), sensors, mobile, 3D printing, cloud computing, web-based platforms, social media, blockchain, augmented reality, virtual reality, and satellite imaging. These levers are essential to a wide range of applications which are explored in this report.



The following case study of mFish illustrates how digital technology (for example, communication software) builds on information and communication technology (for example, mobile phones and tablets) to provide solutions.

CASE STUDY: mFISH

Launched in 2014 by the US Department of State and powered by EcoHub, mFish is a mobile application that provides fishers in developing nations with market and weather information and allows them to digitally log their catch for the purpose of traceability and fisheries management. To minimize barriers to access, mFish is available free of data charges through Facebook's Free Basics and accessible on both smartphones and feature phones even in low bandwidth environments. The goal of mFish is not only to improve the livelihoods of fishers through better information and market access, but also to be the first link in a series of data feeds throughout seafood supply chains allowing them to be more traceable, sustainable and responsible. In this case, the digital technology is the suite of mobile services and the software that enables connectivity, while the ICT is the mobile phones used by the fishers.

Digital technology has several unique advantages over earlier forms of infrastructure:

ACCESS AND PARTICIPATION:

The rapid and widespread deployment of digital technology to some of the poorest parts of the world has radically improved access and participation. In 2015, there were 271 mobile money services across 93 countries and 411 million registered mobile money accounts, providing a pathway to financial access for many previously unbanked people¹.

271m
mobile money
services across
93 countries
in 2015

411m
registered
mobile accounts

DELIVERING ESSENTIAL SERVICES:

Connectivity provides platforms to deliver services such as health, education, and energy in new ways. Mobile phones have improved food security by giving farmers access to market information, harvesting, irrigation and logistics support, helping to increase yield, reduce waste and improve productivity. Connectivity is an important tool for strengthening governance. For example, in Mozambique, SMS messages increased voter turnout and enabled citizens to report electoral irregularities leading up to elections in November 2013.

REDUCING COSTS AND EXPANDING SERVICES:

Digital technology can reduce the cost of deploying and expanding services. Digital can expand access to low-cost community health workers, enabling diagnoses and treatments at local level rather than high-cost facilities². 1.6 billion people could be connected to e-health services in 2030³, moving the world closer to universal health coverage. Critically, digital technology enables the collection and analysis of vast amounts of rich data, which facilitates the expansion of services to better serve core societal needs.

1.6bn
people could be
connected to
e-health services
in 2030

¹ GSMA, "2015 State of the Industry Report: Mobile Money", 2015

² The Earth Institute Columbia University & Ericsson, "ICT & SDGs: How Information and Communications Technology can Accelerate Action on the Sustainable Development Goals", 2016

³ Global e-Sustainability Initiative & Accenture Strategy, "#SystemTransformation: How Digital Solutions will deliver Progress Towards the Sustainable Development Goals", 2016

RISKS AND CHALLENGES

2030VISION AIMS TO PROVIDE A PLATFORM FOR COLLABORATION ACROSS THE PRIVATE AND PUBLIC SECTORS TO HELP MANAGE THESE RISKS AND EXPLORE HOW TECHNOLOGY CAN PLAY A ROLE IN MITIGATING SUCH CHALLENGES.

E-WASTE:

The world already has an electronic waste problem – 41.8 million tonnes were created in 2014, 7% from personal devices such as laptops and phones. We risk exacerbating this problem as sensors, chips, and other electronic components are deployed across more products and as higher incomes allow more people to access these technologies.

Digital technology will have profound implications for business and society in the coming decades; if channeled mindfully, it will help achieve the Global Goals. However, there are a number of risks and challenges to consider:

HAVES VS. HAVE NOTS:

Technology has ushered in a host of new products, services and business models, many of which target wealthier consumers such as drone delivery or car sharing. These cases have developed where market needs can be met profitably by the private sector. We need to consider how to enable profitable business cases for underserved populations where they do not yet exist, such as real-time monitoring of ecosystem health.

SECURITY, PRIVACY, AND CONTROL:

With the rise of digital connectivity, cybersecurity concerns will increase. Hacking of critical infrastructure has already happened in Ukraine, and as vehicles evolve to become fully autonomous, we need to ensure they are secure. It will be important to consider the security, ownership and usage of the massive amount of personal data which is created and shared.

ECONOMIC AND LABOR DISRUPTION:

Much has been written about the impact that technology, particularly robotics and automation, has on labor markets. The Center for Business and Economic Research found that technological change was responsible for 85% of the 5.6 million manufacturing jobs lost in the US between 2000 and 2010. Technology could have particular consequences for

countries which rely on sectors like apparel and employ large numbers of unskilled workers. For example, China-based Tianyuan Garments Company, the largest apparel supplier to Adidas, recently announced plans to produce t-shirts in the United States using automation to allow customization and faster speed to market. It is critical to provide training and resources to support those impacted and develop alternate quality employment opportunities.

ACCOUNTABILITY:

As digital technology companies advance, power may be concentrated in ways that current legal and regulatory frameworks are unable to address. Governments and regulators often struggle to understand the pace of change, let alone formulate relevant policies, prompting the question of what technology companies are accountable for and to whom. Such questions raise varying levels of concern in different regions across the world.

OVER-RELIANCE ON TECHNOLOGY:

Progress towards the Global Goals will be accelerated by technology, but it is important to acknowledge that technology is not the silver bullet in all cases. While tools such as IoT can make farmers more productive and resilient, many regions in the world have surpluses of food and still face hunger due to political unrest and poor distribution.

DIGITAL TECHNOLOGY FOR THE GLOBAL GOALS

We have explored the most promising opportunities for digital technology to speed the delivery of the Global Goals – areas where commercial interests and global societal needs are aligned.

2030Vision 2018 Themes

FOOD & AGRICULTURE

Digital technology opportunities

EMPOWERING SMALL-SCALE FARMERS
 REDUCING FOOD WASTE
 SMART RESOURCE ALLOCATION
 FOOD TRACEABILITY
 BUILDING CLIMATE-RESILIENT AGRICULTURE
 CREATING RESILIENT CROPS

TRANSPORT, INFRASTRUCTURE & LOGISTICS

Digital technology opportunities

SMART MOBILITY
 CIRCULAR LIFECYCLE OF MATERIALS
 EFFICIENT ENERGY & INFRASTRUCTURE
 SYSTEMS ENERGY STORAGE
 TRANSPARENT SUPPLY CHAINS
 FINANCING SUSTAINABLE INFRASTRUCTURE
 SKILLS FOR THE JOBS OF THE FUTURE

HEALTH

Digital technology opportunities

PERSONALIZED MEDICINE & EDUCATION
 SUPPORTING VULNERABLE POPULATIONS
 PREDICTING AND MANAGING SHOCKS & DISASTERS
 SOCIAL & POLITICAL INCLUSION
 FINANCIAL ACCESS
 IMPROVING SANITATION
 IDENTITY FOR UNREGISTERED PEOPLE
 TARGETED MEDICINE
 REDUCING ENVIRONMENTAL TOXICITY

Relevant SDGs



FOOD & AGRICULTURE

OPPORTUNITIES

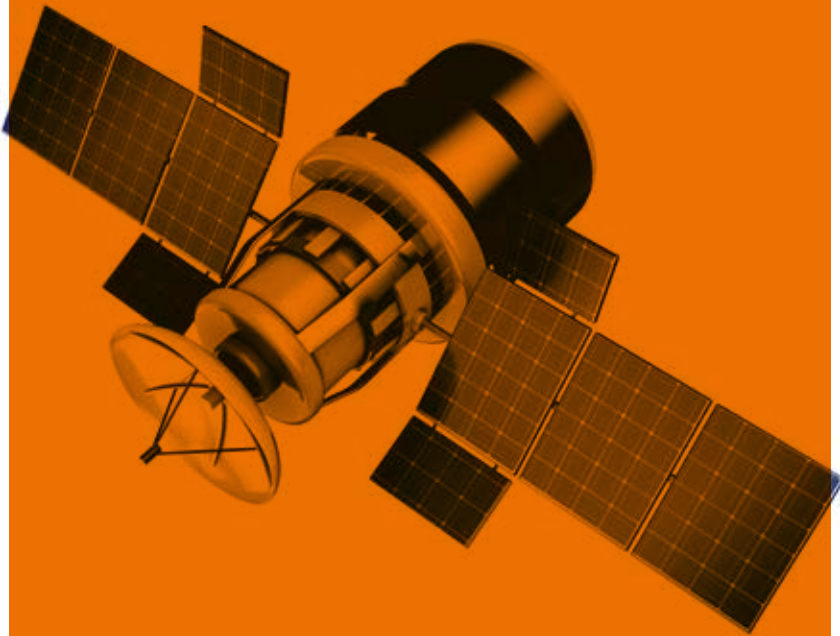
BUILDING CLIMATE-RESILIENT AGRICULTURE

Modeling and predicting environmental patterns helps build resilience to climate-related impacts and reduces food insecurity. Data from satellites and sensors can be analyzed to forecast drivers of extreme weather, famine and food insecurity to guide agricultural decisions.

AWHERE DEVELOPED
A GLOBAL AGRONOMIC
WEATHER DATABASE WITH

1.6m

VIRTUAL WEATHER
STATIONS TO MONITOR
WEATHER EVENTS AND
HIGHLIGHT TARGET
RELIEF AREAS.



FOOD TRACEABILITY

As demand for food grows, so will the importance of efficient supply chain management from farm to plate. Tracking systems, sensors and blockchain allow food to be produced based on demand and allocated where needed, as well as guaranteeing sustainable ingredients sourcing.

A group of companies including IBM, Unilever, Nestlé and Walmart are collaborating to use blockchain to establish traceable food supply chains, focusing on food safety and contamination.

CREATING RESILIENT CROPS

Big data can be used to make genetic or molecular improvements, such as gene editing through CRISPR or TALEN to create more resilient crops.

REDUCING FOOD WASTE

Roughly one-third of food is wasted each year, accounting for 8% of global GHG emissions. Sensors, data analysis and RFID monitoring can reduce food waste from field to fork through smart harvesting, shipping, distribution and inventory management.

SMART SENSORS CAN REDUCE WASTE BY

25% to 40%

ACROSS THE VALUE CHAIN

ROUGHLY

1/3

OF FOOD IS WASTED
EACH YEAR



SMART RESOURCE ALLOCATION

Precision agriculture, including the use of robotics, big data, IoT, smart equipment and farm management software, enables efficient food production for growing populations within resource constraints and without environmental degradation.

For large food companies to leverage big data analytics instead of piloting discrete projects, we will need strategic partnerships with technology companies and investment in solutions. Breaking down silos and creating partnerships with new sectors can accelerate success.

Dave Stangis,
Campbell Soup Company



EMPOWERING SMALL-SCALE FARMERS

Improving agricultural productivity of small-scale farms, which produce over 70% of the world's food, is essential for food security. Mobile and farm management software can provide small-scale farmers with agronomy and market information to improve yields and economic returns.

Smallholder farmers are going to need support from capital and technology to help facilitate a whole generation to change behaviors in crop agriculture in the Global South.

Marc Diaz,
The Nature Conservancy

TRANSPORT, INFRASTRUCTURE & LOGISTICS

OPPORTUNITIES

SMART MOBILITY

Intelligent transport, shipping and distribution systems including autonomous vehicles and vessels, car sharing and drones can lower emissions and costs while improving efficiency and safety.

BY 2050, AUTONOMOUS VEHICLES COULD REDUCE FUEL CONSUMPTION BY

44%

FOR PASSENGER VEHICLES AND . . .

18%

FOR TRUCKS



CIRCULAR LIFECYCLE OF MATERIALS

3D printing avoids waste through local, tailored runs and production of replacement parts. Sensors and smart software can track materials to optimize the planning process and disposal stage. Precision recycling powered by AI enabled robotics allows for disassembly and sophisticated waste sorting.

HP's Multi Jet Fusion 3D printing platform improves product development through production of individual replacement parts locally, quickly and inexpensively.

EFFICIENT ENERGY AND INFRASTRUCTURE SYSTEMS

Connected sensors in infrastructure, industry, cities and homes promote smart allocation of resources such as energy, water and raw materials. Combined with data analysis tools such as AI, this end-to-end management increases productivity while reducing consumption, cost, waste and environmental impact.

Digital technology, through smart manufacturing, agriculture, buildings and transportation, could abate over

12GtCO₂
BY 2030

ENERGY STORAGE

The ability to store large amounts of energy is critical to the proliferation of renewables and is facilitated by systems modeling, open source data sharing platforms, funding tools, and research aggregators.

TRANSPARENT SUPPLY CHAINS

IoT and blockchain can enable the traceability and monitoring of complex, global supply chains to expose risks of human rights abuses or unsustainable natural capital management.

Provenance uses blockchain to work towards an open traceability protocol that can be used to track anything from coffee beans to a roll of fabric.



FINANCING SUSTAINABLE INFRASTRUCTURE PROJECTS

Investment algorithms and crowdfunding platforms can unlock financing streams to address funding gaps in sustainable infrastructure.

SKILLS FOR JOBS OF THE FUTURE

The rapidly changing human capital needs of industries requires employees (particularly youth) to be equipped with the requisite skills to secure quality work. Mobile devices can connect people to education, training, and employment opportunities. AI, AR and VR can upskill workers, catalyze innovation and boost productivity.

THE POWER OF YOUNG PEOPLE IS CONTINGENT ON DIGITAL EDUCATION, TRAINING AND UPSKILLING TO OVERCOME THE UNEMPLOYMENT RISK - WE ARE FACING A 'RACE AGAINST TIME' TO EDUCATE THE MASSES.

Jaideep Prabhu,
Judge Business School



HEALTH

OPPORTUNITIES

PERSONALIZED MEDICINE

Sensors and wearable devices combined with AI enable the collection and utilization of vast amounts of health data, empowering patients to manage their care and assisting healthcare workers in monitoring patients remotely.

THE WEARABLE MEDICAL DEVICE MARKET IS ALREADY WORTH

\$13bn

AND IS FORECAST TO GROW TO

\$34bn

BY 2020.



SUPPORTING VULNERABLE POPULATIONS

Digital technology can be used to provide advice and assistance to vulnerable and marginalized groups: extending healthcare to remote areas, facilitating safe migration for refugees and providing women with sexual health information.

Technology (with access and connectivity) has the potential to open up new employment opportunities for marginalized young people, including refugees.

Katherine Crisp,
UNICEF

REDUCING ENVIRONMENTAL TOXICITY

Tracking data on environmental health and utilizing digital to build efficient infrastructure can reduce pollutants and reduce the risk of disease.

The biggest healthcare challenge which technology will need to tackle by 2030 is the interaction between climate change and health.

Jody Ranck,
RAM Group

SOCIAL AND POLITICAL INCLUSION

Digital platforms can support access to social services, encourage transparency and accountability of governments and corporations, reduce corruption and bring citizens closer to social and political decision making.

TECHNOLOGY OFFERS THE CHANCE TO OPEN THE BLACK BOX OF GOVERNMENT AND PROMOTES GREATER DEMOCRATIZATION VIA PUBLIC PARTICIPATION IN AND CO-CREATION OF PUBLIC SERVICES.

Mark Thompson,
Judge Business School

IDENTITY FOR UNREGISTERED PEOPLE

One fifth of the world's population is without proper identification, which is a barrier to accessing basic services for health and well-being. Digital technology can provide secure identification for unregistered people.

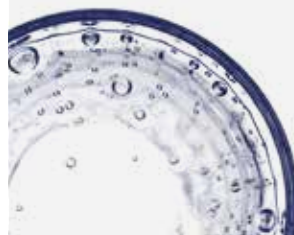
Microsoft is partnering with Blockstack Labs and ConsenSys on a blockchain-based identity system for developing nations.

FINANCIAL ACCESS

Mobile money can provide low-income families with access to financial services. Digital currencies such as bitcoin can accelerate financial inclusion by enabling direct transfers, reducing fees, speeding up transactions and increasing security.

IMPROVING SANITATION

Nanotechnology used in water purification filters can provide a low-cost solution to safe drinking water globally.



TARGETED MEDICINE

Precision medicine uses genetic and cellular information to predict health conditions to enable more effective treatment and care. Gene editing allows cost efficient and reliable targeted modifications to DNA.

The amount of information we now have at a molecular level is changing the way we look at medicine.

Dr Maria Freire,
Foundation for the National
Institutes of Health



PREDICTING AND MANAGING SHOCKS AND DISASTERS

Digital data collection and analysis can help manage the human impact of disasters by predicting crises, optimizing response and recovery tactics, and enabling efficient resource deployment.

Following the 2015 Nepal earthquake, N-Cell and Flowminder analyzed mobile data to track and estimate population movements, enabling targeted relief efforts.

**IN SEPTEMBER 2015,
MORE THAN 190
COUNTRIES SIGNED UP
TO THE 17 SUSTAINABLE
DEVELOPMENT GOALS
OF THE 2030 AGENDA FOR
SUSTAINABLE DEVELOPMENT.**



Delivering the Global Goals by 2030 will require collaboration across the private sector, governments and civil society, massive investment and innovation, as well as fresh thinking about economic paradigms and business models.

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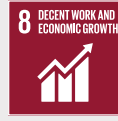
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1

END POVERTY IN ALL ITS FORMS EVERYWHERE

2030 VISION



OVERVIEW

Goal 1 aims to end all forms of poverty, including extreme poverty (those living under \$1.25 per day) and relative poverty (defined at a national level). Poverty is inextricably linked to a number of other Goals – hunger, health, education, gender equality, etc. – and addressing it requires systemic solutions that cut across Goals. There is a particular connection between poverty and areas of conflict and disaster. At the end of 2016, a record 65 million people were displaced, with 20 new displacements every minute.

Although the number of people living on less than \$1.25 a day halved between 2002 and 2012, 1 in 8 people worldwide remain in extreme poverty. This continues to be a regional challenge, with 1 in 5 people in developing markets living below the threshold. According to the World Bank, 78% of the world's poor live in rural areas and are poorly educated.

65m

people displaced in 2016

1 in 8

people worldwide
live in poverty

OPPORTUNITIES AND CHALLENGES

Central to achieving the goal of poverty alleviation is the provision of social assistance and protection systems, as well as the rights to economic resources and basic services.

Access to information:

Accessing relevant information on employment, health, education and social services can have a significant impact on poverty alleviation. Rural areas are particularly impacted by lack of access to information. Exchange of information can drive innovation and productivity, and enable inclusive economic development through finding employment or improving of livelihoods (e.g. access to markets for small-scale food producers).

Unregistered people: For the world's poor, a lack of identification is a barrier to accessing services and legal ownership. Unregistered people face challenges accessing healthcare, social services, education and housing. Globally, 1.1 billion people are without proper identification and one in three children under the age of five does not officially exist because their birth has not been recorded.

Access to social protection:

Benefits and support for children, mothers of newborns, the disabled, the aged, the poor and the unemployed are essential for reducing poverty across peoples' lives. While social protections have expanded globally since 2000, only 1 out of 5 people received any form of social protection in low-income countries (compared with 2 of 3 in upper-middle income countries).

Resilience to shocks and disasters:

Given the connection between poverty and conflict and disaster, building resilient communities will be critical to reducing poverty. Climate change is expected to increase the number of displaced people over the next 30 years, with estimates of 'climate refugees' ranging from 200 million to 750 million. Predicting crises and optimizing response and recovery tactics will be key to managing shocks and disasters.

Monitoring and measurement:

Governments need to develop effective approaches for monitoring and measuring poverty rates in order to define poverty and focus policies and programs for poverty reduction. This requires tools for reaching broad samples of people to understand their experiences as well as for analysis and insights.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Significant policy changes affording social protections and equitable education and job opportunities are critical to poverty alleviation. However, digital technology can play a key role in addressing how these developments are supported:

Access to technology: Access to 2G voice calling and text messaging, 3G mobile and broadband enables improved connectivity, communications and information sharing. Increasingly, these services are key to education and business opportunities and yet a digital divide remains: in developing markets more than 60% of households don't have internet access, and just 41% of people have mobile broadband subscriptions. There is also a gap based on income: the Pew Research Center found double digit gaps in internet usage between lower and higher income citizens across over 40 countries surveyed. Programs must be put in place to ensure these technologies are accessible by the very poorest, including those in rural areas.

“I SEE SMARTPHONES IN DEVELOPING COUNTRIES AS REALLY KEY TO CREATING AND LEVERAGING OPPORTUNITIES FOR US TO CREATE A MEANINGFUL LIFE AT THE INDIVIDUAL LEVEL.”

Sherman Indhul, Transnet

Digital identification: A lack of identification and records can be a barrier to accessing financial services which can provide secure, accessible and authentic registration. In Uganda, the National Identification and Registration Authority in partnership with Uganda Telecom is implementing a mobile vital records system whereby web-based applications and mobile phones are used to register births and deaths. Advances in

computing can provide digital identities through open source software installed as standard into every smartphone or wearable. Mobile network operators can offer digital identity servers which unlock access to e-government services, such as Mobile Connect.

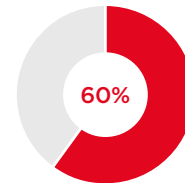
Data Collection: Digital technology enables innovative data collection methods to measure and monitor poverty and living conditions to inform planning and policymaking. The World Bank's 'Pulse of South Sudan' initiative aims to fill the data gap in Sudan by using tablets to document the livelihoods, consumption patterns and perceptions of South Sudanese citizens. Orbital provides satellite imagery to estimate numbers of people living below the poverty line. Expanded technologies in this space can help governments strategically provision social services.

Data analytics: Governments and others can better measure and respond to disasters, conflicts and crises by using data analytics tools. Anonymized meta-data from mobile networks gives real-time insights into population mobility and movement patterns. Data such as hospital intakes, death counts and weather provides meaningful insights for governments and humanitarian agencies to target resource deployment. Drones can generate imagery and georeferenced video to create risk maps. This data is most useful when available and accessible in real-time.

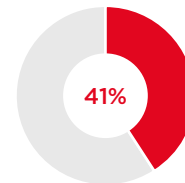
Business model innovation: Digital technologies have the potential to ensure more equitable and transparent distribution of resources, underpinned by business models which focus on sustainable development outcomes as well as financial returns. Digital platforms will be at the heart of monitoring the impact of such enterprises and could enable a new generation of social entrepreneurs – as well as incumbents – to unlock additional revenue streams for achieving demonstrable progress against the Goals.

DIGITAL DIVIDE

Households in developing markets without internet access



People in developing markets with mobile broadband subscriptions



“DIGITAL TECHNOLOGIES REPRESENT A SIGNIFICANT OPPORTUNITY TO INCREASE GLOBAL ECONOMIC INCLUSION. BUT WE WILL ONLY GET THERE BY ADOPTING - AND PUTTING RESOURCES BEHIND - BUSINESS MODELS WHICH ARE EQUITABLE AND EMPOWERING FOR MARGINALIZED COMMUNITIES.”

Mark Rose, Fauna & Flora International

THE INVESTMENT OPPORTUNITY

Providing the world's poorest with access to technology improves livelihoods and drives economic growth. The World Bank found indication of positive economic impact from fixed broadband across almost every study, regardless of methodology etc. However, additional research on the topic is necessary to demonstrate a strong correlation here. Some estimates show that extending internet access in developing economies to the level seen in developed countries could potentially raise living standards and incomes by up to \$600 per year, lifting 160 million people out of extreme poverty.

Universal registration can bring economic value. Estimates suggest that Aadhar, the universal biometric identification system in India, could save the government \$11 billion each year through efficiencies in distribution of services.

CASE STUDIES

HandyGo's mKisan provides agronomy and market information to small-scale farmers in India via SMS. This information results in higher crop yields and economic returns. Similar offerings exist in Kenya (mFarm) and Tanzania (m-Kilimo).

In partnership with the World Bank and the Ministry of Education, Souktel uses SMS technology to deliver job information in Palestine. JobMatch can be used to apply for jobs and internships and reduces costs for employers.

N-Cell and Flowminder partnered to track human migration in Nepal following the 2015 Gorkha earthquake. They estimated national-level population movements through analysis of anonymized data records from N-Cell's 12 million mobile subscribers and provided maps and insights to humanitarian response organizations.

Microsoft, Blockstack Labs and ConsenSys are building an open source, self-sovereign blockchain-based identity system to provide identification to developing nations and refugees. The project is currently at prototype stage as part of the ID2020 initiative which aims to develop and test the best technological solutions for digital identity.





2

END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE

2030 VISION

OVERVIEW

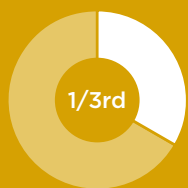
Goal 2 aims to end hunger and malnutrition by 2030, and to ensure access to safe, nutritious and sufficient food. Although global food production has increased faster than the rate of global population growth, nearly 800 million people suffer from stunting or malnutrition.

Hunger and malnutrition are global issues. Even where there is rarely actual scarcity of food, unhealthy diets and lack of access to nutritious food pose significant health challenges. After steadily declining for over a decade, global hunger has been on the rise since 2014.

The majority of undernourished people live in developing or conflict-affected countries. Africa and South-East Asia account for the majority of the world's hungry and stunted children. 60% of malnourished people in the world live in countries affected by conflict.

Globally, obesity has nearly tripled since 1975, and more than 1.9 billion adults and 41 million children under age five were overweight in 2016.

One-third of all food is lost or wasted each year



300m

people could be fed from food lost in Africa

40%

of losses occur at post-harvest and processing

OPPORTUNITIES AND CHALLENGES

We need a paradigm shift in the way we think about global food systems to produce and distribute the healthy food we need using less land and fewer inputs (e.g. water, fertilizer, fossil fuels) and creating decent and attractive livelihoods across the value chain. To do this, we need to consciously design efficiency into the food system as a whole and to recognize the complex interplay between the health of natural systems, human health and well-being, food production and distribution practices and their role as principal drivers of climate change and biodiversity loss.

Reducing food waste across the value chain: Roughly one-third of all food is lost or wasted each year – \$680 billion worth in industrialized countries and \$310 billion worth in developing countries. In the latter, 40% of losses occur at post-harvest and processing levels, while more than 40% of losses in industrialized countries occur at retail and with consumers. While different solutions are needed in these countries, reducing food waste could feed more people, lessen the burden on agricultural systems and reduce climate change impacts. For example, food currently lost in Africa could feed 300 million people.

Increasing agricultural productivity: Feeding a growing population will require farmers to produce more food with less land and fewer resources. According to National Geographic, nearly all new food production over the next 25 years must come from existing agricultural land, and improving nutrient and water supplies where yields are lowest could result in a 58% increase in global food production. Smallholder farms in particular require access to advice and services which enable

efficient, sustainable use of resources to improve yields and farm income. This might include precision farming methods tailored for smallholder needs and the ability to track inputs for optimal production and improve access to markets. Smart systems such as integrated water irrigation and rainwater harvesting can benefit small and large-scale farms, provided that investment and training required for successful implementation and ongoing maintenance is made readily available on enabling terms.

Developing resilient practices: Recent estimates place national cereal grain production losses due to extreme weather at roughly 10% annually. Preparing for climate-change related impacts will require more resilient agricultural practices and investments in relevant infrastructure and technologies, including databases for genomes of diverse livestock and resilient and diverse crops. There is a growing body of evidence that scaling agro-ecological practices could drive significant progress against multiple Goals. While the science and practice of agro-ecology is not dependent on digital technologies for successful implementation, online communities of practice and e-commerce solutions will be central to sharing best practice, enabling implementation at scale and enabling smallholders to access markets directly.

Educating on nutrition, health and diet: Supporting healthy nutrition for children and mothers is a particular priority. Globally, 6% of children under five years in 2016 were overweight.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Precision agriculture, including the use of drones, robotics, big data, IoT and smart equipment and farm management software, promises to deliver higher yields with fewer inputs. Field To Market found that technology such as GPS navigation and auto-controlled equipment has dramatically increased labor efficiency. As these technologies scale and become cheaper, smaller farms will be better able to access them.

“SMALLHOLDER FARMERS ARE GOING TO NEED SUPPORT FROM CAPITAL AND TECHNOLOGY TO HELP FACILITATE A WHOLE GENERATION TO CHANGE BEHAVIORS IN CROP AGRICULTURE IN THE GLOBAL SOUTH.”

Marc Diaz, TNC

New production and business models, such as indoor agriculture, cellular agriculture and the sharing of inputs and farm equipment, create new opportunities and increase access for farmers. E-grocers can enable farm-to-consumer distribution and access to food in remote areas or “food deserts”, as well as reduce emissions related to brick and mortar stores.

Waste reduction technologies, such as RFID and big data analysis, can improve the tracking of shelf life and quality of fresh produce and can optimize ordering and inventory for distributors and retailers, which can reduce GHG emissions and land use. Smart sensors have the potential to reduce waste by 25% to 40% across the value chain.

Improved famine prediction networks: Satellites and ground-based sensors in oceans, rivers and farms can forecast the drivers of food insecurity with increasing accuracy. High-resolution imaging informs farmers of ideal grazing locations in remote regions and guides business decisions. At the farmer level, services like Esoko send daily market pricing information to farmers in 10 different countries, while tools like the Rice Crop Manager from the International Rice Research Institute are used by extension agents in five countries to help them better understand farmer needs and necessary investments for greater yields.

Climate adaptation technologies: The CHAI program uses mobile tools to gather weekly crop and livestock market information and disseminate climate adaptation information in local languages to vulnerable communities. aWhere developed a global agronomic weather database with 1.6 million virtual weather stations to monitor weather events at 9km intervals and highlight ‘pocket droughts’ to target relief areas.

Big data can inform strategic agriculture decision making and enable genetic or molecular improvements. Currently, data-driven agriculture is primarily focused on conventional, industrial-scale operations, rather than small farmers, who grow 70% of the world’s food. There is a need to democratize big data – putting control and ownership of data into the hands of small farmers and deeper into the countries facing the greatest incidences of malnutrition.

“FOR LARGE FOOD COMPANIES TO LEVERAGE BIG DATA ANALYTICS INSTEAD OF PILOTING DISCRETE PROJECTS, WE WILL NEED STRATEGIC PARTNERSHIPS WITH TECHNOLOGY COMPANIES AND INVESTMENT IN SOLUTIONS. BREAKING DOWN SILOS AND CREATING PARTNERSHIPS WITH NEW SECTORS CAN ACCELERATE SUCCESS.”

Dave Stangis,
Campbell Soup Company

25 to 40%

potential amount of reduced waste using smart sensors

THE INVESTMENT OPPORTUNITY

Serving the 815 million people globally who are undernourished or food-insecure is both a moral imperative and massive economic opportunity. The food and agribusiness industry represents 10% of global consumer spending and 40% of employment, while investment in the industry has grown threefold since 2004.

Agriculture technology has captured the interest of the venture capital community, with investments totaling \$3.2 billion in 2016. Vertical farming startup Plenty just announced a \$200 million round of funding from investors including SoftBank and Bezos Expeditions. Scaling digital-tech driven solutions and companies across the regions that need them most, e.g. Africa, presents significant business opportunities.

CASE STUDIES

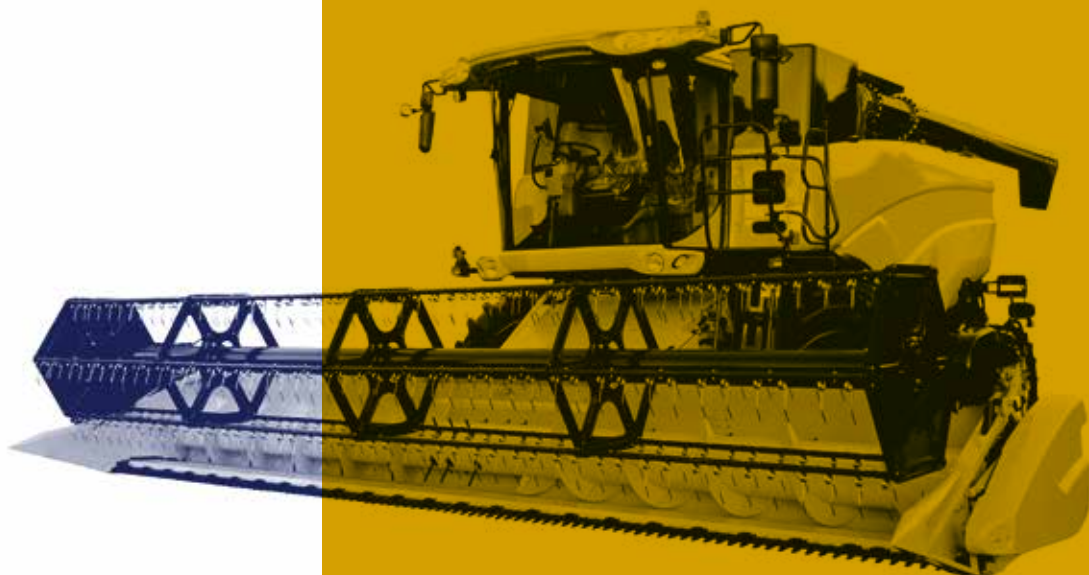
BASF and John Deere have partnered to develop smart farming equipment that leverages data collected through precision farming to make processes more efficient.

Using the app SmartBarley, suppliers to AB InBev around the world log details on more than 40 variables that affect barley production, such as variety planted, soil type, tillage method and applications of water and fertilizer. Growers use the platform to compare practices and yields with others who operate in similar conditions.

George Kantor, a roboticist at Carnegie Mellon University, recently launched FarmView, a project that combines AI with robotics to improve the agricultural yield of certain staple crops, including sorghum. In countries like India, Nigeria and Ethiopia, this drought- and heat-tolerant plant is a valuable cereal crop that has great potential due to its more than 40,000 varieties.

There are a variety of technology companies working to address food waste across the food and agricultural value chain. For example, BT9 monitors the condition of perishable food products along the cold chain, while Edipeel is a plant-based extract which keeps produce fresh for longer after harvest. The Consumer Goods Forum recently announced an initiative to harmonize food date labels around the world (confusion over “best by” dates is a major contributor to food waste).

Microsoft is helping agribusinesses aggregate, share and monitor data to overcome current challenges of disparate and siloed data systems. This will enable companies to improve applications of seeds, herbicides and fertilizers to reduce sustainable impact as well as improve crop production and yield.





3

ENSURE HEALTHY LIVES AND PROMOTE WELL-BEING FOR ALL AT ALL AGES

2030 VISION

OVERVIEW

Goal 3 aims to ensure health and well-being for all, at every stage of life. While there has been significant improvement in global health in the last two decades, further progress is needed. For example, the global rate of maternal mortality decreased 44% between 1990 and 2015, yet most maternal deaths are preventable. In sub-Saharan Africa, only 53% of live births are accompanied by expert care during delivery.

Globally, non-communicable diseases (NCDs) are the biggest cause of death, responsible for 70% of all deaths. However, more than half of all deaths in low-income countries are due to communicable diseases, nutritional deficiencies and conditions arising during pregnancy or childbirth.

Neonatal mortality is highest in Central and Southern Asia and sub-Saharan Africa, and lack of safe water, sanitation and hygiene services are major risk factors for infectious diseases and mortality. Death rates in these regions due to these factors were two to four times that of the global average. In addition, the incidence of HIV infection remains highest in sub-Saharan Africa.



“THE BIGGEST HEALTHCARE CHALLENGE WHICH TECHNOLOGY WILL NEED TO TACKLE BY 2030 IS THE INTERACTION BETWEEN CLIMATE CHANGE AND HEALTH.”

Jody Ranck, RAM Group

OPPORTUNITIES AND CHALLENGES

While health funding has increased since 2005, rising rates of NCDs and compounding factors result in a lack of adequate healthcare and poor health conditions. Addressing this will require extending access to health information and personnel as well as improving funding models. Several key changes required include:

Increased access to healthcare workers: Insufficient doctor and healthcare worker density is a problem in many parts of the world, limiting progress towards universal access to healthcare.

Improved sanitation: Rapidly growing cities could further strain overburdened systems and spread infectious diseases. Educating communities on how infections spread has significant potential to improve health outcomes. Improving water treatment infrastructure will also help improve sanitation and water quality conditions.

New investment models and tools for funding: Collaborative models such as impact investing or public-private partnerships will be crucial to access healthcare funding required to meet Goal 3.

Reducing environmental toxicity: An estimated 12.6 million deaths each year (nearly one in four of total deaths) are attributable to unhealthy environments. In the coming years, climate change poses a significant health challenge. Building more efficient infrastructure, transport and manufacturing systems can help reduce pollutants in the air, water and soil, in turn reducing the risk of both non-communicable and infectious diseases.

Improved nutrition: A lack of access to nutritious foods is a key contributor to poor health (see Goal 2 for more discussion).

“THE BIGGEST OBSTRUCTION TO REACHING SDG 3 IS THE NEED FOR NEW WAYS OF WORKING AND MOVING BEYOND TRADITIONAL PHARMACEUTICAL BUSINESS MODELS.”

Anne Gaadegard, Novo Nordisk

12m+

deaths per year attributed to unhealthy environments

\$34bn

forecasted market value of wearable devices by 2030



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Precision medicine, which uses genetic and cellular information to predict health conditions and medication sensitivity, could lower lifelong healthcare costs for individuals and the system.

Gene editing via CRISPR and Cas9 can make targeted modifications to DNA more cost-effective and reliable, accelerating research and development and increasing therapeutic applications.

“THE AMOUNT OF INFORMATION WE NOW HAVE AT A MOLECULAR LEVEL IS CHANGING THE WAY WE LOOK AT MEDICINE.”

Dr Maria Freire,
Foundation for the National
Institutes of Health

Electronic health records can bring efficiencies and better coordination in healthcare delivery, and giving patients control over their digital health identities has the potential to improve health outcomes.

Transparency-enabling technologies can reduce medical fraud and litigation, as well as unethical pricing of drugs and insurance. For example, blockchain can support new models of health information exchanges and create a new level of integrity for healthcare information.

Wearables and health monitoring devices empower patients to manage their care and medications, and assist doctors and healthcare workers in monitoring and advising patients remotely. The wearable medical device market is worth \$13 billion and is forecast to reach \$34 billion by 2030.

“LOW POWER TECHNOLOGY IS STARTING TO ENABLE THE COLLECTION AND UTILIZATION OF THE MASS OF CONTINUOUS DATA WHICH OUR BODIES PROVIDE. HAVING ACCESS TO NEW, RICHER, REAL-TIME INFORMATION WE COULDN'T COLLECT BEFORE WILL ENABLE THE HEALTHCARE INDUSTRY TO DELIVER FASTER, MORE EFFECTIVE TREATMENT - PROVIDED WE CAN CONTINUE TO DEVELOP THE INFRASTRUCTURE REQUIRED TO SUPPORT IT.”

Peter Ferguson, Arm

Telemedicine and mobile health (or m-health) solutions have proven successful in extending care, new payment models and health-related information to remote areas. In the US, Mercy Health Systems has built a Virtual Care Center, staffed by hundreds of healthcare providers, that provides telehealth services across four states. In Andhra Pradesh in India, the non-profit Health Management and Research Institute provides an internet-based video system that allows pregnant women to consult obstetricians and gynecologists in the city of Hyderabad. This has raised the rate of safe deliveries by 50%.

AI and machine learning will be crucial for analysis of the vast amounts of health data generated through connected devices to enable practitioners to make informed care decisions. IBM's Medical Sieve is an image-guided informatics system which is designed to assist in clinical decision making and efficiency in patient treatment. Deep Mind is working with NHS UK to roll out its Streams app which uses AI to pick up on patient warning signals. Growth in the AI health market is expected to reach \$6.6 billion by 2021.

“IN DEVELOPING MARKETS, TECHNOLOGY ENABLES THE HEALTH WORKFORCE TO BE REGISTERED; THIS CAN SUPPORT QUICK AND EFFECTIVE DEPLOYMENT OF RESOURCES, AS WELL AS ACCESS TO TRAINING AND INFORMATION.”

Leslie-Anne Long, PATH

50%

Increase in safe deliveries by women using internet-based video systems in Andhra Pradesh, India

THE INVESTMENT OPPORTUNITY

Grand View Research projects that the healthcare sector will invest \$410 billion in IoT devices, software and services in 2022 (up from \$58.9 billion in 2014). Accenture predicts that funding for on-demand healthcare, enabled by digital technology, will reach nearly \$1 billion by the end of 2017 (up from \$200 million in 2014).

Several gene-sequencing ventures, including Human Longevity Inc. (\$300 million), have raised significant backing from investors who see the potential of DNA databases in tackling disease. Experts suggest that the gene sequencing market will exceed \$20 billion by 2020.

In particular, mobile health offers promising investment opportunities. For example, remote patient monitoring could bring an estimated \$300 to \$440 billion in business opportunities by 2030.

CASE STUDIES

ZiDi, an m-health solution in Kenya which monitors services and vaccine consumption, forecasts potential patient demand at over 5,000 health facilities. ZiDi has enabled county governments and hospitals to deploy a pay-per-use model that improves access to services and ensures patients' feel secure in making their payments.

GE has developed V-Scan, a handheld ultrasound device with WiFi and DICOM capabilities which connects with a smartphone. The device was first deployed in rural India and Tanzania and can identify top risks of breaches. After training, local healthcare workers can use it to promote maternal health, and not rely on expensive outreach services.

Similar to what iTunes did for music and the iPhone did for the now robust universe of apps, **Apple** has launched an open source platform, called CareKit, that makes it easier for developers to aggregate and share patients' medical information (with consent) with healthcare workers. CareKit has been used to make apps to help people manage diabetes, depression, reproductive health and record health conditions, such as asthma.





4

**ENSURE INCLUSIVE
AND EQUITABLE
QUALITY EDUCATION
AND PROMOTE
LIFELONG LEARNING
OPPORTUNITIES
FOR ALL**

2030 VISION



OVERVIEW

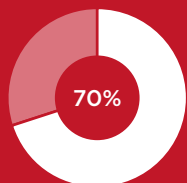
Goal 4 aims to provide inclusive, equitable and quality education for all people, globally. Its targets span a variety of challenges related to inclusion of marginalized populations at multiple levels of education and in the workforce.

Access to education remains absent from the lives of 263 million under 18s. Young people in sub-Saharan Africa and South Asia make up 70% of this figure. Those who attend school often fail to acquire basic skills in reading and mathematics. In almost half of Latin American countries, less than 50% of primary school graduates attain minimum proficiency in mathematics and reading, while 25% of sub-Saharan African countries have less than half their graduates attain minimum reading proficiency.

Gaining a quality education most impacts children in developing nations; studies show that each additional year of school increases future income by an average of 10%.

263m

people under 18 globally are without access to education



of under 18s without access to education are from sub-Saharan Africa and South Asia

OPPORTUNITIES AND CHALLENGES

Improving quality and delivery of education for children and adults, especially those living in rural areas and in low-income countries, presents a number of challenges and opportunities:

Extending the classroom:

90% of children worldwide completed primary education, but only 63% finish secondary school. The lack of trained teachers and poor conditions of schools are key barriers to achieving quality education. Cost-effective education products and services that eliminate barriers to access and improve quality of learning, especially for rural and disadvantaged populations, represent a significant opportunity.

Equal access to education:

In 2013, two-thirds of the 757 million adults unable to read or write were women. Women are particularly under-represented in STEM education: 16% of female students graduate in STEM subjects vs. 30% of male students. Technology-driven education programs must recognize gender-specific challenges including fewer role models and negative stereotypes that can lower girls' aspirations and achievements. Equal access to education requires addressing financial disadvantages of students and increasing funding for innovative business models. For example, the Teacher Incentive Fund has trialed pay-for-performance programs in the US, and open source programs continue to grow (e.g. edX, Khan Academy).

Measuring learning achievements:

Lack of comparable data makes measuring educational attainment across countries difficult. Leveraging big data, IoT and connected classrooms to better track learning outcomes can help identify and prioritize effective teaching methods.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Mobile and connected classrooms, enabled by mobile phones, fast broadband and ICT infrastructure increase and extend access to education, unlocking new opportunities for learning. For example, Colombia's Programa Nacional de Alfabetización delivers mobile devices with SIM cards that offer educational content to illiterate adults.

"IN MANY DEVELOPING MARKETS IT IS NOT EXPENSIVE, SOPHISTICATED TECHNOLOGY WHICH HAS THE BIGGEST IMPACT ON EDUCATION, BUT MORE UBIQUITOUS, INCLUSIVE AND AFFORDABLE TECHNOLOGY LIKE MOBILE."

Jaideep Prabhu,
Judge Business School

Online learning and collaboration can be an accessible and engaging way for students to work together and test ideas via massive open online courses (MOOCs). Smartphones and the internet can provide learning, online certifications and student advisory services to rural, low-access areas and to disadvantaged populations.

"THERE IS A NEED TO TRANSCEND THE IMPERIAL IVORY TOWER MENTALITY AND CREATE A GLOBAL STANDARD IN EDUCATION. SMARTPHONES AND PHONE BASED CURRICULUMS CAN BE A MAJOR PART OF THIS."

Sherman Indhul, Transnet

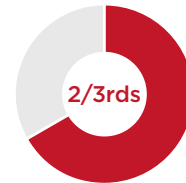
Real-time analytics can be leveraged to develop personalized curricula to students and trainees, helping to accelerate learning and upskilling. IBM is developing data-driven cognitive technologies to enable personalized education and improve outcomes for students, educators and administrators.

AI and machine learning can extend teachers' reach and, for example, Brainly uses machine learning to automate content shared on its platform, allowing its decentralized team of moderators to focus on providing quality support to students. Quill uses machine learning and natural language processing to help students improve grammar and writing.

Augmented Reality and Virtual Reality can create immersive experiences for students and trainees and bridge the gap between school and the workplace. These tools have particular application in STEM subjects where learning opportunities are enriched through interaction with dimensional objects and environments (e.g. zSpace).

+10%

Increase in average income with each additional year of school



In 2013, two-thirds of the 757 million adults unable to read and write were women

\$3.1bn

of venture capital flowed into ed-tech companies in 2015

THE INVESTMENT OPPORTUNITY

According to UNESCO, there is a financing gap of \$26 billion per year to achieve universal education – this is greatest in developing nations with large youth populations. For example, India's youth comprises over 50% of its population, but only about 25% are employable after graduation. This is also a business issue as educated workers are better equipped to become productive employees as well as consumers with disposable income.

In the US, the education sector is a \$1.5 trillion industry and growing 5% annually. In 2015, \$3.1 billion of venture capital flowed into ed-tech companies, with one of the largest deals in 2016 a \$16 million Series B investment in EdCast.

CASE STUDIES

UNESCO has developed a framework to inform teachers (and others including policymakers) on the role of ICT in education and to enable them to help students become collaborative and creative learners through the use of ICT.

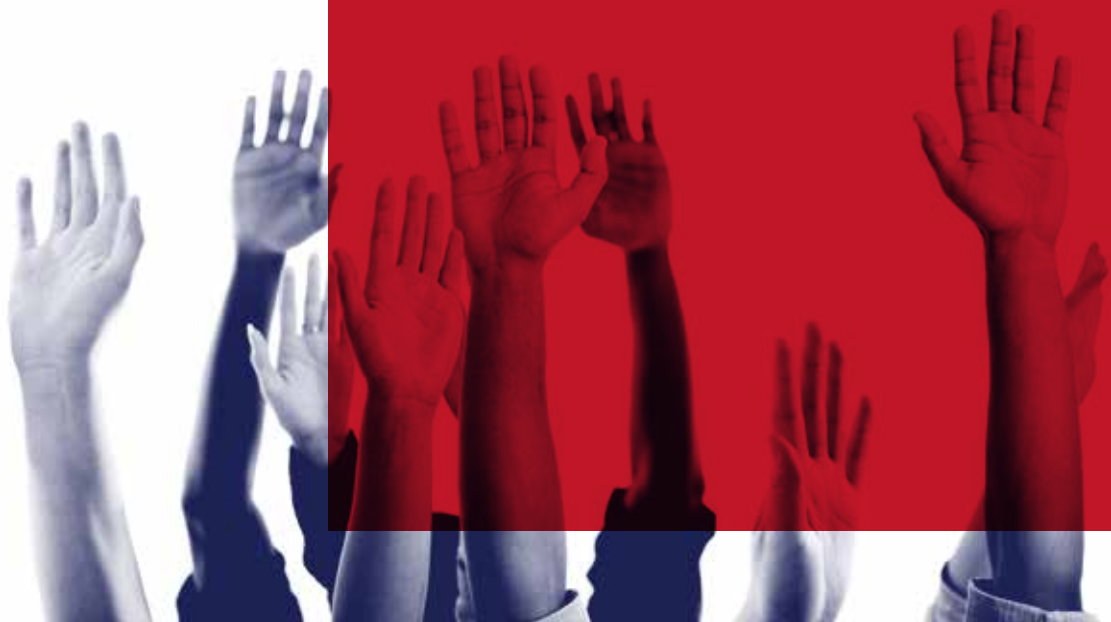
Endless OS offers a free operating system for PCs that is designed to be used with relatively little data and in areas with inconsistent internet access. In Thailand, the OS includes an encyclopedia with Thai articles, an office suite and educational games for children.

Arm partnered with Literacy Bridge to create a low-cost computer designed to support the learning needs of illiterate populations. The so-called Talking Books have had a positive impact on local health outcomes and agricultural activity. A UNICEF survey showed that people with access to Talking Books were 50% more likely to engage in healthy behaviors such as using bed nets, washing hands with soap and registering their child's birth, while an independent study shows that 91% of farmers who used Talking Books applied the information they learned.

Content Technologies leverages artificial intelligence and deep learning to assemble custom, up-to-date and relevant textbooks. Educators import their syllabi and materials for the system to read, "learn" the content and find new patterns that are used to create textbooks and classroom materials based on core concepts.

Pearson is experimenting with Learning Companion Systems, or software agents that exist in the cloud and be accessed from multiple devices, gathering data about how people learn and assisting them as they continue to develop knowledge.

Providing educational options to reach the "last mile", such as how **Eneza Education** provides learning content and courses via mobile and computer devices in Africa, will be essential in reaching those out of school, especially the disabled, minorities, women and girls.





5

ACHIEVE GENDER EQUALITY AND EMPOWER ALL WOMEN AND GIRLS

2030 VISION

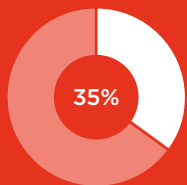


OVERVIEW

The restriction on the basic rights of women and girls and lack of access to opportunities impede the progress of sustainable development. Women participate in labor markets on an unequal basis and are more likely to work in vulnerable, low-paid or undervalued jobs. In most countries, women are under-represented in managerial positions, STEM careers and in politics. Women in developing countries spend four times as many hours on unpaid work as men.

In developing countries, reproductive health problems are a leading cause of poor health and death for women and girls of childbearing age. While child marriage rates have declined, they remain high in some regions including Southern Asia and sub-Saharan Africa, which limits educational and employment opportunities.

According to the WHO, 35% of women worldwide have experienced physical and/or sexually intimate partner violence or non-partner sexual violence.



of women worldwide have experienced physical and/or sexual partner violence

4x

more time spent by women on unpaid work in developing countries than men

\$12tn

could be added to global GDP by 2025 by advancing women's equality

OPPORTUNITIES AND CHALLENGES

Obstacles to women's social, economic and political empowerment are many, and cultural and social norms are two of the major ones. Challenges and opportunities include:

Access to ICT: Lack of ICT access disproportionately affects women and is the third most important development issue for women after poverty and violence.

Cost remains the biggest barrier to women owning a mobile phone or having access to the internet. Other barriers include social norms and lack of digital literacy.

Economic opportunity: Access to ICT provides the means for women to access markets and business services, in turn opening up income opportunities. For example, a UN Women/CISCO Networking Academy training program in Morocco enabled 60% of the graduating students to gain access to the job market within three months after graduation.

Financial inclusion and access: Women tend to have less access to formal financial services, despite often being responsible for spending the majority of family income. This lack of access remains a barrier to achieving equal rights.

“WHAT’S REALLY INTERESTING IS INNOVATION IN CASH-BASED TRANSFERS. AID TARGETS MEN, BUT WOMEN GENERALLY USE 90% OF FAMILY INCOME ON THEIR FAMILY, COMPARED TO MEN WHO USE 30% ON THEIR FAMILY.”

Caroline Rusten, UN Women

Sexual and reproductive health: Denial of reproductive rights exacerbates poverty and gender inequality. Fully addressing the unmet contraceptive needs of women in developing regions would prevent 35 million abortions and 76,000 maternal deaths each year. Complications from pregnancy and childbirth is a leading killer of adolescent girls in developing countries. Access to information about safe sex and family planning is often not openly available in communities.

Violence and trafficking: WHO data from 2014 shows that one in three women has been beaten, coerced into sex or abused in some way, most often by someone she knows. Gaps in data undermine efforts to reduce violence – most instances of abuse do not come to the attention of authorities or service providers.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Gender relevant content tailored for and created by women enables civic participation, education and employment. This content can be delivered via mobile technology to enable social inclusion through networks such as She Leads Africa or WINGS Network.

Technology can improve **data transparency** around gender equality across employment, education, health and gender-based violence. Aware is a technology platform that allows companies to collect and visualize information about the gender pay gap from their own employees. Egyptian data company NJel worked with volunteers to create HarassMap, which uses crowdsourced data to map incidents of sexual harassment. Many applications like these have been created for North American and European markets - in the future, more need to be applied to developing countries.

Providing access to information on safe sex and family planning is critical to advancing reproductive rights. Technology, including **mobile health solutions**, can aid the delivery of sex education, for example via **websites** that provide a secure place for girls to learn about issues that may be a cultural taboo. Mobile health tools and **messaging services** allow mothers to be tracked during pregnancy and help ensure they receive necessary care.

Mobile Money can provide women with access to finance, and **blockchain** technology (e.g. VipiCash) holds promise to enable secure money transfer so women have control over their own money.

“WOMEN ARE PARTICULARLY IMPACTED BY TECHNOLOGY DEVELOPMENT IN INDIA, ESPECIALLY ACCESS TO MICRO-FINANCE.”

Jaideep Prabhu,
Judge Business School

Wearables and mobile tracking can improve the safety of women, providing an easy way to get in touch with friends in difficult situations and a safety net when traveling alone. **Data and social networking tools** can be used to map and share incidents of violence in public places and allow women to make better informed decisions on where to travel in a city.

\$170bn

market opportunity by closing the gender gap in mobile phone ownership and usage

95%

The UN estimates that 95% of harassment, abusive language and derogatory imagery online is aimed at women.

Technology-related violence against women, according to the Association for Progressive Communications, includes acts of gender-based violence that are “committed, abetted or aggravated, in part or fully, by the use of information and communication technologies.”

THE INVESTMENT OPPORTUNITY

An increase in female labor force participation (or reducing the gap between men and women) results in faster economic growth. McKinsey finds that \$12 trillion could be added to global GDP by 2025 by advancing women's equality.

When women have access to the internet, it leads to significant economic benefits and breaks cycles of poverty. GSMA finds that closing the gender gap in mobile phone ownership and usage could unlock a \$170 billion market opportunity.

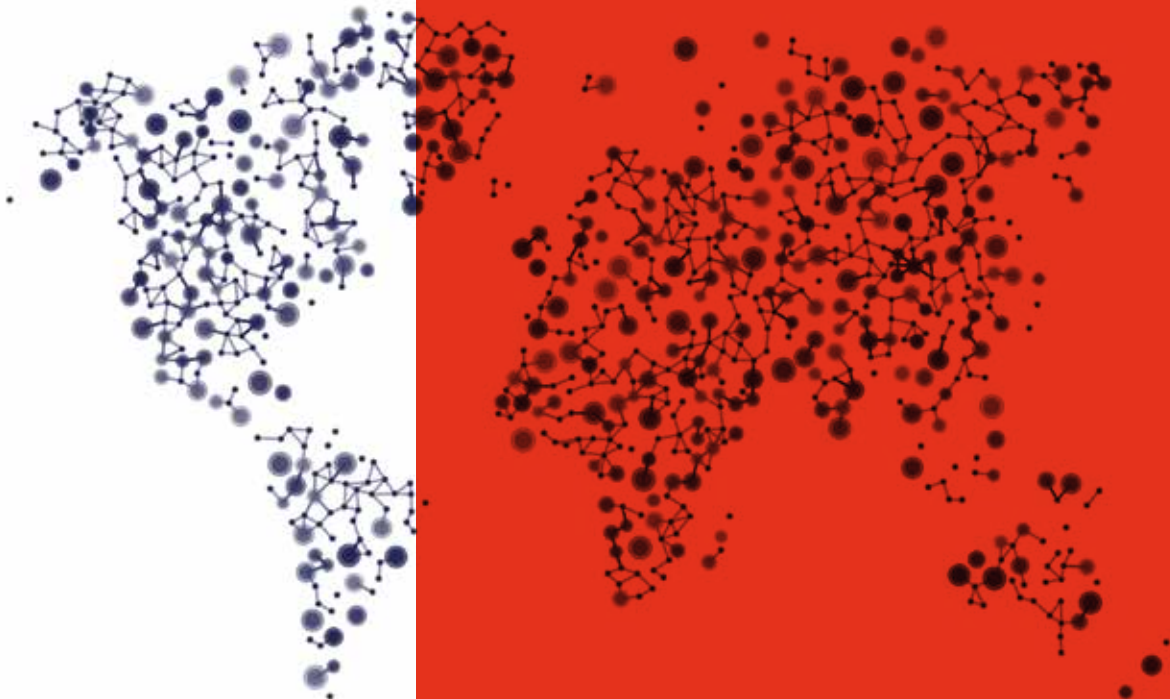
CASE STUDIES

Google established **WomenWill** to help erase the gender gap by connecting women to the internet and providing them with tools to maximize the value of it. The initiative includes programs to improve digital literacy by training women, connecting female entrepreneurs and supporting women re-entering the workforce.

Variable Labs uses virtual reality to overcome the gender pay gap through experiences which foster empathy, develop soft skills and change behavior. This includes a tool which simulates salary negotiations and includes a narrative through which women can make pitches and navigate the challenges of a resistant boss.

Souktel and MEPI are partnering with women's organizations to boost female-led content in Palestine by launching the first on-demand mobile text and audio content platform for women, making it easier to access information about civic rights. The project provides data on service use that can improve content delivery and women's rights advocacy efforts.

Data2X supports a variety of projects exploring how promising sources of big data – cell phone call records, satellite datasets and social media – can help close gender gaps. Their mission is to improve the quality, availability and use of gender data in order to make a practical difference in the lives of women and girls worldwide.





6

ENSURE ACCESS TO WATER AND SANITATION FOR ALL

2030 VISION

OVERVIEW

Goal 6 aims to provide universal access to safe water and sanitation, which in addition to immediate health benefits has positive impacts on socio-economic issues such as education and employment, particularly for women and girls. Globally, 12% of the population lack access to drinking water services, and 32% lack access to basic sanitation services.

The use of such services has increased more rapidly than use of basic drinking water services, however, no region is on track to achieve universal basic sanitation by 2030. Lack of access to water and sanitation for health (WASH) is more pronounced in developing and emerging markets in Central & South Asia and sub-Saharan Africa.

Globally, water use has grown at more than twice the rate of population growth over the last century, and water scarcity is a reality in parts of the world. By 2030, global water demand will be 40% above accessible, reliable supply and one-third of the population (concentrated in developing countries) will reside in basins where this deficit is larger than 50%.

“SMART ALLOCATION OF WATER SUPPLY CAN ENHANCE ACCESS TO CLEAN WATER; FOR EXAMPLE, THROUGH PIPELINE SENSORS WHICH ALLOCATE WATER BASED ON DAY-TO-DAY CONSUMPTION AND WATER LEVELS IN A DAM.”

Darshan Mundada,
Sterlite Technologies

12%

of the population globally lack access to drinking water services

OPPORTUNITIES AND CHALLENGES

Access to WASH relies on broader water security and water resource management, and faces several opportunities:

Improving **water efficiency** in agriculture (71% of global water use) and industry (16%) can reduce the number of people affected by water scarcity. The annual rate of efficiency improvement in agricultural and industrial water use between 1990 and 2004 was just 1%. Efficient water use is essential in India and China, both of which will see water demand outstripping supply by 2030 according to McKinsey.

As global water requirements grow, the allocation of water to where it is most needed will be critical. **Water and sanitation infrastructure** is often derelict and unable to cope with growing demographics. For example, roughly 37% of the water supply is lost to leaks in South Africa.

Lack of WASH access is driven by **water quality** and availability, the former of which can be compromised by infectious agents and toxic chemicals. In China, industrial and domestic pollution renders 21% of available surface water unfit even for agriculture. Over 80% of wastewater generated in developing countries is discharged without treatment into surface water bodies. As a result, 3.4 million people, mostly children, die annually from water-related diseases.

Although 80% of water used by humans is surface water, the growing water crisis is leading many to investigate **unconventional water sources**. More efficient and cost-effective desalination processes are being developed such as reverse osmosis. In Australia, scientists are investigating areas which could be suitable for the harvesting of storm water, an untapped sustainable water resource.

Mapping water resources:

Understanding the demand and supply of water in the coming decades will be crucial in order to close the “water gap”. This involves monitoring of information regarding the geography and hydrology of land, drainage basins, water table conditions and rainfall. Data analysts can map and model key scenarios and risks and pinpoint intervention points for impact, such as new freshwater sources or optimal points for aquifers. Exchange of this data between service centers and countries will be crucial to building a global picture.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

IoT and sensors can drive efficiencies in both supply and demand. Smart pipes monitor and provide information about the state of the pipes (including leaks), and trigger corrective actions. For example, Zonescan Alpha has reduced water loss by two million liters in a south German town. Sensors can significantly improve agricultural irrigation efficiencies through soil and humidity monitoring and remote management. More broadly, sensors can monitor surface water availability and provide early warning systems, such as in the hydrological sensor web for South Esk river catchment area in Tasmania. Sensors systems can also be used to assess water quality and transmit information to decision makers. FREDsense is a portable, cost-effective sensor and testing platform that can detect a variety of chemicals and contaminants in under an hour.

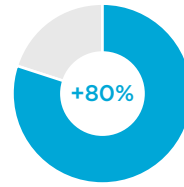
“NEXT GENERATION, POST-SILICON SENSORS CAN POWER SMART CITIES AND SMART WATER MANAGEMENT BY ASSESSING WATER QUALITY AND QUANTITY FROM THE OUTSIDE OF PIPES.”

Jody Ranck, RAM Group

Analysis and exchange of data collected by IoT sensors can build data-based land and water management modeling tools which drive better decision making, ecosystem valuation and identification of priority areas for both the public and private sector. For example, WatrHub is seeking to establish a big data terminal of the future for water data. Data analysis tools can assess the economic and environmental tradeoffs of potential water management approaches to engage and inform stakeholders on the best course of action.

AI can be used to analyze water-related data and optimize use for industrial and water management companies. Pluto AI is an analytics platform that extracts insights from unstructured data to help companies reduce water wastage, predict asset health and minimize operating costs.

Satellites and drones can collect data for watershed mapping and surface mapping. Utilis provides satellite imagery to detect leaks in water distribution systems.



of wastewater generated in developing countries is discharged without treatment into surface water bodies

3.4m

people, mostly children, die annually from water-related diseases

40%

Water demand will exceed supply by 40% by 2030 (globally)

THE INVESTMENT OPPORTUNITY

At a macro level, the UN estimates that \$6.4 trillion of investment is needed for water-related projects by 2036.

There are various market size predictions about “smart water” systems. One, from Global Market Insights, forecasts that the market for smart meters will exceed \$14 billion by 2024.

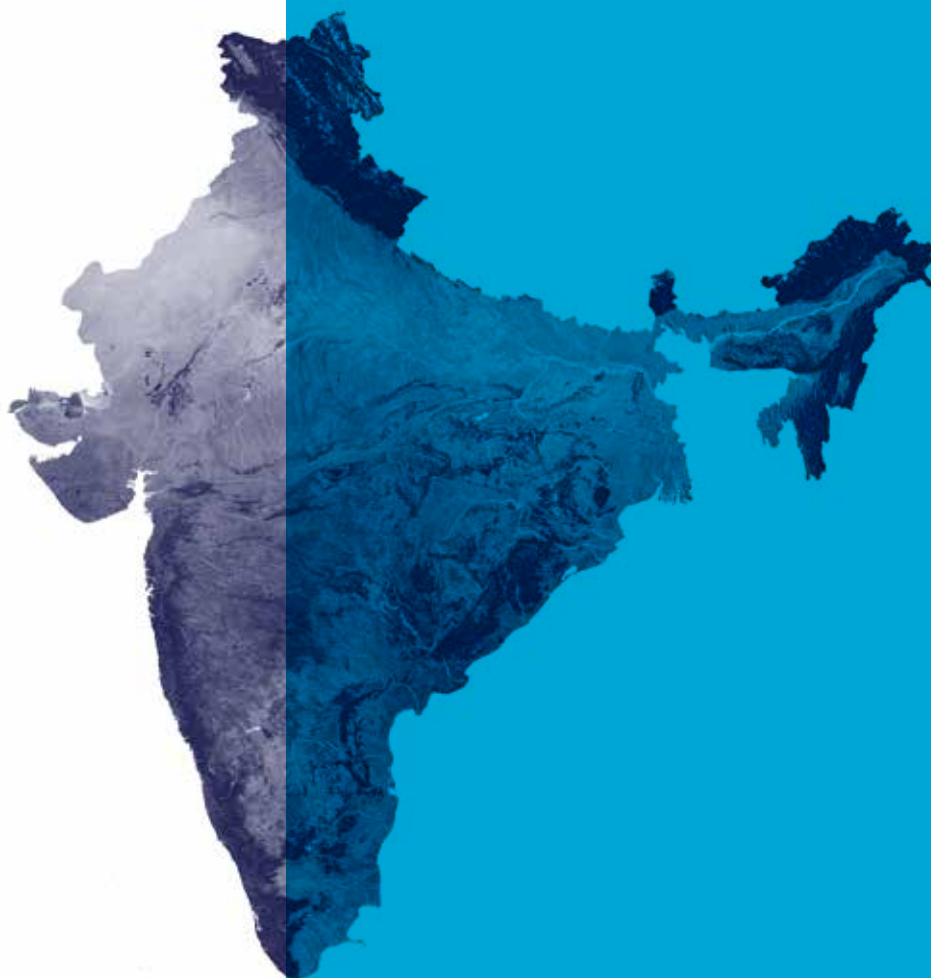
CASE STUDIES

AT&T and **Hydropoint** partnered on an IoT solution to outdoor irrigation which helped customers save more than 15 billion gallons of water and \$137 million in expenses in 2014.

EMAGIN is a cloud-based, AI platform that helps water utilities proactively manage infrastructure operations. HARVI, the company’s flagship product, provides system-wide monitoring, generates alerts for anomalies and creates GIS-based visualization of system KPIs.

Grundfos manufactures water pumps and filtration devices that enable greater access to clean water around the world. Grundfos recently entered into a partnership with ARDA International to provide clean water access to 1.5 million people in Africa, Asia, Central and South America and the South Pacific over the next five years.

In India, the **National Remote Sensing Centre** uses sensors on satellites to identify new groundwater supplies and monitor groundwater quality to provide drinking water to villages.





7

**ENSURE ACCESS
TO AFFORDABLE,
RELIABLE,
SUSTAINABLE AND
MODERN ENERGY
FOR ALL**

2030 VISION



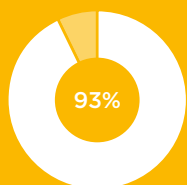
OVERVIEW

Access to reliable, sustainable energy is essential for economic development, yet over one billion people, predominantly rural dwellers, live without electricity. Half of these people live in sub-Saharan Africa.

While renewable energy capacity has grown rapidly, it comprises only 19% of total energy consumption. The heat and transport sectors, which account for 80% of global energy consumption, are heavily reliant on fossil fuels. The scaling-up of renewables in the transport sector has been slow, where oil products still account for around 93% of final energy consumption.

>1bn

people, predominantly rural dwellers, live without electricity



of energy consumed in the transport sector is from oil products

\$55bn

funding gap to address the total cost of Africa's energy infrastructure needs

OPPORTUNITIES AND CHALLENGES

There are a number of challenges and opportunities in accelerating progress on renewable energy:

Improved financing for renewable energy: More finance needs to be directed to renewable energy, particularly in developing countries. There is an estimated funding gap of \$55 billion to address the total cost of Africa's energy infrastructure needs, where lack of access to energy affects 600 million people, limiting economic opportunity and harming health through the use of low-cost energy sources such as wood fuel.

Promoting economic development: Countries with electrification rates of less than 80% consistently suffer from reduced GDP per capita. Without access to reliable electricity from the grid, many businesses must run diesel generators to keep their operations functioning, which costs between three and six times what electricity from the grid costs worldwide. Lighting alone is estimated to generate income gains of \$5 to \$16 per month for poor households in developing countries.

Greater energy reliability and efficiency: Increased energy efficiency enables the energy grid to service a wider population where infrastructure does exist.

Partnerships and collaboration: Target 7A specifically highlights the need for increased international collaboration to facilitate access to clean energy by sharing research and renewable energy technology. This will require open source innovations and pre-competitive sharing of best practices.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Efficient and “smart” grids.

Smart grids enable two-way communication between end users of energy and utility companies, or distributed energy sources, to more efficiently and reliably manage energy usage. They rely on predictive analytics and demand response technology to manage energy loads appropriately. Smart grids and meters can help deliver efficiency gains while intelligent algorithms and automation allows connected systems to operate with fewer errors by identifying shortages or problems quickly. The U.S. Department of Energy has made supporting the smart grid a national policy goal. Also, some households and businesses are pursuing “grid-less” options or “mini-grids” that leverage digital technology to manage their renewable energy resources.

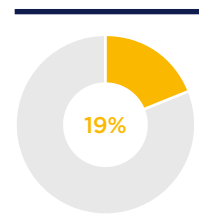
Energy storage: The ability to store large amounts of energy is critical to the ultimate proliferation of renewable energy across industries and sectors, like transportation and heating. Advancement of energy storage is enabled by systems modeling, open source data sharing platforms and research aggregators such as the Joint Center for Energy Storage Research, which combines the efforts of researchers to accelerate the discovery of new batteries while supporting their commercialization. AI can improve the efficiency of energy storage by informing when and how energy needs to be stored.

Smart appliances and sensors: Smart appliances ranging from in-home devices to industrial manufacturing tools can reduce energy consumption while educating consumers about the relative energy intensity of different appliances.

3D printing and robotics can ensure robust renewable energy supply. 3D printing allows advanced production techniques and nanorobots can inspect and carry out any necessary repairs on complex machinery including turbines and solar panels.

New financing models:

Crowdfunding platforms and socially responsible investing platforms that rely on algorithms have the potential to provide new financing streams to renewable energy infrastructure.



Only 19% of total energy consumption is from renewables

600m

People are affected by limited access to energy in Africa

THE INVESTMENT OPPORTUNITY

The International Energy Agency (IEA) suggests that filling the gap in access to energy around the world will mostly come from renewables and will be underpinned by new business models using digital and mobile technologies. By 2030, renewable energy sources are expected to power over 60% of new energy access. Off-grid and mini-grid systems will provide the means for almost half of new access.

As energy demand rises in regions like India and sub-Saharan Africa, new products and services will be required to meet the demand while digital technology will be vital to enabling smart, efficient and sustainable energy sources in keeping with policy demands and planetary boundaries.

There are several market opportunities on the efficiency side. According to IHS Technology, the global smart-connected white-goods market is forecast to grow from less than 1 million units in 2014 to over 223 million units in 2020 - a five-year compound annual growth rate of 134%. The smart grid sensors market overall is expected to reach \$350 million by 2021.

CASE STUDIES

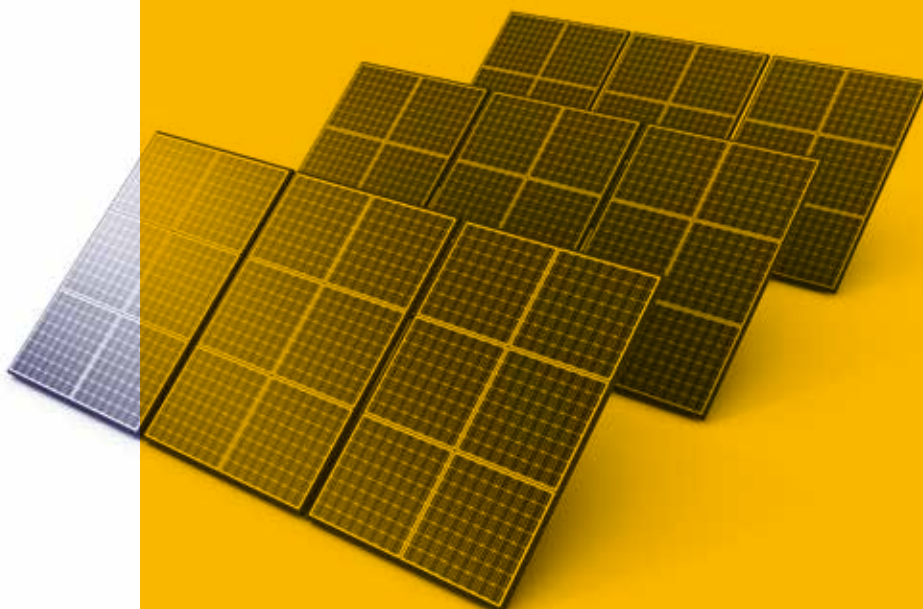
TRINE is a solar energy crowdfunding startup focused on the global south. Their model allows for financing of solar energy solutions to bring electricity to communities that can't afford the initial infrastructure and equipment investment, while delivering a financial return for investors. Allowing small-scale investors to profit from their contributions improves access to renewables and economic opportunities in developing countries, reducing CO₂ emissions from sources like kerosene.

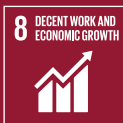
Similarly, pay-as-you go electricity systems like M-KOPA or Arnergy provide electricity to off-grid households and businesses by leasing solar equipment and combining micropayment and mobile technology to resolve the challenge of high upfront costs for solar power.

Digital technology is underpinning new renewable energy access models in both developing and developed markets. Upside Energy is a UK-based energy startup which aims to provide a more intelligent, cost-effective energy system based around millions of small, connected loads optimized via artificial intelligence.

SteamaCo uses smart metering and data analytics technology to enable mini-grid operators to reach people living beyond the grid.

The Philips Lighting Foundation works with NGOs and underserved communities around the world to address challenges such as the failure of adequate technology transfer and poor education that have slowed the adoption of solar power in developing countries.





8

PROMOTE SUSTAINED, INCLUSIVE AND SUSTAINABLE ECONOMIC GROWTH, FULL AND PRODUCTIVE EMPLOYMENT AND DECENT WORK FOR ALL

2030 VISION

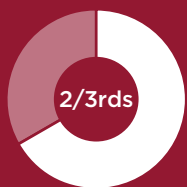
OVERVIEW

Global unemployment is forecast to rise to 5.8% in 2017, representing 201 million people out of work – the majority of whom are young people. High youth unemployment is a major problem in many developing economies, with the growth of the workforce outstripping job creation. Technological development and automation are often cited as negative forces on employment opportunities for youth.

600 million new jobs will need to be created by 2030 to keep pace with the growth of the working age population. The creation of quality jobs will remain a significant challenge for almost all countries.

Having a job does not guarantee an escape from poverty. The ILO finds that vulnerable employment represents 42% of total employment: one in two workers in emerging countries and four in five in developing economies.

According to the ILO, 21 million people are victims of forced labour globally – over 50% of whom are in Asia Pacific.



of children now entering primary school will work in jobs that don't exist today

5.8%

forecasted rise in global unemployment in 2017

2bn

people are globally unbanked

OPPORTUNITIES AND CHALLENGES

Key challenges to deliver Goal 8 include:

Skills for the jobs of the future: Young people are disproportionately engaged in low-quality jobs with fewer opportunities for permanent employment. The education system remains out of step with the needs of rapidly changing workplaces. As low-skilled jobs are lost to automation, it will be critical that young people are equipped with the necessary skills to secure quality work.

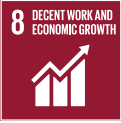
Financial access: Globally, two billion people are “unbanked” and lack access to formal financial services. When low-income workers and poor families gain access to basic financial services (e.g. savings, credit), they take the first step towards greater security. Lack of credit history can be a barrier, especially for those who seek to start or expand a business.

“FINANCIAL ACCESS IS A KEY WAY IN WHICH TECHNOLOGY WILL TRANSFORM EVERYDAY LIVING.”

Darshan Mundada,
Sterlite Technologies

Forced labor and modern slavery: Mechanisms to identify child and forced labor throughout global supply chains need to be put in place. Sharing and tracking information will be critical to understand and address the scope, size and nature of modern slavery.

Insufficient labor demands: The job landscape of 2030 will likely look vastly different to today, as companies and industries face profound evolution or disruption through digital technology. Two-thirds of children now entering primary school will work in jobs that don't exist today. Programmers and data scientists will be in high demand, and working environments will evolve with the rise of the gig economy and flexible working patterns. While organizations such as WEF and Deloitte have highlighted the job creation potential in this future, technology could result in significant job losses. McKinsey estimates that 45% of activities individuals are paid to perform today can be automated by adapting existing technologies. Although technology could create job opportunities for highly skilled workers, those losing their jobs as a result of automation are unlikely to have the skills required for these jobs.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Digital learning and upskilling:

Technology is a key enabler of education, which in turn drives youth employment. **Mobile devices** can connect young people to education, job training and employment opportunities. MOOCs allow marginal groups to access low-cost education from wherever they are. **AI** can be used to upskill workers (for example, through coaching networks), and as companies like GE and other industrial manufacturers argue that skilled humans and robots are necessary for operations, **Augmented Reality** can be used to boost worker productivity and make workers safer and more valuable to employers. For example, Chorus.ai is used to train new sales representatives and coach existing team members by learning workers' best practices and sharing with a broader group worldwide.

“GOVERNMENTS AND CORPORATIONS SHOULD TRAIN THE WORKFORCE WITH THE SKILLS TO WORK ALONGSIDE NEW TECHNOLOGIES AND ENCOURAGE PEOPLE TO PURSUE LONG-TERM CAREERS THAT ARE BEST FILLED BY HUMANS, NOT MACHINES.”

Diya Soubra, Arm

Mobile money helps reach the unbanked in rural areas where citizens currently rely on companies to act as a go-between for payments. **Blockchain** and **bitcoin** can accelerate financial access in the world's most financially excluded regions by enabling direct transfers, reducing fees, speeding up transactions and increasing security. Diversifying and optimizing payments for all types of agriculture can enable farmers to more easily sell goods.

Data analytics can be key in the fight against slavery and trafficking. In the UK alone, the Home Office estimates the economic costs of modern slavery to be £890 million per year. Precise and secure data are essential to address the problem. Project Protect is a coalition of banks aiming to track human trafficking through financial flows, with a growing focus on cryptocurrencies.

THE INVESTMENT OPPORTUNITY

GeSI estimates that e-learning participants could raise their income potential by 11% through obtaining e-learning degrees. The WEF estimates massive losses in office and administrative jobs as well as manufacturing and production jobs with jobs growth focused on higher skilled job areas like management, computer sciences and mathematics etc. This creates significant educational demand and opportunity, though job losses overall are still a concern.

Mastercard Center for Inclusive Growth finds that financial inclusion drives GDP growth of between 0.2% and 1.2% through smarter capital allocation to small and medium size enterprises (SMEs) and more efficient financial contracts.

The unbanked dropped 20% between 2011 and 2014 due to innovations in technology, in particular **mobile money**. Digital payment technologies can reduce the cost of financial transactions by more than 90%. The 2.5 billion adults who are unserved by formal financial or microfinance institutions represent an opportunity for institutions that offer innovative, affordable and accessible financial services. Accenture estimates that banks “could generate up to \$380 billion in annual revenues by closing the small business credit gap and including un/underbanked adults into the formal financial system.”

Companies adopting broadband-based processes (e.g. information storage, customer interfaces, logistics and supply chain systems) improve their employees’ labor productivity on average by 5% in the manufacturing sector and by 10% in the services sector.

CASE STUDIES

Liberty Asia is a startup that aims to provide NGOs with data insights to fight human trafficking. It has partnered with **Salesforce** to build a cloud-based victim case management system and data collection app to facilitate the sharing of information with anti-trafficking stakeholders.

Companies are increasingly investing in programs to fill the skills gap in the context of the Fourth Industrial Revolution. For example, **Salesforce’s** Futureforce program includes investing in STEM education, vocational training and apprenticeships.

Walmart and Boeing are using AR and VR to train workers. Walmart has partnered with virtual reality startup STRIVR to allow employees to experience real-world scenarios through VR headsets. Boeing uses Augmented Reality glasses to improve productivity and safety of engineering technicians, cutting production time by 25% and lowering error rates to nearly zero.

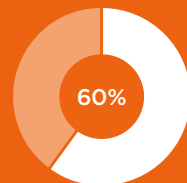




9

BUILD RESILIENT INFRASTRUCTURE, PROMOTE INCLUSIVE AND SUSTAINABLE INDUSTRIALIZATION AND FOSTER INNOVATION

2030 VISION



60%
of the population
globally have no
internet access

OVERVIEW

Goal 9 is based on the three interconnected pillars of infrastructure, industry and innovation and aims to ensure universal availability of basic services which support economic growth, for example technology, communication and transportation.

According to the Global Infrastructure Outlook, global investment in infrastructure will need to reach \$94 trillion by 2040 to keep pace with economic and demographic changes. China, India and Japan account for 39% of this total, and the sectors most in need of investment are electricity and roads.

The number of people connected to the internet has tripled in the last decade, yet four billion people (60% of humanity) have no access. Only 11% of households in developing countries had internet access at the end of 2016 compared to 84% in developed countries. Mobile coverage is more universal: in 2016, 95% of the world's population and 85% of people in less developed countries had mobile coverage, although the cost of data remains a barrier for many.

Investment in research and development and innovation is critical to driving sustained economic growth. While global research and development expenditure has grown, wide disparities exist. According to the UN, in 2013, developed countries dedicated 2.4% of their GDP to research and development, while the figure for developing countries was less than 0.3%.

OPPORTUNITIES AND CHALLENGES

Opportunities and challenges to accelerate development of sustainable infrastructure and innovation include:

SME Finance: SMEs are a crucial contributor to industry in emerging markets, contributing up to 60% of total employment. However, 200 million SMEs lack access to affordable financial services and credit. When firms gain access to financial services such as credit and insurance, they can accumulate assets, expand their firms, make more productive investments and create jobs.

Supporting rural markets and services: Investments in local infrastructure and technologies, such as clean and efficient water pumps, cook stoves, mini-grids and mills can support local and inclusive growth. Investment in reliable and resilient infrastructure enables access to services, markets and helps increase agricultural and business productivity.

Smart infrastructure: Developing countries face a large infrastructure deficit, which will be exacerbated by population growth and urbanization. Cities are expected to require new built floor space equivalent to 85% of today's building stock, and 2.5 times today's level of port infrastructure to meet rising container shipping demand. Most of this infrastructure growth will be required in developing markets. It is estimated that Africa has a \$55 to \$60 billion public deficit spend on infrastructure each year.

Upgrading transport and logistics networks: As the pace of economic growth and industrial development accelerates, transport and logistics systems will need to keep pace. Developing markets often have the poorest transport systems, and regions such as Africa are growing too quickly for road systems to keep pace.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Robotics, IoT, sensors and AI have the potential to revolutionize manufacturing by lowering costs and radically improving efficiency and waste. These technologies maximize productivity and efficiency by providing information needed for allocation of limited resources such as energy, materials and water. GeSI estimates ICT, through smart manufacturing, agriculture, buildings and transportation, could generate over 12 Gt CO₂e abatement by 2030. For example, connected vehicles or digital warehouses can optimize transport and logistics networks to promote cost-efficiency and reduce environmental impact.

“THE MAIN SUSTAINABILITY BENEFIT OF TECHNOLOGY WILL BE EFFICIENCY AND REDUCTION OF WASTE - DOING THE SAME THINGS WE DO TODAY, BUT MORE EFFICIENTLY.”

Philip Sparks, Arm

3D printing can improve materials efficiency by streamlining the prototyping process and improving the economics of short-run manufacturing, avoiding the waste associated with mass production. HP recently announced plans to sell 3D printers that produce metal objects, an expansion of its existing printers that deliver plastic products.

Drones and other aerial robotics could take pressure off existing road systems – adding transport capacity, enabling more efficient transportation of medicines, spare parts and other products. As the cost of robotics declines, these technologies will become more accessible.

Cloud computing allows SMEs to operate more efficiently without the infrastructure that might not be available or the capital investment of larger rivals. Peer to peer platforms, tech-powered angel investing ecosystems and mobile money can help SMEs better access capital.

\$450bn

estimated investment needed to connect the next 1.5 billion people to the internet

THE INVESTMENT OPPORTUNITY

According to the World Bank, a 10% increase in infrastructure investment contributes 1% GDP growth.

Extending internet access in the developing world could create roughly 140 million net jobs according to Deloitte, while Accenture cites that a 10% increase in a country's digital density could help some developed economies gain an extra 0.25% of GDP growth by 2020. The ITU/Broadband Commission estimates that connecting the next 1.5 billion people to the internet requires around \$450 billion of investment.

PwC puts the market value of drone powered solutions in infrastructure at over \$45 billion and the market value of drone technology in transport at \$13 billion.

GeSI estimates that automated and smart logistics and manufacturing processes will lead to nearly \$12 billion in cost savings and \$982 billion in economic benefits to industries by 2030. GeSI also found that ICT could help deliver close to \$4.9 trillion in cost savings (\$1.2 trillion in electricity, \$1.1 trillion in fuel and \$2.6 trillion from other items - e.g. water, food waste, paper.

CASE STUDIES

Yandex Data Factory provides AI and machine learning solutions that improve operational efficiency of industrial companies. The company's machine learning models can make intelligent recommendations to improve efficiency and reduce costs, spot anomalies and maintenance needs, as well as predict the expected quality of products.

Hyperloop Transportation Technologies has announced a collaboration with the South Korean government and local universities to build the world's first scale Hyperloop system that will transport passengers through near vacuum tubes at close to the speed of sound.

Companies extending internet infrastructure to unserved communities include **Fairwave**, hardware from which, when connected to power and an antenna, establishes a local cellular network at a much lower cost. **Project Loon (Google X)** is a network of balloons traveling on the edge of space, designed to extend internet connectivity to rural and remote areas.

Ford's Immersive Virtual Environment (FiVE) lab uses VR technology to enable designers, engineers and others involved in product development to experience a vehicle before it's built. Through a variety of environments, including a virtual room where they can walk around a virtual car, users can experience the vehicles from customers' perspectives.

Zipline is a drone for medical delivery services in Rwanda that delivers supplies directly to clinics eight times faster than transportation by car. More than two billion people lack access to essential medical products due to gaps in infrastructure.





10

REDUCE INEQUALITY WITHIN AND AMONG COUNTRIES

2030 VISION



OVERVIEW

Goal 10 aims to promote inclusive economic growth and equal opportunity. Inequality and discrimination occur across various dimensions: economic status, age, gender, ability, sexual orientation, race, ethnicity and religion.

Growing inequality is a challenge for both developed and developing countries. The average income of the richest 10% of the population is about nine times that of the poorest 10% across the OECD, up from seven times 25 years ago. In the United States, the top 1% of income earners have more than doubled their share of the nation's income over the last 30 years. In developing countries, more than 75% of the population live in societies where income is more unequally distributed than it was in the 1990s.

Inequality between countries is also growing: from 1960 to 2016, the absolute gap between the average incomes of people in the richest and poorest countries grew by 135%.

65m

people forced from home as a result of persecution, conflict, violence or human rights violations in 2016

OPPORTUNITIES AND CHALLENGES

Tackling inequality relies on a complex web of social, financial and legislative measures to promote equal opportunities and inclusion.

Inclusive access to technology:

Reducing inequality relies on equal access to services and resources, including technology. Over half the world's population (most of whom live in the developing world) are not connected to the internet, primarily due to the cost. In developed countries, consistent access to fast, uncapped broadband is relatively inexpensive, but this is not the case in developing nations. For example, for Nigerians, just 500MB of mobile data can cost more than expenditures for education. In Africa, the Middle East and Latin America, high levels of income inequality means that the cost of a data subscription remains unaffordable for the bottom 20%.

“LOWERING THE COST OF ACCESS TO TECHNOLOGY HAS BEEN A FORCE FOR CHANGE - FIVE YEARS AGO IN MYANMAR, A SIM CARD COST \$200. NOW WITH MARKET DEREGULATION, MOBILE SIGNAL HAS BEEN BROUGHT TO THE MOST REMOTE AREAS. HOWEVER, ACCESS AND AFFORDABILITY ALONE WILL NOT NECESSARILY GET TO THE HEART OF ISSUES SUCH AS CONFIDENCE, LITERACY AND GENDER NORMS WHICH ALLOW AN UNLEVEL PLAYING FIELD IN THE MOBILE MARKET.”

Amy O'Donnell, Oxfam

Political and social inclusion:

A key facet of inequality is unequal representation in social and political affairs. In economically unequal societies, poorer populations are less likely to be politically represented. Participation in local and national governance enables more representative perspectives in decision making, promotes progressive policies, helps end discriminatory practices and ensures local populations have a voice regarding issues affecting their communities.

Safe migration:

Managing displacement and migration is crucial for tackling inequality, as the migrating and displaced are at greater risk of being marginalized. Safe, regular and responsible migration and mobility of people has never been more important; 2016 saw the highest levels of displacement on record, with 65.6 million people forced from home as a result of persecution, conflict, violence or human rights violations (versus 33.9 million in 1997). Among them are nearly 22.5 million refugees, over half of whom are under the age of 18.

Reducing the cost of remittances:

The cost of remittances remains a challenge to reducing inequalities in the developing world. Reducing commission charges to 5% (versus the current 7.6% average) could result in an additional \$4 billion reaching Africa's migrants, boosting capital flows and stimulating economies.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Technology companies can **tailor products and services** to serve the needs of low-income and vulnerable groups, for example making them more affordable and accessible for remote populations. This might include the creation of mobile tariffs and service bundles focused on increasing affordability. Xinwei Telecom has launched affordable products and services for rural populations in Malawi, including mobile phones in the sub-\$20 range.

“THE PRICE OF A COMPUTER HAS DROPPED TO A POINT WHERE IT SHOULDN’T BE A PROBLEM FOR ANYONE IN THE WORLD TO ACCESS IT.”

Philip Colligan, Raspberry Pi

Social media and crowdsourcing **platforms** can encourage participation and inclusion. Social networks can support activism and campaigns aimed at solving critical social challenges and showcase issues of importance for their communities. Apps exist for communities to report social problems such as damaged roads and graffiti; the next generation of platforms could promote participative design of solutions to social needs such as schools and infrastructure.

Apps and web-based platforms can facilitate safe migration and support vulnerable populations. For example, AI programs can provide psychological support to those who have experienced trauma, and chatbots can aid organizations connecting and responding to displaced people. The current refugee crisis is rooted in the digital age and mobile is indispensable for the majority of refugees – in Za’atari, Jordan (the second largest refugee camp in the world) 86% of young people own a mobile phone, with more than 50% of those using it to access the internet daily. Apps such as InfoAid can help refugees prepare before departing, providing information about national borders and transportation and advice on security. Web platforms can help refugees embed in a new society and navigate local services such as housing and employment. In Germany, Flüchtlinge Willkommen (Refugees Welcome) has been referred to as “Airbnb for refugees”.

“TECHNOLOGY, WITH ACCESS AND CONNECTIVITY, HAS THE POTENTIAL TO OPEN UP NEW EMPLOYMENT OPPORTUNITIES FOR MARGINALIZED YOUNG PEOPLE, INCLUDING REFUGEES.”

Katherine Crisp, UNICEF

Analysis of **big data** can facilitate understanding of migration trends and help optimize management approaches. The Refugee Project has collated 40 years of refugee data into a single hub. This data can be provided to displaced people to improve safety, such as the database Crisis Info Hub.

Mobile money services can offer alternative channels for remittances, removing the physical barriers faced by remote communities. Mobile can reduce the cost of remittances by removing the need for physical transaction locations, and brings greater speed and security to transfers.

THE INVESTMENT OPPORTUNITY

Technological inclusion offers a significant economic opportunity and internet connectivity is one of the single most important market opportunities anticipated today. Estimates suggest that achieving universal internet penetration could expand world output by \$6.7 trillion.

The World Bank has identified the labor and workforce opportunities from the growing refugee crisis plaguing Europe in particular, where educated and often skilled families can support countries with aging populations and skills deficits.

CASE STUDIES

Cisco, Facebook, Google, Intel and Microsoft are among the global sponsors of the Alliance for Affordable Internet, an initiative of the World Wide Web Foundation established by Sir Tim Berners-Lee. The Alliance aims to drive down the cost of broadband access via policy and regulatory change, underpinned by research and knowledge sharing.

Governments and civil society organizations are beginning to leverage digital tools to increase civic engagement. I Run Říčany is a platform to enable citizens of Říčany, Czech Republic to participate in city decisions like determining city ordinances and investment projects. D-CENT, an EU-funded project led by Nesta, has developed a set of open source, distributed and privacy-orientated tools that enable citizens to participate in policymaking.

Bitnation has launched two services aiming to offer financial access to refugees and displaced people. Blockchain Emergency ID is a rudimentary emergency identification card, based on blockchain technology, that is available to anyone, including individuals who cannot obtain other forms of identification. Bitnation Bitcoin Visa Cards are debit cards available to anyone and are loaded using bitcoins, and then used as normal VISA cards at ATM's, shops, etc.

Souktel launched a mobile supply management system in the Syrian refugee camp in Jordan aiming to facilitate delivery of food, water and medical supplies. The system includes a mobile inventory management tool that records incoming and outgoing shipments, and smartphone applications to track packages via satellite and report back on their status and GPS coordinates in real-time. The end result is a faster, more efficient aid supply chain.

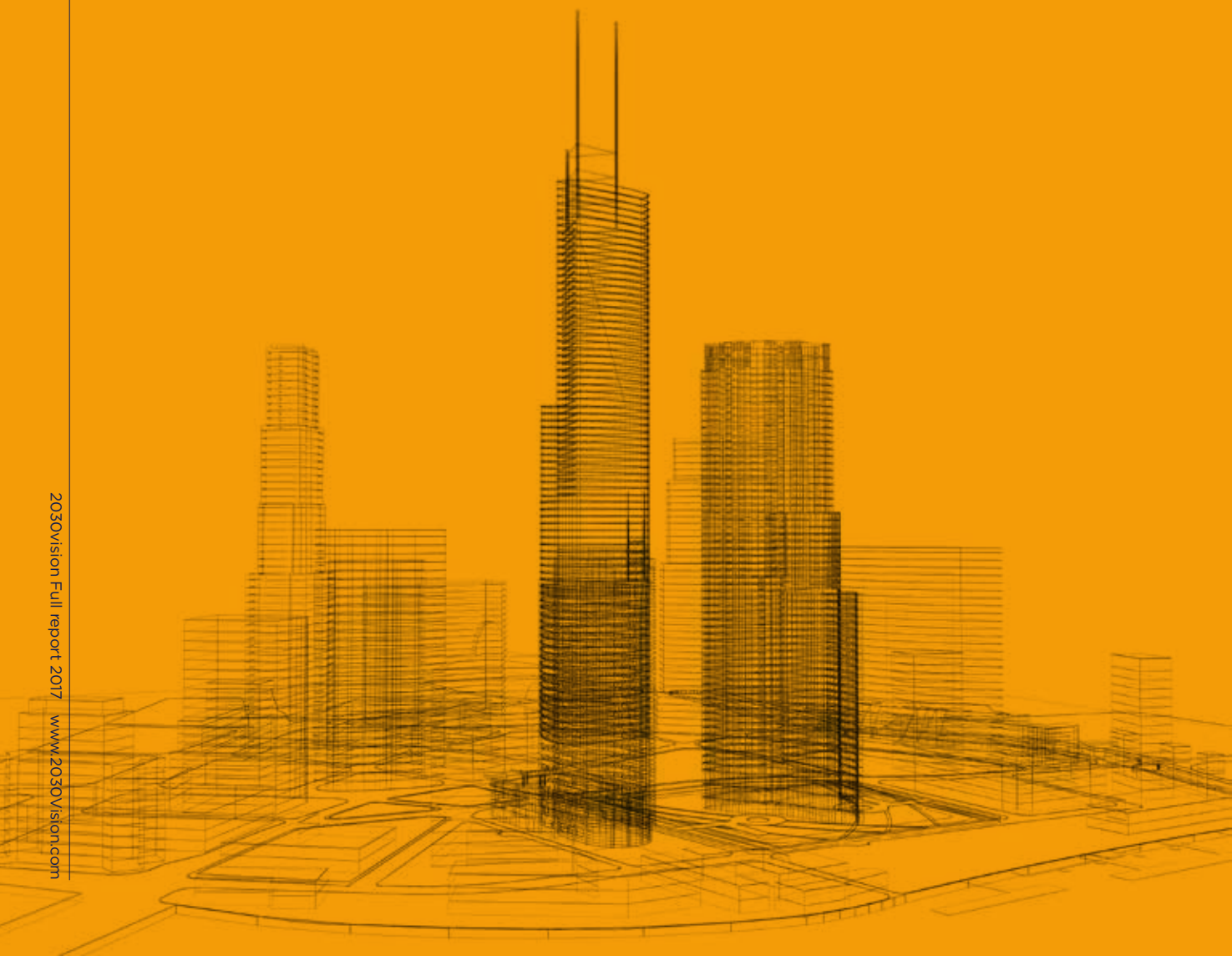




11

MAKE CITIES AND
HUMAN SETTLEMENTS
INCLUSIVE, SAFE,
RESILIENT AND
SUSTAINABLE

2030 VISION



OVERVIEW

The world has experienced unprecedented urban growth, making cities critical to achieving sustainable development. In 2015, 54% of the world's population (nearly four billion people) lived in cities, and this will reach 70% by 2050. Rapid urbanization has brought many challenges including air pollution, an increase in slums and pressure on basic services and infrastructure.

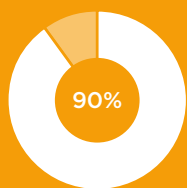
Most of the additional 2.5 billion people living in urban areas by 2050 will be in cities of the global south, in particular in Asia and Africa. Nearly 40% of all future urban growth is expected to take place in China, India and Nigeria.

70%

of the world's population will live in cities by 2050

60%

of energy consumption is from cities



of city dwellers breathed air that did not comply with WHO standards

OPPORTUNITIES AND CHALLENGES

Making cities more inclusive and sustainable faces several opportunities and challenges.

Access to affordable housing:

The number of urban residents living in slum conditions continues to grow, and collecting better data on the areas of greatest need will help direct financing opportunities and public services to lift populations out of slums and unsuitable housing.

Urban planning and management:

Unplanned urban sprawl undermines other factors of sustainable development. For example, with every 10% increase in sprawl, there is nearly a 10% increase in per capita hazardous pollution. In 2014, 90% of city dwellers breathed air that did not comply with WHO standards. The majority of urban centers lack current information on the indicators for Goal 11, and better data is necessary to inform planning decisions.

Sustainable and resilient infrastructure and transportation:

Today, cities occupy roughly 3% of total land, yet they are responsible for 70% of GDP, 60% of energy consumption, 70% of GHG emissions and 70% of waste (UN Habitat III). Access to transportation is a key indicator of Goal 11 while efficient systems, especially waste, sanitation, building and transportation services are fundamental to improving the quality of life in cities and minimizing environmental impact.

Accessible and inclusive finance, innovative designs and delivery models: Technology can democratize access to finance and services across cities, lessen implicit biases in loan distribution and enable innovative funding models.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Big data enabling policy decision making in cities: One of the greatest hindrances to attaining Goal 11 is the lack of data. Given this, urban sustainable development solutions center heavily around the collection, dissemination and leverage of data to support efficiency, increased and equitable access to services and better urban planning that incorporates sustainable development. The New York Police Department maps and models criminal activity to inform its allocation of resources, and India plans to create 100 smart cities by 2022.

Data-driven efficient city systems: Real-time analytics and data on traffic conditions can reduce congestion, and there are apps that enable individuals to make choices about timing and route of travel. Vehicle-to-vehicle or infrastructure communication can also optimize traffic flows. Data on pedestrian and cyclist fatalities can pinpoint the most dangerous intersections and enable alterations to reduce

accidents. Robotics, scanning technology and traceability tools such as RFID promise to improve the effectiveness of recycling systems.

Decentralized social services: Technology can support decentralized social services by providing mobile access to finance and tools. MasterCard and Mercy Corps partnered to distribute prepaid debit cards to eligible refugees so they can make purchases more securely than with cash. Google, Mercy Corps and the International Rescue Committee created Refugee.info, a site that new arrivals to Europe can access for critical information on everything from medical services to housing and transportation.

Smart mobility: According to some researchers, car sharing services from Uber, Lyft, Didi Chuxing and car2go have reduced car ownership and air emissions in cities. By reducing the human factor behind the wheel, autonomous vehicles could cut accidents by as much as 90%,

saving thousands of lives and up to \$190 billion in the US alone by 2050. Autonomous driving could also increase the carrying capacity of existing roads, as vehicles would be able to travel closer together and at higher speeds.

Clean technology: Smart building management, smart metering, alarm automation, IoT sensors and detection and diagnosis technologies can help reduce resource consumption, improve energy efficiency and reduce air pollution. India-based Zenatix provides IoT based products for energy monitoring and control.

\$4.5tn

Investment needed for infrastructure such as roads, waste management and water treatment

90%

possible reduction in accidents by introducing autonomous vehicles

THE INVESTMENT OPPORTUNITY

Globally, over \$4.5 trillion of investment is needed for infrastructure such as roads, waste management and water treatment. The Cities Climate Finance Leadership Alliance (CCFLA) estimates that 9% to 27% of that figure is needed to make cities more climate resilient, particularly in the developing world.

Some estimate that cities around the world will invest roughly \$41 trillion in total over the next 20 years to upgrade their infrastructure and benefit from the network of connected devices. The value of the smart cities market has been estimated at \$1.5 trillion by 2025 for the provision of sensors, connected transit and utility systems and data communications services and Cisco estimates that digital cities can generate \$2.3 trillion globally through 2024 through projects and services in areas including cybersecurity, infrastructure and transportation.



CASE STUDIES

IBM has initiated a variety of smart city projects through its Smart Cities Challenge including a smart microgrid in Pingtung County, Taiwan and an open data communication system between the public and policymakers to guide tax allocations in Porto Alegre, Brazil. Cisco has connected city projects around the world focused on security, transport and wifi installations for marginalized communities (e.g. Jaipur, India).

Virtual Singapore is a dynamic 3D model that enables city planners to run virtual tests, verifying, for instance, how crowds might evacuate from a neighborhood facing an emergency. The program has an open data platform served by sensors across the island.

Barcelona has equipped its street lights with sensors to measure traffic and crowds in addition to pollution and weather. The sensors track irrigation and rainfall to improve sprinkler efficiency within the city.

Sidewalk Labs harnesses digital technologies to solve urban problems. For example, it is currently looking at how traffic flows through a city and how hotspots of congestion might be solved, in turn reducing air pollution and congestion.

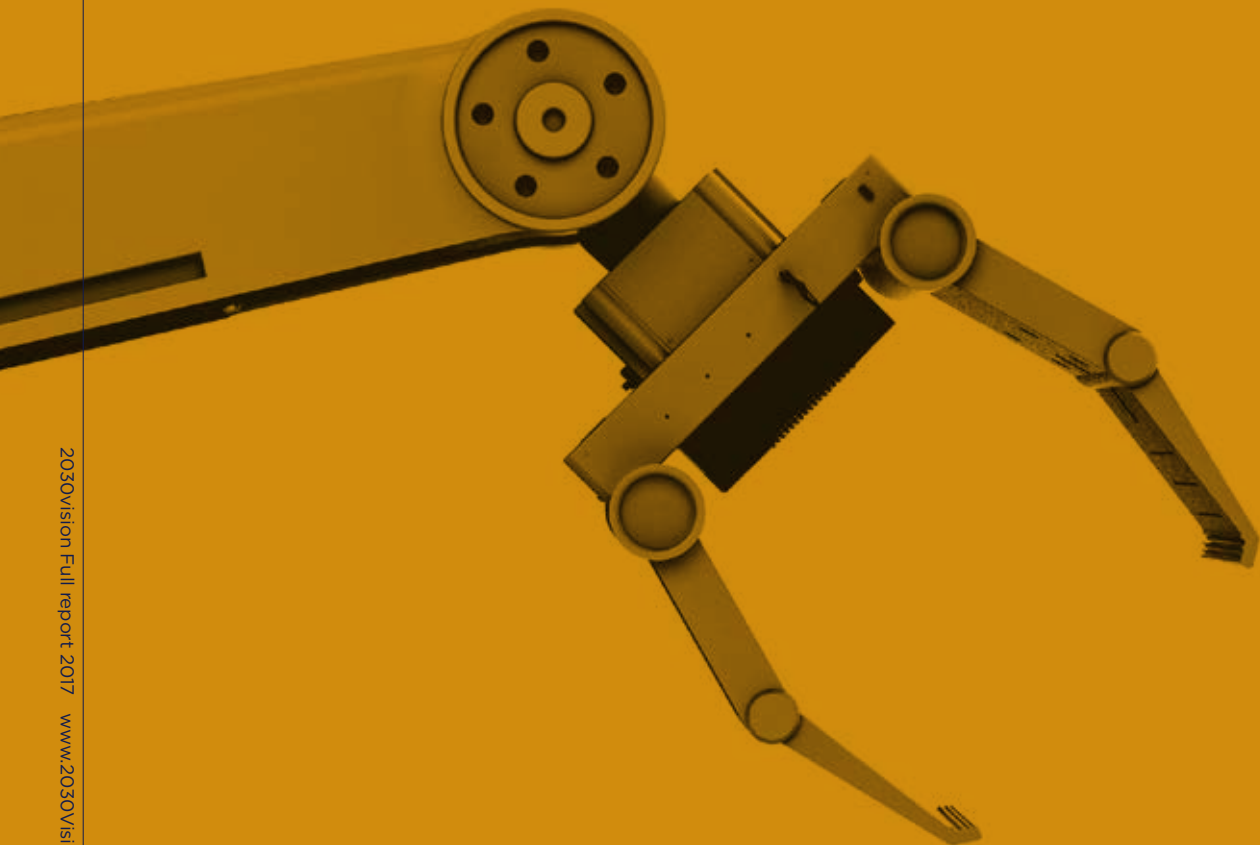




12

ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS

2030 VISION



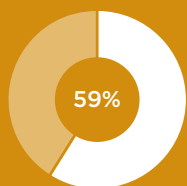
OVERVIEW

Goal 12 aims to fundamentally change the way that we produce and consume goods and services. The Goal acknowledges that production and consumption of goods and services drives economic growth and improved quality of life, but that we must do so with fewer natural resources and resulting environmental impact across the life cycle.

Some progress is evident – the overall material footprint declined in developed regions between 2000 and 2010 as a result of greater efficiency in industrial processes. The material footprint of developing regions grew over this period but it is still substantially lower than that of developed regions. Roughly one-third (1.3 billion tons) of all food produced for human consumption is wasted – this represents \$1 trillion at retail prices and 3.3 gigatons of CO₂ emissions annually. The world generates two million metric tonnes of electronic waste per year. According to the EPA, as of 2014 only 41% of electronics are recycled in the US, even with legislation in place.

1.3bn

tons of food wasted



of electronics
are not recycled

OPPORTUNITIES AND CHALLENGES

Doing more with less, and improving the quality of lives around the world, presents a number of opportunities and challenges:

Circular economy: According to the Ellen MacArthur Foundation, the circular economy aims to move beyond the current “take, make, waste” economic paradigm to one in that is restorative and regenerative by design – where waste is designed out and products and materials are kept at their highest utility and value at all times. Making this shift requires a fundamental rethink of our economic system, along with new models of design, manufacturing, logistics and consumer engagement.

New business models: A shift from selling products to services, including sharing and leasing models, will enable businesses to grow revenue with lower material intensity and maintain control over the materials in use (which facilitates reuse, repair and recyclability).

Smarter shipping and distribution: Smarter distribution systems can streamline shipping channels and bring more efficiency and cost savings. These systems are expected to improve safety and environmental impact of shipping and port activities.

Recycling and recovery: One of the more pressing challenges in addressing waste and shifting to a more circular economy is the increasing complexity of products. For example, electronics are getting smaller and more sophisticated, making recovery and reuse of materials more challenging. Product designers need to consider how to create products with end of life in mind (e.g. fewer components), and we need to develop the infrastructure, policies and systems to support repair, reuse and recycling.

**“TECHNOLOGY HAS
A LOT OF POTENTIAL,
FROM HELPING TO INFORM
PRODUCT DESIGN TO
ENABLING OPEN DATA
AND SHARING FOR
GREATER INNOVATION.”**

John Gardner, Novelis



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Business model and product innovation: Technology is at the forefront of enabling consumer behavior change via new business model and product innovation. Technology-enabled business models like AirBnB and Uber have expanded the sharing economy, which promises to reduce material consumption and waste. Smart refrigerators, equipped with cameras accessible via smartphone apps, allow consumers/users to check their contents while shopping – this promises to reduce food waste. Smart buildings and offices help users understand their energy consumption relative to their peers. As the cost of such technology declines, it will be more available to lower income populations.

Online secondary marketplaces: The apparel industry took early advantage of digitally enabled secondary marketplaces with eBay a driving force. Real-time applications can notify users of excess restaurant food or connect consumers directly to surplus food. Leveraging analytics to increase the efficiency of food collection – for human consumption or for composting – is an area where creative thinking and capital is needed.

Precision recycling: Technological development, like the application of AI enabled robots, is needed to ensure that all products, including those with nanoscale materials, can be recovered and reused or recycled. Automated sorting and robotic capabilities such as metal detection, weight measurement, 3D scanning and spectrometer analysis can enable more sophisticated and precise waste sorting.

Materials tracking systems: Blockchain, data analytics and tracking systems like RFID chips will be integral to efficient systems and reducing consumption. Improved materials tracking can optimize planning by processing user data constraints spatially and temporally and allow efficiency at the planning stages of construction and product development. Sensors and smart software can track materials through the disposal stages and limit illegal disposal of hazardous materials and waste. Big data analytics will be essential to ensuring materials efficiencies and designing for recyclability by aggregating information on how materials are processed throughout their lifecycle.

3D printing: This can improve materials efficiency by simplifying the prototype process and avoiding waste that comes with mass production. It also promises to extend the lifespan of products by making it possible to produce replacement parts.

\$321bn

estimated growth in
the sharing economy
between 2014 and 2025

\$33bn

estimated worth of 3D
printing market by 2023

THE INVESTMENT OPPORTUNITY

Sustainable consumption provides endless opportunity for new market and business development. The digitally-enabled sharing economy is estimated to grow from \$14 billion in 2014 to \$335 billion by 2025. The Ellen MacArthur Foundation's latest report, *Achieving Growth Within*, projects an even brighter future for the market of circular economy more broadly, where scaling the circular economy in Europe alone offers investment opportunities totaling €320 billion in the food, mobility and built environment sectors.

The 3D printing market is estimated to be valued at nearly \$33 billion by 2023. Plastic and metal have held the largest share of the 3D printing materials market thus far. However, given 3D printing's entry into other verticals such as electronics, biomedical, pharmaceuticals and construction, it will drive alternative materials' (such as laywood, wax, paper) demands over time.

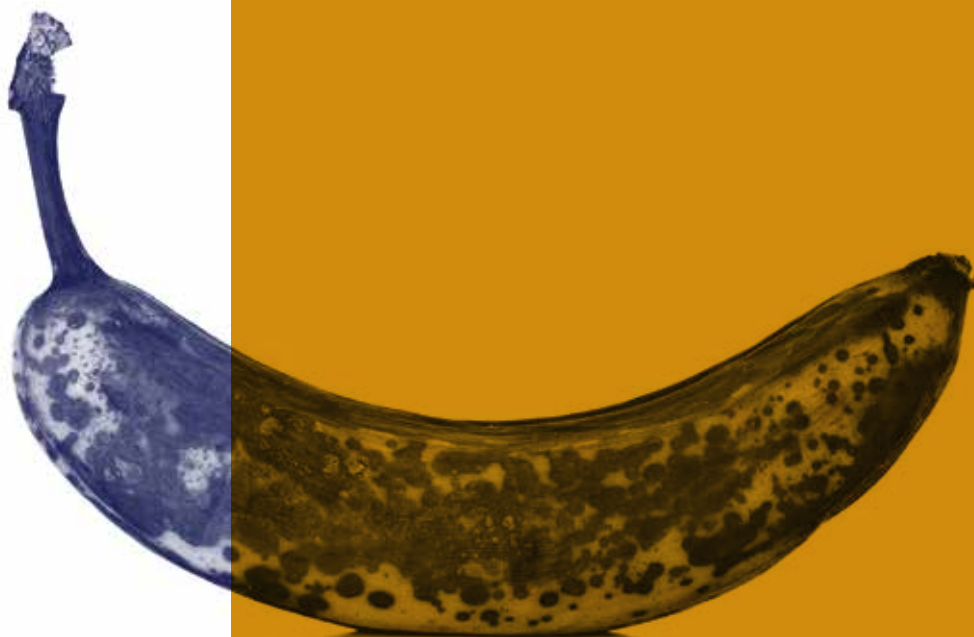
CASE STUDIES

Veolia, ZenRobotics and Waste Robotics are just a few examples of companies expanding the role of automated robots and machines to sort and recycle waste. The machines can work significantly longer hours than human workers and fill often undesirable jobs while improving efficiency and accuracy of sorting.

LG has developed **SmartThinQ** appliances to reduce energy costs and make consumer behavior more efficient. **Sainsburys**, in partnership with **Bosch** and **Samsung** have invested in smart refrigerators that enable users to check contents and even sell-by dates to make smarter purchasing decisions and reduce waste. **Fuji Xerox Co. Ltd** strives for a closed loop system for its products, in which they are taken back after use and parts either reused or recycled.

Olio helps consumers connect with people in the same area who have leftover food to give away, allowing surplus food to be shared and not wasted. **Last Minute Sotto Casa** is a digital intermediary between shops with surplus food and customers who might want to buy it.

IBM and **Alibaba** are both using blockchain technology to improve transparency in supply chains and improve supplier tracking, which can reduce contamination in the global food supply chain and help reduce waste.





13

TAKE URGENT
ACTION TO COMBAT
CLIMATE CHANGE
AND ITS IMPACTS

2030 VISION

OVERVIEW

Goal 13 aims to limit global temperature increase to well below 2°C, and ideally below 1.5°C. The targets for Goal 13 include the integration of climate change measures into national policies, strengthening adaptive capacity to climate-related hazards and disasters and mobilizing financial support for developing nations for mitigation and adaptation.

Climate change affects every country in the world, and people are already experiencing changing weather patterns, rising sea levels and more extreme weather events. Climate change disproportionately impacts the poorest and most vulnerable populations, and could increase extreme poverty rates by 2030. The impacts of climate change pose significant risks for agriculture, water supplies, health, energy, security and infrastructure. According to the UN, more than 1.6 million people died due to natural disasters between 2000 and 2015.

The world experienced continued warming in 2016, with temperatures 1.1°C above the pre-industrial average. Without action, temperatures are projected to increase more than 3°C this century. To remain below 2°C, per capita emissions in the developed world will need to be halved by 2030 (8 to 4.2 gigatons of CO₂e).

+3°C

projected temperature
increase this century
without action

OPPORTUNITIES AND CHALLENGES

Political engagement, collaboration and mobilization of financial resources across national boundaries will be critical to delivering on this global challenge.

Access to finance & technical support: Developing countries need capital, skilled workers and blueprints for clean infrastructure in order to implement their national adaptation plans. Improved data tracking pilot project results and return on investment can guide and support new investment where it is needed most.

Aligning incentives to decarbonize: Companies and governments alike will need to rapidly decarbonize processes and supply chains through energy efficiency, renewable energy and low- and zero-carbon products and services. New business models can help decentralize access to clean energy, while information sharing, greater efficiency, collaboration and affordability should improve adoption and spread of low- to zero-carbon solutions.

Disaster risk planning and management: The devastation wreaked by disasters is widely due to an inability to anticipate and respond to impending risks.

Tracking and monitoring illegal activities: Illegal activities like logging contribute to deforestation and climate change.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Efficient technologies and systems:

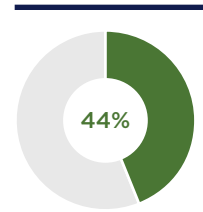
A proliferation of connected systems and sensors can enable significantly more efficient and decentralized use of resources, including energy. Major technology companies from Google to Cisco and Hitachi are embedding sensors and using cloud-based software to track and optimize systems from buildings to transport. Sense uses connected sensors to gauge the electricity usage of appliances, devices and rooms. Utilities use data from sophisticated connected devices, such as smart meters and smart thermostats, to operate the grid more efficiently and help customers reduce consumption. Technology will also play a key role in reducing the carbon footprint of transportation (currently 23% of global energy-related CO₂ emissions and growing). By 2050, the Energy Information Administration estimates that connected, autonomous vehicles could reduce fuel consumption by as much as 44% for passenger vehicles and 18% for trucks.

Renewable energy: Digital technology supports the further advancement of renewable energy. Demand-side management systems, software and sensors support distributed solar and wind energy systems. Automation and digitization have also made management systems more efficient, contributing to cost reductions in renewable energy.

Modeling and prediction: Over the last decade, datasets and software applications have improved, which strengthens our ability to predict extreme weather events and model impacts of natural disasters on at-risk communities. By better equipping communities and disaster-relief services with predictive technologies and communication tools, we can limit casualties and improve resilience. The Community Earth Systems Model (CESM) is a climate change model that shows atmospheric changes and impacts and serves as the foundation for the recommendations from the Intergovernmental Panel on Climate Change (IPCC) and economic impact modeling that informs policy. The U.S. Geological Survey created a \$13 million 3D Elevation Program to develop advanced mapping to better update flood maps and find prime locations for solar and wind farms.

Access to information:

Open source climate solutions, adaptation techniques and technologies and improved communication channels have the ability to improve consumer behavior and decision making on everything from food waste and dietary choices to real estate investment in less climate-vulnerable locations. Oroeco allows users to track and compare their carbon footprints using a shadow carbon price for purchases, food and activities.



estimated reduction in fuel consumption using autonomous vehicles by 2050

24%

China's anticipated smart grid market share by 2020

\$750bn

IoT market

THE INVESTMENT OPPORTUNITY

According to the World Bank, developing countries will need roughly \$100 billion of new investment per year over the next 40 years to build resilience to the effects of climate change. The IFC projects \$23 trillion in opportunities for climate-smart investments in certain emerging markets between now and 2030.

According to the Electric Power Research Institute (EPRI), a smart meter that is reporting data at 15-minute intervals will generate 400MB of data per year alone. Given all of the IoT applications in renewable energy distribution, efficiency and analytics, the energy industry should play heavily in the estimated at \$750 billion IoT market.

The smart grid market is anticipated to cumulatively surpass \$400 billion by 2020. China will be the largest smart grid market in the world, accounting for over 24% of the total. The autonomous driving market is expected to reach \$83 billion by 2025, with the highest investment opportunities in artificial intelligence and vision sensors.

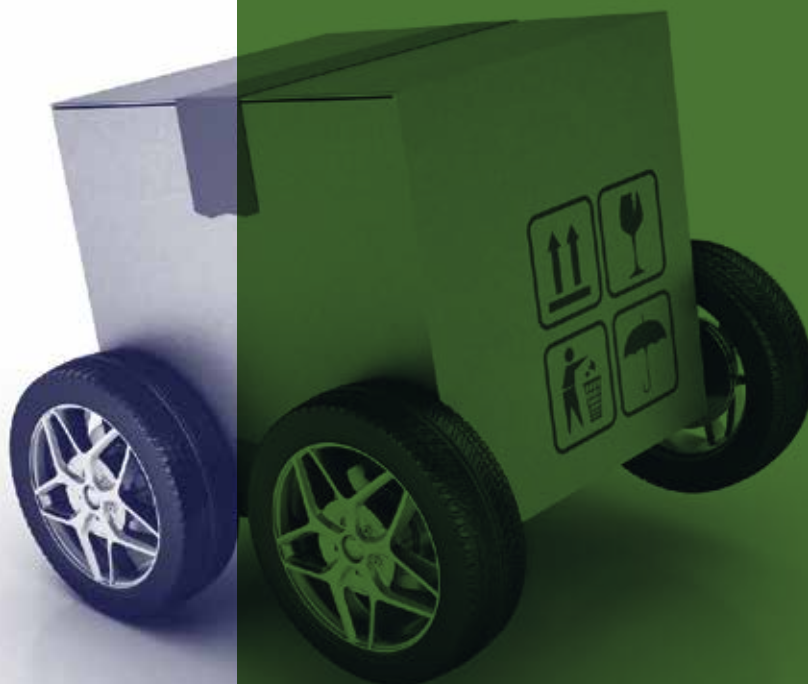
CASE STUDIES

GE's Ecomagination line of products brings energy efficiency tracking and management systems directly into the home while its smart grid offerings improve system-wide energy efficiency and enable distributed, cost-effective renewable energy systems.

Companies large and small (e.g. Honeywell, Nest) offer products and services to help customers reduce energy costs like smart-thermostats and appliances or PlotWatt and Bidgely provide real-time energy tracking services for businesses and utilities to track and improve energy efficiency.

NASA's Earth Now displays real-time global satellite data of Earth's CO₂ conditions, gravity anomalies, ozone levels over Antarctica, etc. NASA has also developed a game, Offset, to educate players about the global carbon cycle, carbon sources and solutions including alternative energy and reforestation.

Michelin, UPS, Route Monkey, Total and Nestlé are collaborating with WBCSD on Road Freight Lab, which explores the untapped and unmapped potential for emissions reduction through optimization and collaboration between road freight transport companies. Meeting the climate challenge requires a 48% decrease in absolute emissions from freight by 2050 (2010 baseline), while meeting a projected four-fold increase in demand.





14 LIFE BELOW WATER

2030 VISION



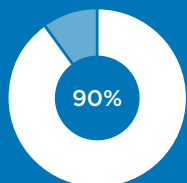
OVERVIEW

Goal 14 aims to reduce ocean pollution and preserve fish stocks for future generations. Oceans are under threat from pollution, acidification and eutrophication, primarily caused by land-based human activities. Plastic waste consistently makes up a significant proportion of all marine debris. The ocean absorbs roughly 26% of the CO₂ added to the atmosphere each year, and since the industrial revolution, ocean acidity has increased 100 times faster than it has during the last 20 million years.

Almost 90% of global marine fish stocks are overfished or fully exploited. Seafood makes up 16% of the animal protein humans consume, and this is expected to double in the next two decades. According to the World Bank, about 11% of the global population relies on fisheries and aquaculture as their main source of income. Globally, 1 in every 5 fish is illegally caught, and the total value of illegal and unreported fishing losses is between \$10 billion and \$23.5 billion annually.

1 in 5

fish are illegally caught



of global fish stocks are overfished

OPPORTUNITIES AND CHALLENGES

A lack of data has long hindered improvements in ocean and fisheries management. Transnational cooperation and a more sophisticated approach to supporting ecosystems and wildlife are necessary to protect our oceans.

Illegal, unreported and unregulated fishing (IUU): Seafood traceability is critical to addressing the issues of overfishing and IUU and needs to be expanded so that consumers can choose seafood that is legal and sustainable. At every point in the complex seafood supply chain, a new actor handles the fish and 'creates' data. However, data on fishing and fish stocks is poor, and 80% of captures are in countries with inadequate or no fisheries data.

Smarter fisheries management: According to WEF, humans ate more farmed fish than wild in 2014, and new technology will be important to prevent pollution and disease caused by coastal fish farms. We need to improve accuracy and availability of information about fish stocks (e.g. the number of fish, the species, data on reproduction and harvesting) in order to manage stocks sustainably. Only 350 of the world's 10,000 fisheries have full stock assessments. Policymakers and fishing fleets need this information to reduce bycatch of other species and reduce discards and waste.

Ocean pollution: Satellites, sensors and other technology are being used to advance our understanding of the breadth of debris polluting the oceans. Yet undeveloped or nascent technologies (e.g. The Ocean Clean Up) will likely play key roles in ridding the world's oceans of plastic.

Marine planning: A high proportion of the oceans lie outside any national jurisdiction, making it hard to manage fish stocks, pollution and the impacts of climate change. A coordinated national and international effort is needed to collect, analyze and interpret marine data for better policymaking. Emerging technologies like open source mapping can help bridge information gaps and provide new tools that could make management and enforcement of protected areas easier.

Ocean acidification: The decrease in the pH of the Earth's oceans, caused by the uptake of CO₂, poses one of the greatest threats to overall ocean health, and the capability to monitor and address acidification needs to be further developed. As of yet, technological solutions in this space are limited, and channeling funding into this critical area is a challenge.

Deciphering data: Translating the vast amount of raw data collected through new digital tools into actionable science and compliance monitoring data poses significant challenges. Cultivating the data analytics skill-sets amongst marine biologists, conservationists and seafood professionals across the value chain will be essential to implementing technological solutions.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Monitoring and regulation of illegal fishing: Motion sensors, GPS and cameras can increase accountability in the fishing industry. Intelligent systems can automatically scan GPS data and security footage for anomalies and make it more efficient for regulators and boat owners to review footage.

“CONNECTED SENSORS COULD MAKE MONITORING SOMETHING AS VAST AS THE OCEAN MUCH MORE ACCESSIBLE.”

Philip Sparks, Arm

Traceability and identification of species: Tracking and identifying species to monitor fisheries, stocks and habitats is currently time and resource intensive. Digital tools like facial or species-recognition software can also be used to track and monitor whales and other endangered species more easily for conservation efforts. RFID and barcode scanners in supply chains, as well as fish-identification applications, can help thwart the sale of endangered or at-risk species.

Sustainable aquaculture:

As demand for fish protein grows, so will the reliance on aquaculture rather than wild fish stocks. Aquaculture presents an opportunity to better trace fish and seafood from farm to plate and with the help of intelligent tracking systems, sensors and barcodes. This can inform the market and support efficiencies such as limiting or increasing fish stocks based on demand trends while additionally reducing seafood fraud. Sensors can also improve water quality and streamline feeding protocols (e.g. automatic feeding units) to reduce resource use.

Environmental monitoring and smart conservation: Sensors from the seafloor to boats and even surfboards can be used to crowdsource data on temperature, salinity and pH in the way that traffic data is being sourced from drivers' smartphones. Some companies have developed algorithms to process this mass of data into usable information for ocean planning and balance the needs of fisherman, marine transport and ocean conservation. Similar tools can be used to monitor fish stocks, track conservation progress and make informed decisions like limiting the capture of unwanted sealife or bycatch.

€10bn

estimated cost of illegal fishing by 2020

THE INVESTMENT OPPORTUNITY

Multiple studies show the economic costs of illegal fishing. One, commissioned by the EU, estimates the cost of illegal fishing will exceed €10 billion by 2020, with over €8 billion in lost stock value and over 27,000 jobs lost in fishing and processing. Another, by the Marine Resources Assessment Group Asia Pacific, estimates the total value of illegally harvested or transshipped tuna in the region at over \$600 million annually.

CASE STUDIES

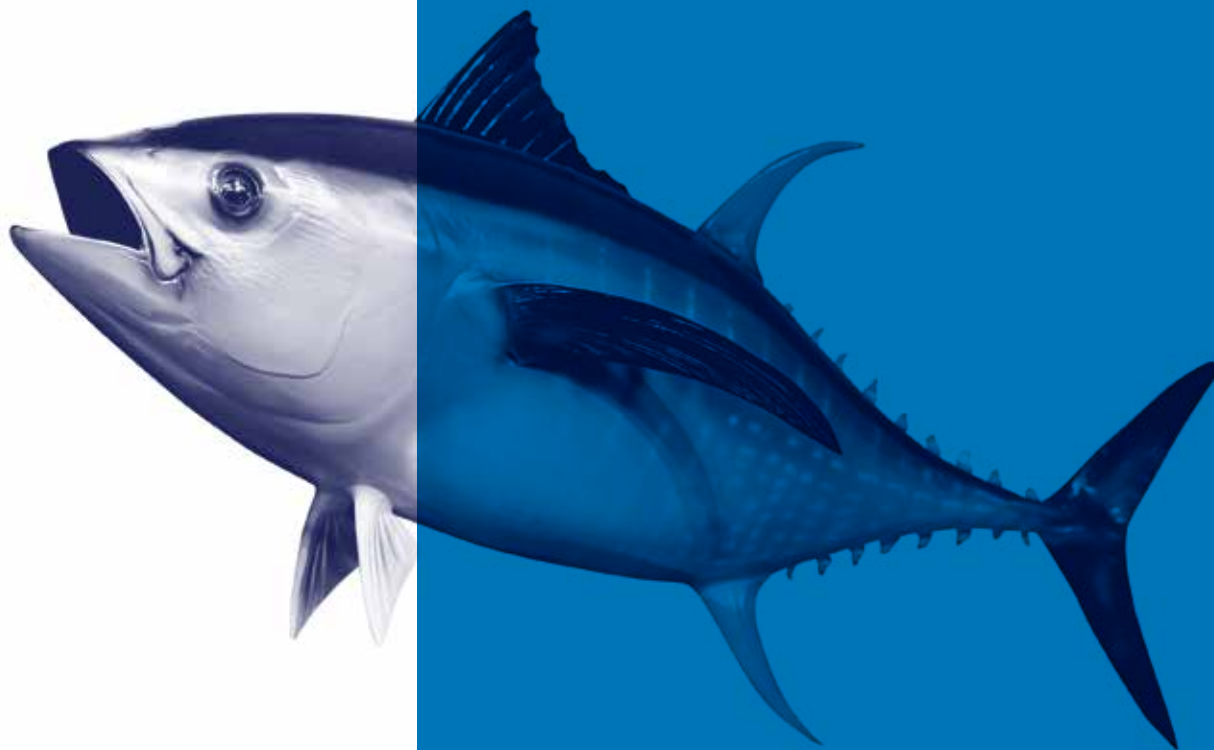
Project Eyes on the Sea: Pew Charitable Trusts has partnered with Satellite Applications Catapult, a UK government initiative, to develop a system that combines data from multiple sources (e.g. space-based radar and photographic imagery, vessels' electronic transponders, databases of authorized and blacklisted vessels) to help authorities identify suspicious fishing operations. The system reduces the amount of human resources needed to detect illegal activities.

Global Fishing Watch, a technology platform developed by Google, SkyTruth and Oceana, uses satellite Automated Information Systems data to monitor fishing activity around the world in almost real-time.

A key challenge in addressing overfishing is a lack of data, including stock assessment information. To address this, The Nature Conservancy is working with technology companies to develop **FishFace**, an app that uses affordable image recognition technology and machine learning to enable users to accurately identify species from photos.

eCatch and the Nature Conservancy are helping fishermen with iPads and tablets share the location of overfished and abundant species with their counterparts. They are also sharing overall trends to check if fishing grounds are healthy and abundant.

Provenance has piloted blockchain technology for tracing yellowfin and skipjack tuna fish in Indonesia to identify cases of illegal fishing and overfishing.





15

**PROTECT, RESTORE
AND PROMOTE
SUSTAINABLE USE
OF TERRESTRIAL
ECOSYSTEMS**

2030 VISION



OVERVIEW

Goal 15 aims to protect land resources by reducing ecosystem and biodiversity loss. Biodiversity and a functioning biosphere are critical to health of ecosystems, and in turn, the health of humans. More than 1.6 billion people directly rely on forests for their livelihoods, and many more depend more broadly on forest resources.

Despite signs of progress such as the protection of 15% of Earth's total land area and a slowing of net forest loss, environmental degradation continues at an alarming rate. Desertification, poaching and environmental changes continue to endanger species on land and in water. Global populations of vertebrates declined by 57% between 1970 and 2012 and scientists propose that we have unleashed a mass extinction event whereby we could witness a two-thirds decline in the half-century from 1970 to 2020.

Key challenges include addressing species and habitat extinctions, which are driven by habitat conversion (largely due to agriculture), climate change, pollution, unsustainable exploitation and invasive species. Climate change threatens ecosystems, water quality, species habitat and biodiversity – which in turn reduces resilience to climate change.

1.6bn

people directly rely on forests for their livelihoods

OPPORTUNITIES AND CHALLENGES

We need to be better informed about impacts to lands, prioritize our land resources differently and take a long term approach to how we value species, habitats and lands as vital components of our human ecosystem.

Increasing productivity: As global population and incomes increase, demand for food, shelter, products and services will put pressure on land resources and will require that we do more within the limits of the planet.

Targeted conservation: Currently, protected land areas are not sufficient to protect biodiversity, and often these lands are not those in most need of protection. Additionally, the interaction of climate change and human activities makes it challenging to track discrete causes and subsequent impact of conservation efforts.

Intelligent land management and policy setting: Target 15.9 calls for the incorporation of ecosystem and biodiversity values into national and local planning which could be supported by technological development in government planning systems.

Track and monitor destructive activities: Over-hunting, over-fishing and over-harvesting contribute greatly to the loss of biodiversity, and are responsible for the demise of numerous species over the last several hundred years. Poaching and other forms of hunting for profit increase the risk of extinction; the demise of an apex predator can result in catastrophic consequences for ecosystems.

Limited funding: Despite advancements in capability and application of digital technology in the conservation space, funding has long posed a challenge. Given the high cost of many of these technologies (e.g. drones, data analytics software) it will be difficult to implement these technologies at the scale needed without widespread investment from the public and private sectors. Just as the causes of these environmental challenges are many and varied, demonstrating the impact of a singular project or solution can often prove difficult. Also, skilled researchers and analysts will be required to demonstrate the benefits of technology solutions so that investment continues.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

Precision agriculture: The use of robotics, big data, IoT and smart equipment and farm management software can conserve valuable resources and provide information to cultivate the highest yields with minimum inputs. Precision agriculture helps farmers reduce waste and limit the amount of fertilizer used, in turn reducing nutrient runoff.

Real-time data collection: Data collection from different types of sensors deployed across the globe can help inform business and public leaders decision making regarding land management and development. Accessible and usable data can aid conservationists in proving impact and return on investment for various solutions.

“DIGITAL TECHNOLOGY COULD TRANSFORM CONSERVATION IN TERMS OF OUR ABILITY TO MONITOR AND UNDERSTAND CHANGES IN NATURAL SYSTEMS OVER TIME, ENSURING THAT THE DECISIONS WE TAKE AND THE INTERVENTIONS WE DESIGN ARE INFORMED BY SOUND SCIENCE.”

Mark Rose,
Fauna & Flora International

Transparent monitoring: Tracking illegal and destructive practices like logging and poaching will empower local law enforcement to address criminal activity. Digital technologies can improve traceability in supply chains and ensure sustainable environmental practices.

Conservation support: Drones are already gaining traction and could potentially eliminate the laborious task of replanting trees and vegetation in addition to delivering nutrients to support early plant growth in harsher areas. Digital mapping tools will continue to be important for biodiversity data tracking systems.

\$5.9bn

estimated total market for drone technology within agriculture by 2020

THE INVESTMENT OPPORTUNITY

Research from JPMorgan Chase, EnVest and The Nature Conservancy found that there is a \$31.7 billion market for investing in conservation, and private investment in conservation is expected to triple over the next five years.

Though it is still currently difficult to segment the digital technology-specific component of this market, many conservation-focused technology startups are proving successful. Farmlogs offers business intelligence software to sustainably manage resource inputs and overall farm production, which will support land conservation efforts and minimize pollutants. Goldman Sachs sees a total market for drones at \$100 billion by 2020, with agriculture representing \$5.9 billion. These investments and market projections indicate a strong market for technology's application in the conservation world over the next several decades.

CASE STUDIES

Orbital Insights plans to collect satellite imagery of tropical forests to track changes over time. The company uses machine learning algorithms on the images to detect small changes in the landscape (possibly illegal logging) that the human eye might miss.

Drones are being widely employed across conservation projects ranging from deforestation to wildlife protection. Several companies – Blue River Technology, AGCO Corporation, Vision Robotics Corporation and 3D Robotics to name a few – use drone technology to sustainably manage farms.

The Brazilian technology company Terras develops land management apps that expand access to socioeconomic and environmental risk monitoring and traceability of rural properties, connecting smallholder farmers to supply chains. Accelerator funding will support a 2017 pilot program to expand access to credit for smallholder cocoa farmers along the Trans-Amazonian Highway who comply with zero deforestation policies.

Arm partnered with Fauna & Flora International, their United for Wildlife partners and Google.org to catalyse WILDLABS.NET – the conservation technology network. WILDLABS.NET is a fast-growing global community of conservationists, technologists, engineers, data scientists, entrepreneurs and change makers who use the online platform to share information, ideas, tools and resources to discover and implement technology-enabled solutions to conservation challenges such as human-wildlife conflict and the illegal trade in wildlife.

Software such as the Domain Awareness System (DAS) created by Vulcan brings together GPS readings of animal movements, radio and vehicle trackers to follow anti-poaching teams in real-time, camera trap photos, surrounding human settlements where poachers are likely to originate, weather conditions and more to support law enforcement.





16

PROMOTE PEACEFUL AND INCLUSIVE SOCIETIES

2030 VISION



OVERVIEW

Goal 16 promotes peace and justice, and accountable and inclusive institutions. Targets include reducing violence, particularly against children, reducing corruption and bribery, increasing transparency of institutions and access to justice.

While some countries still face prolonged armed conflict, many regions have enjoyed increased levels of peace and security. According to the World Bank, the global rate of homicide fell from six to five per 100,000 people between 2012 and 2015. This said, people in some regions – Latin America, sub-Saharan Africa and Asia – face an increased risk of murder.

Various forms of violence against children persist. In 76 countries (mostly developing), about 80% of children under 14 were subjected to psychological aggression and/or physical punishment on a regular basis between 2005 and 2016. While countries have made progress in detecting human trafficking, nearly 30% of all victims detected in 2014 were children.

One in four companies in low and lower-middle income countries have experienced requests for bribes and informal payments from officials. In the worst affected economies nearly 50% of firms have been asked for payment to conduct their business.

30%

of human trafficking victims in 2014 were children

OPPORTUNITIES AND CHALLENGES

While progress has been made towards achieving more stable and secure societies, significant challenges remain.

Transparent and traceable supply chains: Human rights is a significant supply chain risk for companies, and consumer and regulatory pressure is growing on companies to be able to trace products from their origins throughout the supply chain.

“ULTIMATELY, THE ONLY WAY TO SOLVE PROBLEMS AT THE LEVEL OF INSTITUTIONS IS THROUGH SYSTEMS WHICH ENSURE TRANSPARENCY.”

James Hodson, AI for Good

Governance: Improving the effectiveness and transparency of governments is necessary to uphold justice and peace and reduce bribery and corruption. Globally, two-thirds of countries face endemic corruption in the public sector, and there is a clear connection between corruption and inequality.

“TECHNOLOGY OFFERS THE CHANCE TO OPEN THE BLACK BOX OF GOVERNMENT AND PROMOTES GREATER DEMOCRATIZATION VIA PUBLIC PARTICIPATION IN AND CO-CREATION OF PUBLIC SERVICES.”

Mark Thompson,
Judge Business School

Creating safer communities: Violence is one of the leading causes of death globally for persons aged 15 to 44. Developing safe and secure communities is essential to achieving many of the other Goals, notably education, gender equality, well-being and reduced poverty.

Freedom of expression and opposition: Freedom House finds that 2016 marked the 11th consecutive year of decline in global freedom across political rights and civil liberties. The Committee to Protect Journalists finds that countries which lack freedom of expression are likely to be governed by an individual, and have media under total state control with zero tolerance for negative coverage.

Technology and security concerns: Technology is creating a new set of global security concerns. Cybercrime and economic espionage is estimated to cost the world more than \$445 billion every year, equal to 1% of global income. Technology is also revolutionizing modern warfare, prompting Elon Musk, Mustafa Suleyman and other technology leaders to urge a ban on autonomous weapons.



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing the challenges outlined:

Blockchain: This emerging tool holds great promise for engendering trust and traceability. Blockchain can be applied to solve problems such as blood diamonds, forced labor and ivory poaching. Provenance uses blockchain to track the origin of products from coffee beans to fabric. Blockchain also holds promise for payments intended for international development to eliminate fraud and misappropriation of resources in territories where governance is weak and corruption is rife.

AI can be used to deploy **intelligent cybersecurity** to address the increasing risk of cyber attacks. The market is growing for products with adaptive algorithms that study large datasets to better anticipate threats, learn from previous attacks and give real-time responses to attacks.

“AI WILL BE CRUCIAL TO MAKE SENSE OF THE ENORMOUS AMOUNT OF DATA COLLECTED ACROSS INSTITUTIONS.”

Philip Sparks, Arm

Automating processes: such as tax collection, welfare distribution and designation of land rights, where information is recorded electronically and accessed only by those who need it, can lower the risk of bribery and corruption. In Afghanistan, automating the tax system reduced corruption and has increased revenue collection from \$250 million to almost \$2 billion since 2004.

App and web-based platforms can bring citizens closer to governments. E-government programmes can provide transparency and better accountability of the success, progress and impact of government actions. Whatdotheyknow is a web-based tool which helps UK citizens make freedom of information requests, and writetothem helps UK citizens get in contact with local politicians.

Collection of **big data** is crucial in making information visible and accessible to the public. Investigative Dashboard provides data to help journalists trace people, companies and assets across the globe. In Nigeria, YourBudget provides data regarding public budgets and spending.

Data analytics can be used to detect patterns of suspicious behaviors or transactions. The real-time analysis of a large number of transactions, the use of anomaly detection and risk-scoring algorithms alongside predictive modeling can support the identification of illicit financial flows and payments. Amnesty International uses digitized data from their Urgent Action alerts to predict and prevent future human rights violations.

\$1.26tn

cost of corruption, bribery, theft and tax evasion to developing countries per year

60x

more effective to invest in crime prevention than spending after violence erupts

THE INVESTMENT OPPORTUNITY

Corruption, bribery, theft and tax evasion cost developing countries \$1.26 trillion per year, and violence containment costs in the US alone are over \$1.7 trillion. Research indicates that investing early to prevent conflicts from escalating into violent crises is, on average, 60 times more cost-effective than intervening after violence erupts.

CASE STUDIES

Do not pay is the world's first chatbot lawyer which can provide affordable legal access for the masses. It started with the objective of helping people fight parking tickets and appeal compensation for delayed flights, and is now used to help refugees claim asylum.

The Australian Taxation Office uses big data to search through vast amounts of records to find evidence of the use of tax havens, and data-matching to identify small online retailers that are not meeting their compliance obligations.

Integrity App aims to provide citizens with access to World Bank financed projects and opportunities to report concerns of fraud and corruption. Users can directly send information relevant to bank financed projects such as photos of a half-built school or recording of a bribe.

Huawei's Safer Cities initiative uses LTE technologies to provide police and emergency services with real-time video and data connections to fight crime and make cities safer, improve cities by keeping them secure as well as giving communities the freedom.

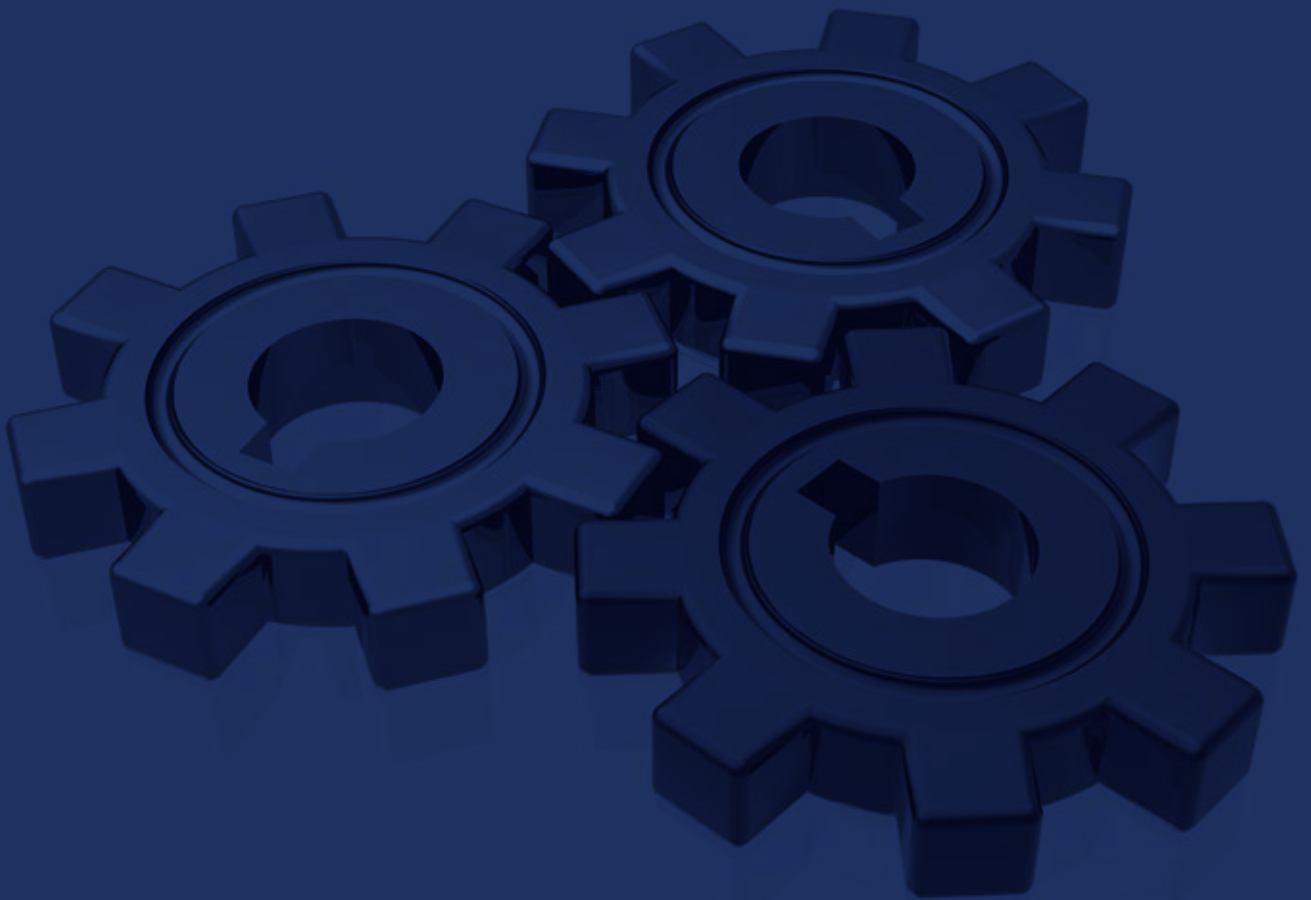




17

REVITALIZE THE GLOBAL PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT

2030 VISION



OVERVIEW

Goal 17 calls for renewed partnership across governments, civil society, the private sector, the United Nations system and other actors to mobilize resources to address all the Goals. Support for developing countries is fundamental for equitable progress for all nations.

Overseas financial aid is critical for ensuring sustainable development and some progress has already been made in securing these resources. Though there is significant work yet to be done, in 2016, net overseas development assistance (ODA) from member countries of the Development Assistance Committee of OECD rose by 8.9% to \$142.6 billion (a new high). Six countries – Germany, Denmark, Luxembourg, Norway, Sweden and the UK – met a UN target to keep ODA at or above 0.7% of gross national income.

Robust data and measurement is important to strengthen implementation of the Goals and multi-stakeholder partnerships. In 2016, 125 countries engaged in country-led monitoring of development effectiveness, and 54 of those countries reported progress towards those commitments.

Technology is specifically highlighted in SDG 17 as a key means of achieving the goals; through increasing access and affordability of ICT services, operationalizing the global technology bank and promoting environmentally sound technologies.

OPPORTUNITIES AND CHALLENGES

Improving global partnerships is essential to achieving the Goals as well as ensuring the peace and prosperity of mankind. Key opportunities and challenges include:

Mobilizing financial resources: Financial resources for development must continue to increase, through international aid, domestic revenue collection as well as alternative sources such as remittances. Although total development assistance continues to grow, aid to the poorest countries has stagnated. Remittances sent by international migrants to their home countries have a profound impact on families, communities and countries. In 2016, international remittances totaled \$575 billion, 75% of which went to developing countries.

Increasing capacity, collaboration and knowledge sharing: Building the capacity and ability for national governments and institutions to enable sustainable development is important for the global community, and partnerships will be a crucial means to achieving this. In 2015, aid for capacity-building stood at \$21 billion, representing 19% of total aid. Sub-Saharan Africa received 27% of this, and South and Central Asia received 20%, with the main recipients of capacity-building assistance being public administration, environment and energy sectors.

Enhancing the use of enabling technologies: Developing countries in particular need to develop technology ecosystems in order to achieve the Goals, yet WEF finds that lower income countries have significantly less capacity to leverage technology for competitiveness and well-being. This will rely on global collaboration with particular focus on building the capacity of developing countries. The Technology Bank is an initiative that aims to strengthen national technology capabilities and provide expertise to the world's least developed countries.

Improving data, monitoring and accountability: Governments and institutions are increasingly aware of the importance of harnessing data to better inform decision making. Lack of reliable data on even the most basic indicators of development can lead to misguided policies and misallocation of resources. The number of countries with a national statistical plan increased between 2010 and 2015, including the least developed countries, though many lack such a plan. Data on population, housing and deaths are essential for development policies, yet collection of this data remains far from universal. Between 2006-2015, 88% of developing countries conducted at least one population and housing census, but only 67% of countries in Southern Asia and 69% of countries in Western Asia did so. In sub-Saharan Africa, only 9 in 53 countries collected death registration data and only 8 in 53 collected birth registration data.

“COLLABORATION BETWEEN DIFFERENT SECTORS AND BRINGING IN MORE ‘UNLIKELY SUSPECTS’ HELPS THE SEARCH FOR SOLUTIONS. THE TECHNOLOGY SECTOR ALONE WON’T SOLVE THESE CHALLENGES, BUT WE WILL NEED TO PARTNER FOR EFFECTIVENESS.”

Ingvild Soerensen, UNGC



THE ROLE OF TECHNOLOGY

Digital technology will play a key role in addressing these challenges:

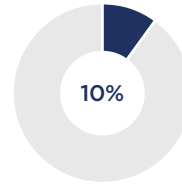
Digital collaboration platforms can fuel the new types of partnerships required to achieve the Goals. Collaborative software informed by machine learning can make decision making within and between institutions more efficient. Platforms can power capacity-building through information exchange, education and training. AidHub is a platform designed to enable partnerships to plan, implement, manage and improve initiatives throughout their lifecycle. The technology supports third party developers to extend the platform's functionality to meet the individual needs of partners around the globe.

“WE CAN HAVE A DIFFERENT MODEL OF GROWTH PREDICATED ON COLLABORATION VERSUS COMPETITION.”

Rachel Coldicutt, doteveryone

IoT and AI: The future of collecting and analyzing the data needed for informed decision making will hinge on the connected sensors and automated analysis of IoT and AI, which will enable measurement and tracking of progress towards the Goals. Sensors can significantly increase the availability of high-quality, timely and reliable data while AI is expected to improve analytic abilities and guide decision making. For example, OPAL is a collaborative project leveraging the power of platforms, big data and advanced analytics for the public good in a privacy-preserving, commercially sensible, stable, scalable and sustainable manner. Open data and “data philanthropy” are crucial to build the powerful data ecosystems required. Data for Climate Action is looking at how data from the private sector can be used in the fight against climate change.

Mobile financial services can be used by citizens and institutions to increase the formality of transactions in the economy, including remittances. One year after the Tanzania Revenue Authority enabled tax payments over mobile money for property taxes and personal income taxes, around 15% of the tax base was collected using mobile money.



of infrastructure investments come from the private sector

380m

estimated new jobs by 2030 if the GOALS are achieved

THE INVESTMENT OPPORTUNITY

The United Nations Conference on Trade and Development (UNCTAD) estimates that an investment of between \$5 trillion to \$7 trillion is needed to attain the Goals, with an investment gap in developing countries of about \$2.5 trillion. Only 10% of current infrastructure investments come from the private sector, but a recent report by the Business & Sustainable Development Commission estimates that achieving the Goals could open up \$12 trillion of market opportunities in food and agriculture, cities, energy and materials and health and well-being and create 380 million new jobs by 2030. Realizing this market potential will require collaboration across the public and private sectors.

CASE STUDIES

The Geneva Internet Platform (GIP) is a digital policy platform, observatory and capacity-building center to assist governments, civil society, academia and other information-society stakeholders in finding resources related to digital policy and governance, with a special focus on small and developing countries.

Project8 is a platform for individuals and organizations to share, compare, analyze and discuss data and measurement perspectives on sustainable development.

The United Nations Global Pulse aims to promote awareness of the opportunities big data presents for sustainable development and humanitarian action, forge public-private data sharing partnerships, generate high-impact analytical tools and approaches through its network of Pulse Labs in New York, Jakarta and Kampala.

Skuchain is a blockchain platform that provides transparency, security and efficiency to the supply chain, enabling optimal planning and agility for downstream buyers and working capital relief for upstream suppliers, initially focused on trading cotton between Texas and China.



CONCLUSION

The global community's agreement of the 2030 Agenda and the Global Goals was a remarkable achievement. However, by far the greater challenge will be to achieve the Global Goals. Doing so will require an unprecedented deployment of human ingenuity and technical capability.

We will need to deploy all our resources collaboratively and wisely. The scale of the challenges ahead and the potential rewards demand nothing less.

Technology is only relevant and viable in the long term insofar as it can combine purpose with commercial outcomes. We believe that more can and will be done to apply technology for positive progress as needs and opportunities are better understood.

As members of the 2030Vision Partnership, we recognize that the Global Goals are wholly interconnected. We believe that technology must play a pivotal role in every Goal and that innovative partnerships and collaborations will be essential. No sector on its own can achieve the progress we need. For example, health, agriculture, logistics, and infrastructure are all interconnected.

That is why we support a new era in which civil society, governments, the scientific community, policymakers and business work together in a relentless drive towards a more equitable, prosperous and sustainable world. We can achieve the Global Goals, but only by finding new ways to channel the power of technology to help realize them. This report is a crucial step in framing a new dialog urgently needed to stimulate action.

2030Vision Partners

We would like to thank all those who supported this research. A full list of names of individuals with whom we spoke is available on request.

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2030Vision is a partnership that connects businesses, NGOs and governments with the technology and expertise they need to realize the Goals.

Founded and chaired by Arm, it is a partnership with UN Global Compact, UNICEF, The New York Academy of Sciences, SustainAbility, Fauna & Flora International, Centre for Global Equality, Cambridge Judge Business School, British Council and Be He@lthy Be Mobile and Project Everyone.

Our ambition is to transform the use of technology so that all people can live their lives to their full potential by 2030.

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