SUMMARY

Digital with Purpose: Delivering a SMARTer2030

GeSI ENABLING DIGITAL SUSTAINABILITY

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About the authors

About GeSI

The Global Enabling Sustainability Initiative (GeSI) is a strategic partnership of the Information and Communication Technology (ICT) sector and organisations committed to creating and promoting technologies and practices that foster economic, environmental and social sustainability. Formed in 2001, GeSI's vision is a sustainable world through responsible, ICT-enabled transformation. GeSI fosters global and open cooperation, informs the public of its members' voluntary actions to improve their sustainability performance, and promotes technologies that foster sustainable development.

GeSI enjoys a diverse and global membership, representing around 40 of the world's leading ICT companies and partners with over 12 global business and international organisations such as the International Telecommunications Union (ITU), the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environment Program (UNEP), the World Business Council for Sustainable Development (WBCSD), the World Resources Forum Association (WRFA) - as well as a range of international stakeholders committed to ICT sustainability objectives to share and develop ideas, launch joint initiatives, and collaborate on a broad range of sustainability projects. These partnerships help shape GeSI's global vision regarding the evolution of the ICT sector, and how it can best meet the challenges of sustainable development. For more information, see www.gesi.org

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Foreword

The Global Enabling Sustainability Initiative (GeSI) is made up of leading ICT companies, partners and international organisations, all committed to achieving integrated social, environmental and economic sustainability as defined by the transformative Sustainable Development Goals (SDGs) Agenda.

Our vision is to create a sustainable world through responsible, ICT-enabled transformation, using the SDGs as a central framework for action. In particular, we are focused on researching and addressing climate change (SDG 13), by accelerating the development of digital solutions to usher in an era of innovation and low-carbon growth.

We are proud to introduce this new report, #DigitalWithPurpose, which identifies and quantifies the ways in which digital technologies, both established and cutting-edge, are capable of delivering transformative impact against each of the 17 SDGs. It also clearly lays out where these technologies can have a negative impact.

The opportunity, both for the ICT sector and the sectors and organisations at the forefront of deployment, is enormous. Given the slow pace of progress against the SDGs, it is also non-negotiable. We conclude this report with some specific commitments for all who are on this journey – the first commitment being to share a common purpose to secure a SMARTer2030.

We are grateful to Deloitte, all the GeSI members and the amazing high-level group of external experts who have supported us in developing this thorough and powerful report. We do hope you find it useful and agree to join us, commit, and take action.

Luis Neves
GeSI CEO

James Gowen
GeSI Chairman
Verizon CSO

The Sustainable Development Goals represent the opportunity for our generation to move the world onto a sustainable path. At Deloitte, we place our role in society at the heart of what we do. Our purpose is to make an impact that matters and we embed this ideal in our work every day. By helping our clients to succeed sustainably; by operating responsibly and through our corporate responsibility programmes; we are dedicated to making a global impact.

Digital technology is interwoven into all that we do. But digital technology in and of itself does not deliver impact. Rather, it's how we develop and deploy technology that matters.

Through this report, we stand with GeSI to call on the ICT sector, on business, and on governments, to commit to 'Digital with Purpose.' This means taking on the 2030 Agenda as our own. It means calling out our intended contribution to the delivery of the SDGs. And, it means identifying how we can use digital technology to maximise our impact.

As detailed in this report, digital technology is already being used in ways that can help drive incredible positive change in our world. But there is still so much more to do. Together with our clients, we at Deloitte are committed to help meet this challenge so that we can all enjoy a sustainable future.

Punit Renjen
Global CEO, Deloitte

Key messages

Urgent intervention is required

On its current trajectory, the world will be unable to deliver the 2030 Agenda for Sustainable Development.[1] Our **biosphere** is under threat from rising carbon emissions, our **society** sees persistent inequality and lack of access to basic services, and our **economy** continues to drive the unsustainable consumption of natural resources. Climate action (SDG 13) is a critical precondition for the 2030 Agenda. Addressing the climate crisis transcends geography and local interests and is an issue that nation states have committed to; but one that requires truly integrated and innovative solutions.

Digital technologies are having a powerful impact

In the face of this challenge, digital technologies, the powerful collection of seven technologies[2] that increasingly pervade our lives, drive positive progress across the 2030 Agenda in four key ways. They help us:

- **Connect & Communicate**, opening up relationships, information, ideas and opportunity;
- **Monitor & Track** the world around us, so that our impact is transparent and we can make targeted interventions;
- **Analyse** vast swathes of information; **Optimise** processes, procedures and resource productivity; and **Predict** where we need to intervene; and
- **Augment** our human abilities and **Autonomate** systems to carry out activities on our behalf by creating an 'active bridge' between the physical and digital worlds.

Of the 169 SDG targets, 103 are directly influenced by these technologies, with established examples of deployment that provide insight into their potential to make an impact. Analysis of 20 targets and their indicators across the SDGs shows that the expected deployment of existing digital technologies will, on average, help accelerate progress by 22% and mitigate downward trends by 23%.

Digital technologies can and need to contribute more

Whilst digital technologies will help close the gap to some of the 2030 targets, performance against approximately a third of targets analysed is expected to deteriorate even after increased technology adoption. Digital technologies need to do much more, and there is plenty to suggest they can:

- This report analyses the emissions abatement potential of seven existing applications. It is estimated that emissions abated in 2030 as a result of greater adoption of these use cases will be equivalent to nearly seven times the size of the growth in the total ICT sector emissions footprint between now and 2030.
- A more optimistic scenario featuring ambitious policy and sector interventions could reverse the growth of the ICT sector footprint and enable emissions reduction equivalent to 9% of total world emissions.
- Over $3 trillion is likely to be spent on research and development in the ICT sector in the ten years up to 2030, indicating huge potential for innovative solutions to the SDGs if effectively directed and as existing technologies mature.

Digital technologies can also be deployed in ways that counter the Goals: fuelling consumption; hardening the digital divide; creating dislocation in the labour markets; and consolidating power of the few over the many. Enhancing the positive impact needs to go hand in hand with minimising any negative impacts.

Key messages

Digital with purpose is the way forward

To fully support the transformation required by the SDGs, digital technologies need to be developed and deployed with positive societal impact in mind and within a context of shared aspiration: **digital with purpose**. Digital with purpose has three components:

- Commitments for all;
- Leadership by the ICT sector; and
- Roles for each of the key stakeholder groups.

Commitments for all

All organisations and individuals need to make four "universal commitments":

1) recommit to the 2030 Agenda;

2) state their intended impact on the SDGs, including a specific commitment to reduce greenhouse gases by 50% by 2030;[3]

3) embrace the principles of **transparency and collaboration**; and

4) harness the power of digital technologies to support these commitments.

Organisations need to do this to secure not only all our futures, but also their own long-term success. The two are increasingly, indivisibly, interdependent.

Leadership by the ICT sector

According to analysis by Arabesque, the ICT sector performs well across a range of broad environmental, social and governance themes – relative to the wider market. This provides a good basis for the sector to provide sector-level leadership and individual organisation dedication to:

- **Lead on the universal commitments,** recognising the need to collectively support the entire 2030 Agenda. This includes areas that may be more difficult to deliver with existing business models, e.g. providing digital access to all;
- **Build impact transparency** across the ICT sector; partner sectors; at individual, village, city, state, country levels; and globally. To help build the data, systems and governance to link activities to impact on the SDGs, enhancing impact and locking in longer term success;
- **Recognise and address negative externalities.** This will necessarily include investment to better understand contexts, cause and effects, and potential solutions to mitigate the negative impacts; and
- **Operate responsibly.** The sector, and particularly the services subsector, needs the credibility of both acting, and being seen to act, as the responsible sector if it is to lead on this broader agenda.

Roles for each of the key stakeholder groups

Critical stakeholder groups include governments, NGOs, institutional investors, businesses and partner sectors, and citizens. Each group needs to embrace the universal commitments, and for each this report proposes some specific additional commitments, with the single most important for each being:

- **Governments:** work with the ICT sector, NGOs, investors and other stakeholders to develop precompetitive approaches to ensure more equal access to the benefits of digital technology, both inter- and intra-economy;
- **NGOs:** hold stakeholder groups to account for their use of digital technologies, and help form multi-sector partnerships with the ICT sector to drive impact;
- **Institutional investors:** demand evidence of commitment to the 2030 Agenda and transparency of impact from investee companies. Utilise the capability of ICT sector to help evolve impact transparency together;
- **Businesses and partner sectors:** deploy digital technologies with an understanding of their impact, and recognise and help manage negative externalities; and
- **Citizens:** become educated on the role of digital technologies in the 2030 Agenda, take responsibility for positive and negative impacts of personal usage and use power as a consumer to promote impact.

GeSI commits to delivering a SMARTer2030

GeSI, its members and partners stand by these commitments and announce their intention to work across the industry and with the key stakeholder groups to make Digital with Purpose a reality. **Join us!**

GeSI ENABLING DIGITAL SUSTAINABILITY

Executive summary

1 Introduction

More informed and purposeful development and deployment of digital technologies will catalyse progress towards the Sustainable Development Goals (SDGs).

This report builds on GeSI's previous work, particularly the 'Smart' series; and through research, dialogue with over 40 GeSI members and partner organisations and the challenge of a distinguished expert panel, lays out the following:

- **Digital technologies:** an introduction to the technologies explored in the report and an overview of the opportunities they provide to develop and deploy for maximum impact on the SDGs;
- **Impact on the SDGs:** the impact these technologies have now and will have in the future, supported by a deep dive which details the opportunities for each Goal individually;
- **Impact on the SDGs – Sectors:** an exploration of the scope for key sectors to deploy digital technologies for impact on the SDGs;
- **Impact on the SDGs – Geography:** reflections on the most immediately relevant Goals for six major global regions; progress against these and the comparative impact of digital technologies;
- **The ICT sector: the Catalyst for Sustainable Development:** estimations on the current scale and impact of the ICT sector, as well as projections to 2030; and
- **Actions to deliver a SMARTer2030:** delineation of the critical roles for both the ICT sector and related stakeholders in developing and deploying digital technologies to maximise positive impact and minimise negatives.

Digital technologies could have a transformational impact on our ability to meet the 2030 Agenda. This, however, requires both the ICT sector and the key sectors (or 'partner sectors') who deploy these technologies to put this Agenda more intentionally at the centre of who they are and what they do. It also requires a substantially enhanced understanding of how actions lead to impact on the achievement of the SDGs, be they the actions of government, businesses, NGOs, or citizens.

This report comes at a time when the world is waking up, albeit slowly, to the existential challenge it faces from climate change and to the slow progress against the broader 2030 Agenda, which has such profound implications for everyone. This awakening is resulting in pressure on all organisations from their many stakeholders – not least investors, customers, employees and regulators – to articulate and demonstrate how societal impact is at the core of what they do. The result is that a greater commitment to societal impact is not just about securing a license to operate, but a critical element of building long-term success, with application to all organisations including business.

It also comes at a time when the ICT sector is viewed by many with distrust, often seen as the source of products and services that harm rather than heal our society and environment. Digital technologies can be leading contributors to positive societal value, but this will only become a reality if the focus of technological development and deployment is framed by a clear commitment to the SDGs. If the ICT sector can demonstrate to the world that it is moving the dial on progress towards the 2030 Agenda, and assumes responsibility to address and prevent negative outcomes that result, the world will substantially benefit and the sector will be assured of long-term success.

2 Approach

This report explores the relationship between the development and deployment of digital technologies and the achievement of the SDGs. It employs an explanatory framework of 'impact functions' to categorise example 'use cases' that illustrate this relationship across each of the 17 Goals. For each Goal, new quantitative modelling explores the expected contribution of digital technologies to progress against a selection of priority targets, compared to a business-as-usual scenario in which the adoption of digital technology is held constant. Further quantitative analysis explores the impact of the ICT sector itself.

3 Digital technologies

Seven digital technologies have been chosen as broadly representative of the way digital capability will evolve in the medium term and for their critical influence on the world. These technologies are:

1. Digital Access: connectivity for people to people, and people to the internet;

2. Fast Internet: next generation connectivity, personified by 5G, that provides speed and capacity at fundamentally different levels;

3. Cloud: the provision of highly scalable, advanced IT capabilities as 3rd party services;

4. IoT (Internet of Things): the connecting of physical objects to the internet enabling communication from, and to, the object;

5. Cognitive: the application of advanced analytics, machine learning and artificial intelligence approaches to big data to develop insight;

6. Digital Reality: virtual digital worlds or systems (virtual reality) or mixed virtual and physical worlds (augmented reality); and

7. Blockchain: a system of digital, distributed ledgers of transactions comprising a database of information, with an append-only structure, governed by a network of computers instead of a central party.

These technologies typically work together both in their development and deployment. AI for instance is crucial to the effective development and operation of the networks that underpin the evolution of 5G; whilst scaled deployment of AI by an organisation will often involve cloud services.

The seven technologies vary significantly in maturity: digital access is both global and at scale, if not pervasive. Blockchain is in its comparative infancy. Every one of the technologies still has plenty of opportunity to scale in terms of deployment, and therefore by extension, in terms of impact.

Each of these technologies affects the world in multiple ways. To help navigate these effects, this report uses a new framework specifying 'impact functions' that link the technologies and their combinations with the way they impact the world. The four top level impact functions concern:

Connect & Communicate
Connecting people to each other and to critical information;

Monitor & Track
The real-time, extensive observation of the world and its natural and man-made systems;

Analyse, Optimise & Predict
The development of insights from data, and the use of those insights to drive process efficiency and infer the future; and

Augment & Autonomate
Provision of an 'active bridge' between digital and physical, from simulation through augmentation to the creation of autonomous systems.

These functions can lead to good and bad impacts. This report uses the functions and the underlying technologies to explain the depth of the positive contribution they make, now and in the future, to the SDGs.

Whilst this contribution is profound and will be critical to the achievement of the 2030 Agenda going forward, maximising potential will depend on a more collaborative, more integrated approach to deployment. Organisations rarely optimise internal coordination around the deployment of digital technologies, let alone externally, which falls short of the imperative of the SDGs for coordination, cohesion, and integration. An approach that puts partnerships and collaboration at its core will be vital to making tangible progress towards the 2030 Agenda.

4 Impact on the SDGs

This report details the many different ways in which digital technologies can impact the SDGs, focusing on 103 of the total 169 SDG targets which are not primarily reliant on policy, aid financing, or non-digital interventions. These targets have been reviewed for current progress and the four impact functions have been used as a framework to establish links between each target and the seven focus digital technologies, and to categorise how digital technology drives impact. In order to illustrate these drivers, example use cases have been noted, along with instances in which digital technologies can have a negative, rather than positive, impact. Illustrative modelling has also been undertaken to demonstrate the potential impact of digital technologies on one or more SDG indicator.

This modelling of the expected increased adoption of digital technologies assumes no significant changes to technology, policy, or infrastructure, and shows a range of possible achievements against a business-as-usual scenario. For example, an additional 150kg of cereal could be produced per hectare for smallholder farms globally through improved access to and use of data – an enhancement of just under 10%.

Analysis of 20 targets and 25 associated indicators across a range of SDGs shows that the expected deployment of existing digital technologies will, on average, help accelerate progress by 22% and mitigate downward trends by 23%.

There is, however, much more that needs to be done. Whilst the increased adoption of digital technologies will help close the gap to some of the 2030 targets, performance of 8 out of 25 indicators analysed is still expected to deteriorate. So to meet the Goals, the world needs to progress further and faster. Key actors within the ICT sector and partner sectors need to significantly shift the extent to which the 2030 Agenda is truly a common focus in order for digital technologies to be truly transformative. There needs to be a fundamentally different, and systemic, understanding of the impact of digital technology. By having a better understanding of both the positive and negative impacts of digital technologies, these sectors will be able to work together more effectively to accelerate the benefits and limit the downsides. The focus must be on both optimising the capabilities currently existing, and directing research and development at new capabilities on the basis of the impact they have.

The SDGs are an integrated framework, which this report presents here under the domains of Biosphere, Society, and Economy.[1] For each we summarise the main opportunities that digital technologies can help deliver and note any possible negative externalities.

Biosphere

The biosphere, representing the planet we depend upon, is covered across the topics of climate change and natural resources:

- **Climate change** focusses on SDG 13 (Climate Action), and includes the need to reduce emissions, ensure resilience to natural hazards, and enhance our ability to act; and
- **Natural resources** covers SDG 6 (Clean Water and Sanitation), SDG 14 (Life Below Water), and SDG 15 (Life On Land), and addresses the conservation of these domains.

Digital technologies have a critical role to play in protecting the biosphere and reversing negative progress against the four biosphere SDGs and their targets. The most relevant impacts are particularly concentrated within *monitoring and tracking* the state of the natural world (SDGs 6, 14, 15), and *analysing and optimising* energy and material usage across sectors to minimise the impact of climate change (SDG 13). There will be increasing opportunities in the future for emission savings under *augment and autonomate*, as the automation of processes across agriculture, industry and manufacturing becomes increasingly sophisticated and automated, helping in the fight against climate change.

Impact modelling for climate change suggests that the expected adoption of digital technology will lead to the abatement of 668 Mt CO2e (accounting for rebound effects), equivalent to 1.3% of global emissions in 2030. This is the result of efficiency gains from the optimisation of existing processes in agriculture, on roads, in energy networks, and in manufacturing.

Six impacts have been modelled for natural resources: agriculture and municipal water withdrawals, clean drinking water, sustainable fish stocks, the global forest area, and net emissions from forests. For example, impact analysis on water withdrawals shows that digital technologies can have a significant positive impact. Excess water withdrawals can lead to water stress or scarcity, where water supply does not meet demand, and hence managing water use is important. This report estimates that the expected increased deployment of smart water infrastructure could mitigate around 22% of the estimated increase in global municipal water withdrawals against a business-as-usual scenario.

Likely negative impacts on the biosphere resulting from widespread technological deployment include: an increase in emissions directly related to this deployment, quantified below under the section on the ICT sector; the increased extraction of scarce resources; and the creation of e-waste, resulting from, for example, increased proliferation of IoT devices.

Digital technologies have a critical role to play in protecting the biosphere and reversing negative progress against the four biosphere SDGs and their targets.

Society

Society, representing our ability to live together in an equitable and peaceful way, is covered across the topics of basic human needs, amenities and utilities, and a fair and just society:

- **Fulfilment of basic human needs** spans SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), and SDG 4 (Quality Education);
- **Sustainable amenities and utilities** addresses SDG 7 (Affordable and Clean Energy), and SDG 11 (Sustainable Cities and Communities); and
- **A fair and just society** covers SDG 5 (Gender Equality), and SDG 16 (Peace, Justice and Strong Institutions).

Digital technologies, if carefully managed, have an important role to play in ensuring sustainable and equitable societies. Three major opportunities have been identified: i) continuing to connect the unconnected and vulnerable to basic digital access, to enable financial inclusion, education and empowerment; ii) taking advantage of machine learning (ML) and artificial intelligence (AI), as well as the computing power promised by cloud, to accelerate drug and crop development, and improve targeting of areas of poverty and hunger, disaster impact, and education and health outcomes through the processing of complex datasets; and iii) autonomous machines to transform agriculture, and city utility, service, and security provision.

Eight impacts have been modelled out to 2030 across the different areas covering sustainable and productive agriculture, skilled birth attendance, youth literacy, access to electricity, renewable energy consumption, mean levels of air pollutants (specifically the pollutant PM2.5), and reproductive rights. For example, the proportion of births attended by skilled health personnel is estimated to increase from 84% today to 92% under a scenario with increased deployment of digital technologies that improve communication between health professionals and expectant mothers. Of this increase, 32% can be attributed to digital technology. This indicator is important as it has been shown to have a strong relationship with rates of maternal mortality.

Whilst the benefits from the development and deployment of digital technologies are critical to addressing the society-related SDGs, there are multiple possible negative outcomes. These include: enhanced inequalities unless access to technology is more even, reduced resilience of core society supporting systems unless cyber security is invested in, and the spread of disinformation leading to misinformation unless appropriate weight is given to transparency and truth.

Economy

The economy, the system through which we gather, produce and distribute resources, is covered across the topics of inclusive growth and sustainable industry:

- **Inclusive growth** comprises SDG 8 (Decent Work and Economic Growth), and SDG 10 (Reduced Inequalities); and
- **Sustainable industry** comprises SDG 9 (Industry, Innovation and Infrastructure), and SDG 12 (Responsible Consumption and Production).

Digital technologies have a critical role to play in enabling inclusive growth and sustainable industry. Two major opportunities stand out: i) monitoring supply chains accurately to create transparency in production; and ii) optimising processes to increase productivity while reducing energy and material usage and emissions.

Five impacts have been modelled to 2030 across SDGs 8, 9, 10 and 12 covering financial inclusion, remittance costs, manufacturing value add, domestic material consumption, and food loss in the supply chain. For example, the global deployment of Industry 4.0 has the potential to increase gross value added from manufacturing, which will be especially important to the development of emerging economies. This report estimates that with increased digital technology in manufacturing, global manufacturing value add per capita could increase from around $1,800 currently to over $2,700 in 2030. Of this increase, 22% can be attributed to Industry 4.0.

Negative externalities that should also be considered include: a greater divide between developed and less developed economies as the former get better access to digital technologies, an increase in consumption as wealth increases, job displacement as digital technologies contribute to increased automation across sectors, and an increase in system-wide risk from centralised control and cyber attack.

5 Impact on the SDGs – Sectors

To realise the potential of digital technologies for the achievement of the SDGs, the ICT sector needs to collaborate on the basis of impact with the key sectors involved in delivering the 2030 Agenda.

Some SDG targets explicitly refer to individual sectors; with others the sectoral responsibility and opportunity is more implicit. The report lays out a set of priority SDG targets and key actions for each partner sector to consider, reflecting the intersection of their core business activity and the potential deployment of digital technologies for impact. The list below provides one example per sector, selected on the extent to which the responsibility lies with the sector:

- **Agriculture and Fisheries:** improved monitoring of farm and fishing activities (Target 14.4) with solutions using IoT, satellite imagery, AI, and digital access;
- **Consumer Products and Industrials:** evolution of the circular economy (Targets 8.4, 9.4, 12.2, 12.5, 13.2) through enhanced transparency on provenance, material composition and the CO2 footprint of products and smart recycling systems;
- **Energy, Extractives and Utilities:** increase in the share of renewable energy in the global energy mix (Targets 7.2, 7.3) facilitated by IoT/ AI-driven efficiency in plants and on the grid, and pay-as-you-go solar access;
- **Financial Services:** encourage and expand access to banking, insurance and financial services for all (Target 8.10) through digital access and better informed and tailored products and services facilitated by big data and AI;
- **Government and Public Services:** provision of unique identities for the c. 1 billion people without them (Targets 16.9, 1.3) through use of e.g. digital access, AI and blockchain;
- **Life Science and Health Care:** ensure universal access to sexual and reproductive healthcare services (Target 3.7) through connectivity, remote access to patient records and AI-driven diagnosis; and
- **Transport and Logistics:** provide access to safe, accessible and sustainable transport (Target 11.2) through access to mobility on demand type platforms.

6 Impact on the SDGs – Geography

A global response to the SDGs is vital for the 2030 Agenda to be realised, however the priorities for the deployment of digital technology against specific SDG targets vary for each geographic region.

Profiling of the UN-defined major regions of the world has been undertaken to highlight the most immediately relevant targets for each. Expected progress against these priority goals has been assessed with an exploration of the comparative impact of digital technologies to achieve these priorities, as detailed in the list below:

- **Africa:** Digital access will support improvements in maternal mortality (Target 3.1) by increasing the number of births attended by skilled healthcare professionals, and increase smallholder farm productivity (Target 2.3);
- **Asia:** Digital access, IoT and AI will help reduce air pollution (Target 11.6) from road transport, and enable more sustainable farming (Target 2.4), reducing the amount of synthetic nitrogen fertiliser used;
- **Oceania:** Digital access will support an increase in women's access to family planning services (Target 5.6) and improvement in youth literacy (Target 4.6);
- **Latin America and the Caribbean:** IoT and cloud will enable a reduction in food loss in the supply chain (Target 12.3), and AI and cloud will enable more sustainable management of forests (Target 15.2);
- **North America:** Digital access, AI and IoT will support more sustainable use of water resources (Target 6.4) and improve energy efficiency (Target 7.3);
- **Europe:** IoT will help achieve greater sustainability and resource efficiency in industry (Targets 8.4, 9.4, 12.2) and help develop more sustainable agriculture (Target 2.4), reducing emissions from the sector.

7 The ICT sector: the Catalyst for Sustainable Development

Whilst the deployment of digital technologies is the primary focus of this report, it is also important to consider the primary source of these technologies – the ICT sector itself. The ICT sector's commitment and contribution to the SDGs can be construed in terms of its shape and size, emissions, and its management of externalities.

Shape and size

The sector's direct contribution amounted to an estimated €3.7 trillion in GVA (gross value add) in 2019, split around 80/20 between services and manufacturing. Services are distributed roughly in line with GDP, whilst manufacturing is concentrated in the US and a group of East Asian economies. The sector is a major contributor to R&D e.g. accounting for 20% of all business R&D in Japan; and in 2015 employed 48 million people, amounting to 1.5% of global employment. The sector also drives an indirect economic contribution through the use of products and services.

Growth

The sector has been growing and is expected to continue to grow to around €6 trillion to 2030 – an increase of €2.3 trillion from 2019, with commensurate growth in both R&D and employment.

There are significant risks to the accuracy of this projection. It could be considered too conservative since disruptive new technologies could result in the creation of major new digital business models that result in rapid economic activity shifts, such as moving entire subsectors into the ICT sector. Alternatively it could be an overestimate since the sector faces a rapidly increasing burden of constraints and demands by regulators, consumers, and other key stakeholders over concerns around its societal contribution slowing its rapid expansion.

ICT sector growth is likely to be highly dependent on the ability of the industry to manage, and verify, its emissions and other critical negative externalities, and crucially demonstrate its social value and contribution to SDG achievement in all key sectors to all key stakeholders.

Management of externalities

According to analysis by Arabesque, the ICT sector performs better than the wider market on environmental and social issues, reflecting above-average commitment to relevant policies and procedures. In particular, the sector performs well relative to the wider market in terms of its specific commitment to addressing climate change – with above-average commitment to meeting the Paris Agreement to limit climate change to 1.5 ºC. However, despite this commitment, there is a need to consider the potential impact on the environment of the sector's expected growth. The greenhouse gas impact of energy use by the ICT sector is estimated to be just over 800 Mt CO2 in 2019, rising to over 900 Mt CO2 in 2030 – an increase of 11%. This means that, on expected trajectories, the sector footprint is estimated to rise from 1.6% of global GHG emissions in 2017 to 1.7% in 2030. The increase is driven by the growth of the sector and an increase in the energy intensity of transmission networks, although this is partially offset by a reducing energy intensity in manufacturing and data centres, and differing rates of growth of clean energy by country. Many large companies are announcing public plans to curb their emissions, which may result in improvements on this projection, as would a broader and more rapid shift to clean energy. Risks include the continued rise of data volumes without corresponding efficiencies in infrastructure, e.g. legacy networks often continue to be run in parallel with next gen implementations. Accounting for the beneficial impact of the abatement in carbon emissions delivered by the expected deployment of digital technology, the sector is expected to deliver emissions savings estimated to be seven times the growth in its own footprint between 2019 and 2030.

The potential impact of action to reduce ICT emissions and enhance the ICT impact on emissions in the wider economy can be illustrated by considering a scenario for more ambitious decarbonisation. This scenario envisages action from policymakers to reduce energy consumption; the energy sector decarbonising in line with more ambitious IEA scenarios; the telecoms sector and its manufacturing supply chain acting to arrest the rise in network energy consumption; and the ICT sector in general working with its stakeholders to drive adoption of the various use cases that diminish emissions to 100% take-up. In this scenario, the sector GHG footprint would fall by 70 Mt CO2, instead of rising, and ICT use cases would enable a further 3.5 Gt CO2e in emissions abatement. The overall ICT-enabled reduction in emissions would be nearly 3.6 Gt CO2e, which is equivalent to 9% of projected world GHG emissions in the relevant IEA scenario.

Alongside emissions, the ICT sector must consider the other potential negative externalities of its growth, which include increasing resource consumption, the furthering of inequalities, and anti-social impacts of consumption. Considerations surrounding resource consumption involve the initial mining of both abundant and rare materials, and the impact of further activity across the value chain. Growth of the sector has to date had an inflationary impact on resource consumption, although this could be offset by re-use, recycling, and behaviour changes resulting in less demand for resources. Inequalities can be exacerbated both directly, e.g. through maintaining an unbalanced gender mix in sector employment, and indirectly, e.g. by creating greater divisions between those who have access to digital technologies and those that don't.

Finally, digital technology could also provide a platform for other negative social impacts, such as the adverse impacts on mental health caused by cyberbullying. The global understanding of context, cause, and effect is still evolving in these areas, but digital technologies can undoubtedly be used to ill effect and have unintended negative consequences. Cross-sector commitment and investment is needed to understand how such unintended consequences can be avoided, alongside changes in governance. These actions are crucial in order to ensure the full potential of the ICT sector in driving progress to the 2030 Agenda.

8 Actions to Deliver a SMARTer2030

To maximise the potential of digital technologies and to diminish the downsides, there needs to be a common purpose both within the ICT sector and more widely throughout partner sectors.

Across each of the Goals and through each of the four impact functions, digital technologies can, and do already, contribute by accelerating positive impacts and mitigating negatives. However, as indicated by the forecast numbers weaved throughout this report, a significant challenge remains. On current trajectories, even the expected increases in the adoption of digital technology will not be sufficient to support full realisation of the SDGs by the 2030 target date, especially in regard to the growing crisis associated with climate change.

This report outlines the wide variety of ways in which digital technologies can be deployed to support the achievement of the SDGs, detailed in the chapter on Actions to Deliver a SMARTer2030.

To maximise the potential of digital technologies and to diminish the downsides, there needs to be a common purpose both within the ICT sector and more widely throughout partner sectors. As such, to secure a positive future – one that may be described as a 'SMARTer2030' – this report proposes a small number of universal commitments, together with a set of commitments for the ICT sector and other related stakeholder groups.

To be clear, this is not a request for altruism. This is, rather, a request to recognise the powerful challenges the world faces. To recognise the way those challenges are influencing the stakeholders who dictate the success of the organisations they engage with. A request to understand the need to place societal value at the core of the organisation to secure longer-term success, whatever the nature of your organisation.

Universal commitments

The ICT sector and all stakeholders to **recommit to the common purpose of the SDGs**; understand them; promote them; use them as context to all activity and decision making. Supplement this with a specific commitment to reduce GHGs by 50% by 2030.[2]

Each actor to **call out their own role in delivering the SDGs**; explaining how this is embedded in the business model; how it drives success; and enshrining it as their organisation's purpose.

Embrace the principles of impact transparency and collaboration. Invest in the measurement and management of intended impact called out in the organisational purpose, and communicate progress to all stakeholders. Share knowledge assets and collaborate extensively to further impact.

Drive an **enhanced, organisation-wide understanding of how digital technologies can be deployed for positive impact**, and influence development. Move from digital transformation to purpose-led transformation powered by digital.

ICT Sector specific commitments

Lead on the universal commitments: as a large and influential sector of the global economy, the ICT sector has the opportunity to act as an exemplar; collectively supporting and actively pursuing the 2030 Agenda.

Operate responsibly: ICT companies have a responsibility to call out their commitment to the common purpose, and be seen as the responsible sector, working together to address common environmental, social and governance (ESG) challenges in a comparatively progressive way across all recognised dimensions.

Call out the areas of greatest risk and opportunity: with the help of its trade bodies, the sector should identify, understand, and call out the areas of greatest risk and opportunity in terms of its contribution to the SDGs, beyond operations and through core products and services. For example, the sector should call out the opportunity to eradicate the 'digital divide', and enable the drive towards net zero-carbon through digital technologies to enable greater growth and deployment of renewable energy sources.

Enable the development and deployment of digital technologies in countries without a mature ICT sector: it will be challenging to operate in countries that lack the infrastructure to support a transition to a sustainable, digitally-enabled economy. To drive achievement towards the SDGs, ICT companies should work precompetitively to consider how technology can be deployed in partnership with governments in these countries and how the sector can engage with public policy to address identified critical sustainable development challenges. Underachieving against the central tenet of 'leave no one behind' is a very real threat related to further entrenchment of a digital divide.

Harness its unique role in enabling impact transparency: only digital technology can, at scale, monitor and track how organisations impact the wider world and gather the information required to help them take responsibility for their impact and enable decision making for sustainable development. Indeed, understanding an increasingly connected system is a precondition to understanding what is needed to drive impact. The ICT sector must help organisations understand how to adopt impact transparency as a means of enhancing impact and strengthening business models. This requires new data, massive computing power, and new forms of distribution, deployment, and application.

Urgently seek to decouple economic growth from environmental degradation: the sector will be at risk if it cannot find ways to ensure that the energy required to manage increasing volumes of data transfer and computing power does not further contribute to carbon emissions. Circular economy approaches must be taken forward to ensure that the proliferation of IoT devices and smartphones does not lead to an exponential growth in e-waste and depletion of natural resources. Only by working together with a broad range of stakeholders and investing in better understanding the context, cause, and effects of impact, can the ICT sector ensure that its growth does not hinder, but instead 'turbocharges', sustainable development.

Lead on cyber security and cyber ethics, both individually and collectively: the greater adoption of cognitive technologies and reliance of services on digital infrastructure is associated with increasing existential threats around cyber security and new ethical challenges. ICT companies are frequently the first adopters of new technologies, and thus must ensure they implement exemplary cyber security safeguards into their business practices and services. Collectively, the ICT sector has a critical role to play in working with government to develop cyber security and cyber ethics business norms, standards, and codes of conduct, and lead the way in demonstrating good practice. They have to take responsibility to ensure trust.

Other stakeholder group commitments

Critical stakeholder groups include Governments, NGOs, Institutional Investors, Businesses and Partner sectors, and Citizens. Each group needs to embrace the Universal Commitments, and for each this report proposes some specific additional commitments, with the single most important for each being:

- **Governments:** work with the ICT sector and other stakeholders to develop precompetitive approaches to more equal access to the benefits of digital technology, both inter- and intra-economy;
- **NGOs:** hold stakeholder groups to account for their use of digital technologies, and help form multi-sector partnerships with the ICT sector to drive impact;
- **Institutional Investors:** demand evidence concerning commitment to the 2030 Agenda as well as transparency of impact from investee companies. Utilise the capability of ICT sector to help evolve impact transparency together;
- **Businesses and partner sectors:** deploy digital technologies with an understanding of their impact, and recognise and help manage negative externalities;
- **Citizens:** become educated on the role of digital technologies in the 2030 Agenda, take responsibility for positive and negative impacts of personal usage and use power as a consumer to promote impact.

GeSI's role

GeSI exists to bring the ICT sector together to deliver against a vision of a sustainable world through responsible, ICT-enabled transformation. This means working across the industry and with key stakeholder groups to make Digital with Purpose a reality.

This report has outlined the huge potential for digital technology to contribute to the SDGs, but also the significant gap that still exists for the achievement of the 2030 targets.

To that end, there are a series of next steps that GeSI hopes to progress, with the support of its members on the back of this report.

- **Make the case for the 2030 Agenda:** GeSI will continue to call upon its members and all businesses to commit to the common purpose of the SDGs and recognise the interdependence of a commitment to sustainable development and long-term success.
- **Enable inclusive digital transformation:** GeSI will continue to work with its members and wider stakeholders to identify and plug gaps in the development and deployment of digital infrastructure to enable sustainable development for all and leave no one behind.
- **Understand and address negative externalities:** GeSI will continue to work with its members to understand, in depth, the potential negative impacts of the increased adoption of digital technology and the necessary mitigating actions that will enable the sector to realise a radical ambition to drive the transformation needed to realise the SDGs.

Digital with Purpose - Delivering the SMARTer2030 Agenda: GeSI will continue to work with its members and broader civil society, to address the critical externalities, take forward the opportunities, and address the challenges laid out in this report.


GTS

Case Studies

CASE STUDY

AT&T

Introduction

AT&T is a media and telecommunications company, defined by four key elements: premium content, direct-to-consumer relationships, advertising marketplace, and high-speed networks. The Fortune 10 company's mission is 'to inspire human progress through the power of communication and entertainment'.[1]

AT&T has a well-developed approach to sustainability that is becoming increasingly important to its operations, its product and services, and the way it projects itself. Climate change is a particularly important theme within its broader sustainability agenda and in 2018 it was one of the largest corporate purchasers of renewable energy in the US.[2]

As part of its commitment to sustainable development, AT&T has now set a 10x goal to enable carbon savings of ten times the footprint of their operations by the end of 2025. In order to meet this goal, the company is focusing on improving the efficiency of its network and providing technology solutions to help AT&T customers reduce their own carbon footprint. AT&T has further collaborated with other companies to offer innovative, carbon-saving technologies that can have broad and meaningful impact across multiple SDGs, including SDG 7 and SDG 13.

At the end of 2018, AT&T's technology solutions enabled GHG reductions of over 17 million tonnes of CO_2e whilst its carbon footprint was under eight million tonnes of CO_2e, putting their 10x factor at 2.2x.[3] Encouraged by this progress, AT&T is confident that they can meet their 10x goal by 2025, whilst recognising a number of key trends that will play an important role to help meet their target.[4] To manage the GHG footprint of their operations, they have identified improving electricity efficiency in buildings and their network and investing in fuel-efficient vehicles as key focus points. AT&T also plans to further develop their recent renewable energy efforts; in 2018 they committed to delivering up to 820 megawatts of clean wind energy to the American power grid and will continue to invest in more large-scale renewable energy projects in the future.

To unlock new potential for GHG reduction, AT&T expects further technology advancement in areas such as 5G and IoT that will enable impact in emissions-intensive industries, such as energy, manufacturing and transportation.

AT&T has used IoT connectivity to enable more resource-efficient operations and to implement and scale carbon-saving solutions across a broad range of sectors:[5]

- **IoT-enabled building energy management systems:** AT&T IoT connectivity improves visibility of building equipment, allowing for preventative maintenance and proactive responses to reduce energy and carbon footprint.
- **Smart irrigation:** AT&T IoT connectivity enables a more efficient smart irrigation system which could reduce water- and energy usage as well as GHG emissions.
- **Energy-efficient frozen food:** AT&T IoT connectivity is being used to optimise the energy performance of cold storage facilities in order to reduce energy consumption and related GHG emissions.

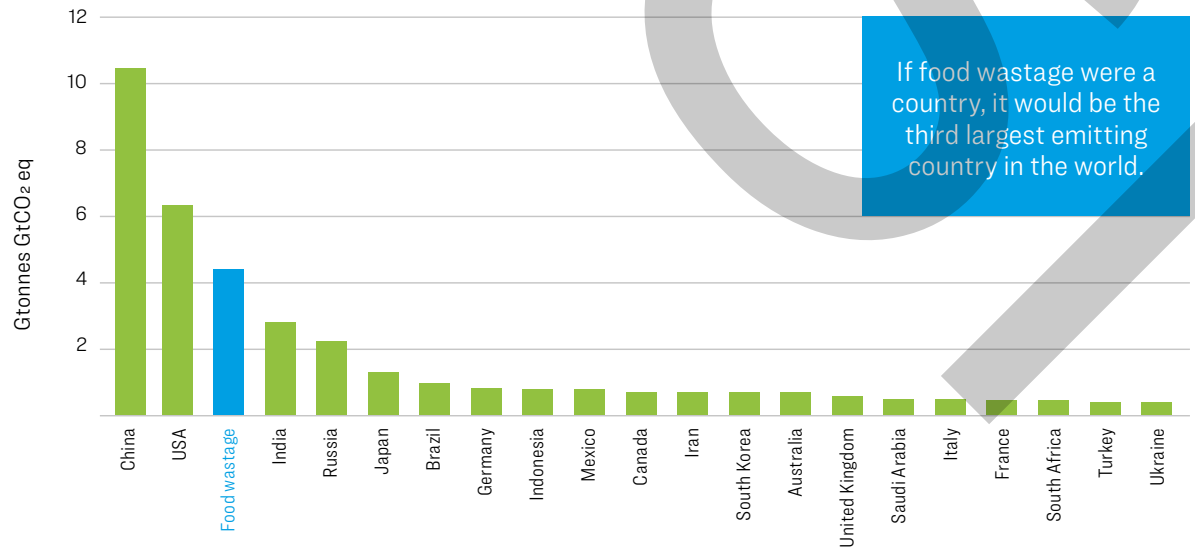
CASE STUDY

Use case – Grind2Energy[6]

The UN Food & Agriculture Organisation (FAO) reports that the total carbon footprint of food waste is around 4.4 billion tonnes of CO2 per year, which is more GHG emitted by any single country except for the US and China. With more than 1.3 billion tonnes of food lost or wasted every year,[7] AT&T has implemented several core elements of AT&T technology into Emerson's Grind2Energy to offer a solution that contributes to the targets of SDGs 2, 7, 11, 12 and 13. Collaboration between AT&T and Emerson has been critical in delivering a solution that produces impact.

Emerson's industrial food grinder converts food waste from grocery stores and restaurants into electricity or heat and fertiliser. AT&T connectivity helps to optimise the performance of this waste-to-energy generation system and eliminate GHG emissions associated with food waste in landfills, instead producing low-carbon energy sources. It also enables customers to optimise their waste pick-up process by presenting real-time data in a dashboard making it easy to manage and take meaningful action.

Total GHGs emissions excluding Land Use, Land-Use Change, and Forestry Top 20 of countries (year 2011) vs. Food wastage



Source: WRI's Climate Data Explorer (4)

CASE STUDY

SDG Benefits

AT&T's solution has had a positive contribution to several of the SDGs.[8]

SDG 7: Affordable and Clean energy

In one year, an estimated 6,700 tonnes of food waste have been diverted from landfills, generating 1.3 million kWh of clean electricity, which would be enough electricity to power 125 homes for a year.

SDG 13: Climate Change

GHG emissions from the landfill were reduced by an estimated 5,000 tonnes of CO2e, which is the same as not consuming 570,000 gallons of gasoline. This translates as 84 tonnes CO2e abated per site.

SDG 11: Sustainable Cities and Communities

This solution helps to reduce the environmental footprint of cities with a focus on reducing urban waste. With the implementation of this technology in restaurants, grocery stores and stadiums, the resource efficiency of buildings can be improved which can go hand in hand with another of AT&T's technologies – the IoT-enabled Building Energy Management System.

Other impacts

This solution also contributes to SDG 2, Zero Hunger, by ensuring a sustainable food production system that minimises food loss. Leveraging this technology can also reduce pollution and waste generation which can help to 'halve per capita global food waste at the retail and consumer levels', a specific target of SDG 12.

Design

The process begins with industrial strength food waste grinders that are able to process the food into a liquid nutrient-rich slurry, pumping it into holding tanks that are then transported to waste management facilities. At this stage, the methane-generating waste is converted into biogas, a source of sustainable energy and fertiliser by anaerobic digesters.

The system utilises 16 industrial IoT sensors that give customers near real-time visibility to monitor and track key performance indicators of their food waste management system. For example, these sensors trigger alerts if the equipment is not functioning properly and when the tank is nearly full so that a truck can be dispatched for pickup. By incorporating IoT connectivity, more real-time data can be measured and therefore greater improvements can be made.

In particular, the increased visibility associated with IoT optimises the system performance in the following ways:

- **Maintenance:** remote monitor systems with built-in alerts allow information to be shared on equipment which isn't working properly or is broken, helping to prevent the pile up of waste and reducing the need for technician trips which can create more emissions.
- **As-needed hauling:** the frequency of pick-ups can be optimised by the capacity to monitor tank level and volume data in real time, reducing the emissions associated with truck transportation of waste.
- **Getting the mix right:** the system is able to track the flow rate and velocity of the slurry and adjust the water if needed to ensure optimal consistency for the anaerobic digesters to work efficiently.

User stories

The Grind2Energy system, enabled by AT&T IoT technology, is being used by US universities. The University of Notre Dame, Indiana,[9] for example, has incorporated Grind2Energy at its Centre of Culinary Excellence (CCE), as well as in its two dining halls, capturing up to 99% of food waste from the CCE and reducing campus-wide waste by 10%, equivalent to over 300 tonnes of waste annually.[10] This translates to saving nearly 40 tonnes of emissions annually.

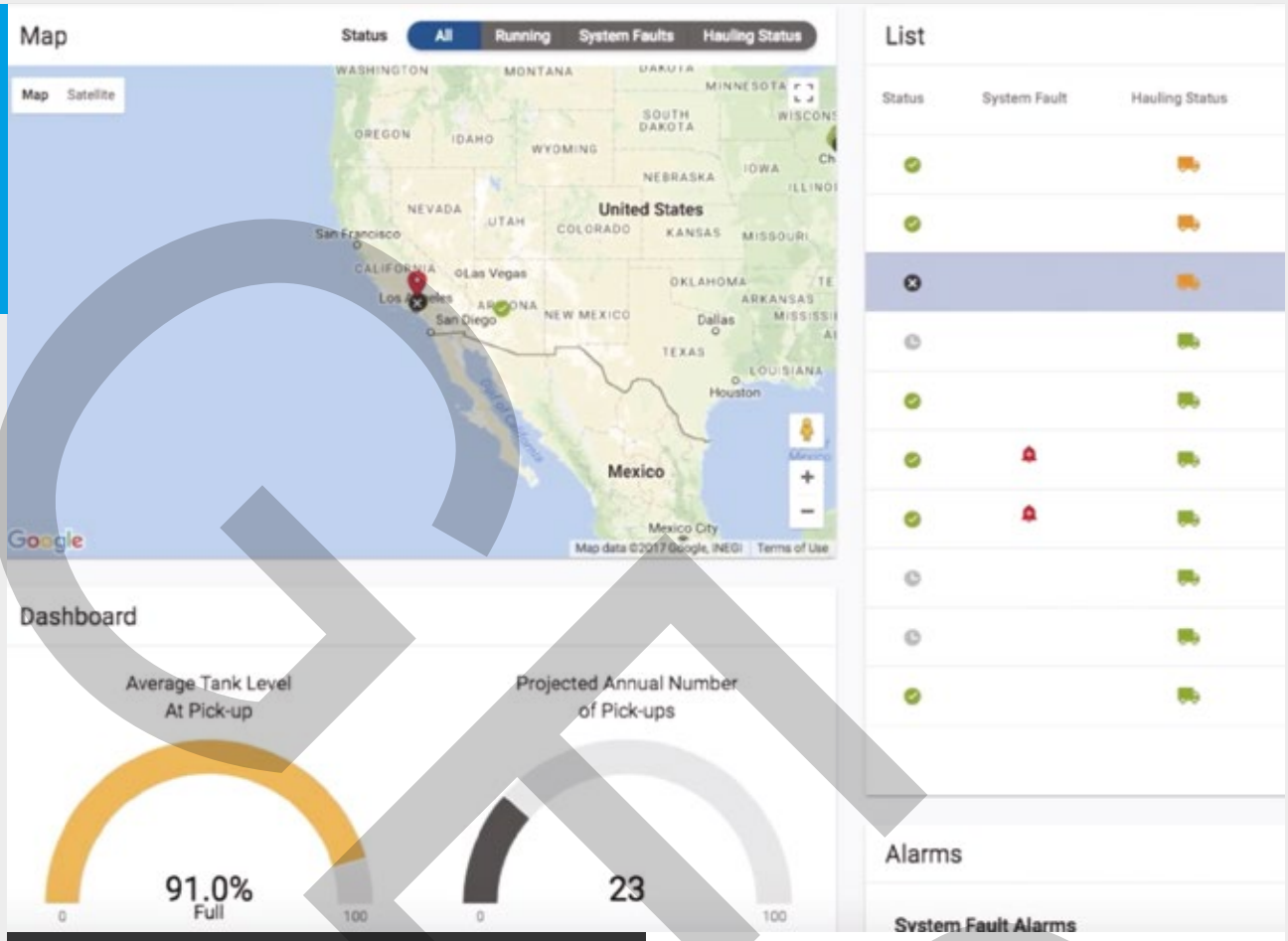
The system at the CCE was installed in January 2019 and in the dining halls in May 2019. By mid-2019 over 50 tonnes of food waste had already been diverted from these locations while creating over 10,000 kWh of electricity. This electricity generation and emissions reduction is equivalent to powering 12 homes for one month or 95,000 fewer vehicle miles driven.

Grind2Energy is currently utilised in back-of-house operations. However, the University hopes to expand use of the system further across the campus.

Scaling

Emerson introduced Grind2Energy in 2012 and started to collaborate with AT&T in 2016 to improve efficiency and scale its operations. Grind2Energy is now installed at grocery stores, restaurants and stadiums across the US, and AT&T has also recently installed this technology-enabled solution at their campus in El Segundo, California, to improve their own operations. AT&T is now working to increase adoption, by further implementing IoT technology to reduce Grind2Energy's operational costs in order to make the system more price-competitive. By increasing the application and usage of the Grind2Energy solution in the marketplace, AT&T can play an important role in helping customers to improve the sustainability of their actions.

CASE STUDY



> " Before we had the IoT, we physically had to send somebody out to tables in the markets, open up the control panel, pull the data down. Everything was manual. Now, we can see how the systems are performing and track the data so much more easily."
>
> — Doug Brokaw, director of sales, Grind2Energy

Wrap Up

With increased awareness of the need for sustainable development and given that the average price of transportation to landfills has increased almost 17% from 2010-2017[11] and is expected to rise further,[12] there is great potential for widespread usage of this technology in the marketplace to generate carbon savings and have real, meaningful impact on the SDGs.

This initiative, enabled by IoT, has had a clear contribution to the 10x goal and more widely to the SDGs having generated 1.3 million kWh of clean electricity and producing a carbon abatement factor of 84 tonnes CO2e per site.

> " Making a difference in the communities where we live and work is a core value for AT&T. That's why we are at the forefront of using innovative technologies – from IoT and 5G to the Grind2Energy solution and beyond – to help transform the lives of people around the world and protect our planet."
>
> – Lori Lee, CEO AT&T Latin America and Global Marketing Officer

CASE STUDY

Deutsche Telekom

Introduction

Deutsche Telekom, present in more than 50 countries, is one of the world's leading integrated telecommunications companies, with 178 million mobile customers, 28 million fixed-network lines, and 20 million broadband lines. The company provides fixed-network/broadband, mobile communications, internet, and IPTV products and services for consumers. Deutsche Telekom also offers T-Systems, present in more than 20 countries, which provides integrated ICT solutions for business and corporate customers. T-Systems solutions include the secure operation of legacy systems, transformation to cloud-based services and innovation projects in areas such as data analytics, the Internet of Things, machine-to-machine communication and Industrial Internet.

Deutsche Telekom is committed to operating in a socially and environmentally responsible way, with a focus on CO2 emissions reduction, the circular economy, and expansion of broadband access. It also offers products and services that support a sustainable lifestyle and contribute to the SDGs.

The company's network infrastructure offers the technological foundation for innovational solutions to social and environmental challenges, and thus it makes the biggest contribution to SDG 9: Industry, Infrastructure and Innovation. However, many of its other products and services contribute to additional SDGs, including:

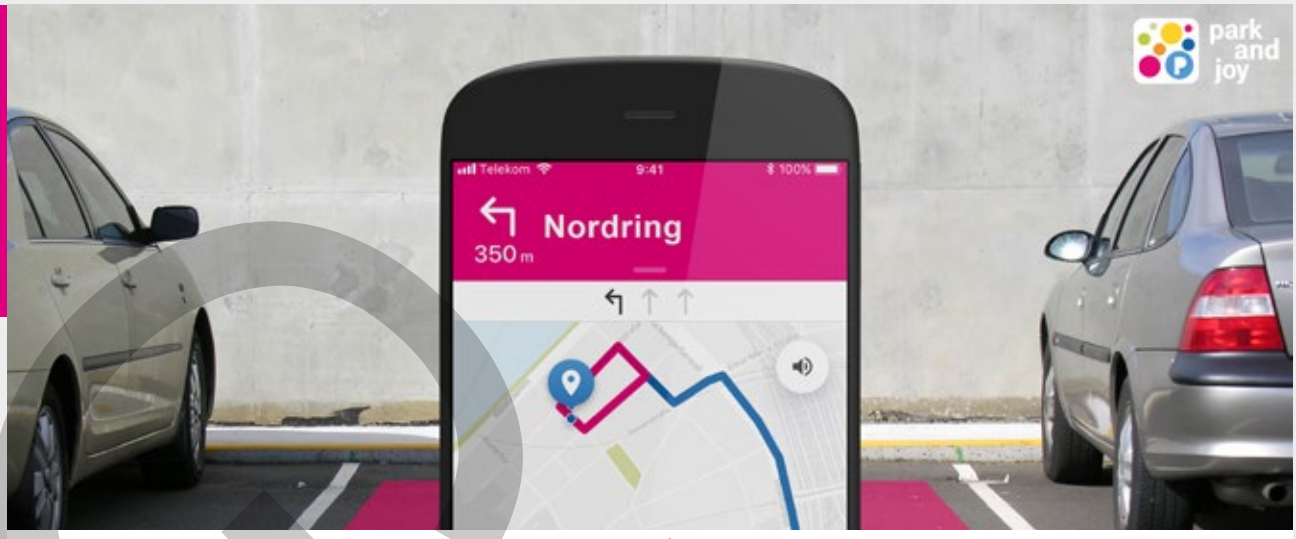
- E-health services that help improve medical care (SDG 3);
- Broadband expansion that gives many people access to digital educational media (SDG 4);
- Cloud solutions that reduce energy consumption and emissions (SDG 12 and 13);
- Smart home solutions that reduce energy consumption in the home (SDG 7 and 13);
- And, a range of Smart City solutions that reduce traffic, optimise street lighting and increase security in cities (SDG 11). One of these solutions, Park and Joy, is already having a demonstrable impact on traffic, congestion and emissions reduction within cities in Germany.

Park and Joy

Cities around the world are suffering from the effects of rising air pollution and carbon emissions. In cities, transport is often the main source of air pollution and emissions,[1] and traffic pollution problems are worsening world-wide, due to an increased number of cars on the road and limited ability to manage urban traffic flow and congestion.[2] Around 30% of urban traffic is caused by drivers searching for parking spaces, with drivers taking an average of 20 minutes to find a space – causing an additional CO2 output of 1.3 kg per search.[3]

Deutsche Telekom developed its mobile application, Park and Joy, to overcome the issue of urban traffic congestion caused by drivers searching for parking spaces. Park and Joy is a digital parking service that provides drivers with a seamless, end-to-end parking experience, allowing users to easily and conveniently find, park and pay for their parking space – all in 2 clicks. Park and Joy uses a combination of mobile data analytics and data from in-road IoT sensors to provide drivers with accurate, real-time information on available spaces, as well as optimised routing towards their chosen space. Park and Joy saves a large amount of time spent finding and driving towards parking spaces, and reduces urban congestion, air pollution and emissions. Park and Joy was piloted in the German city of Hamburg, and is now being rolled out to over 80 cities across Germany.

CASE STUDY



SDG Benefits

Park and Joy positively contributes to a number of SDGs, primarily SDG 11: Sustainable Cities and Communities and SDG 13: Climate Action.

SDG 11: Sustainable Cities and Communities

As Park and Joy is a digital parking service for urban areas, its primary impact relates to SDG 11, particularly Target 11.6: "By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality…" and Target 11.2 "By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all."

Frauenhof based researchers conducted a year-long study on Park and Joy's impact on urban traffic and air pollution in Hamburg, Germany, where the app was on trial. They found that with Park and Joy, parking search distance travelled per car reduced from an average of 1,396 metres to 521 metres – a reduction of 875 metres. Taking into account the carbon footprint of server and sensor production, installation and life cycle, as well as car emissions per kilometre, they also found that Park and Joy saves up to 240g of CO2 and 231mg of NOx per parking procedure, equivalent to a reduction in CO2 and NOx emissions of up to 63%. Park and Joy also helps prevent traffic jams and congestion caused by cars searching and idling in wait of parking spaces, again reducing urban air pollution.

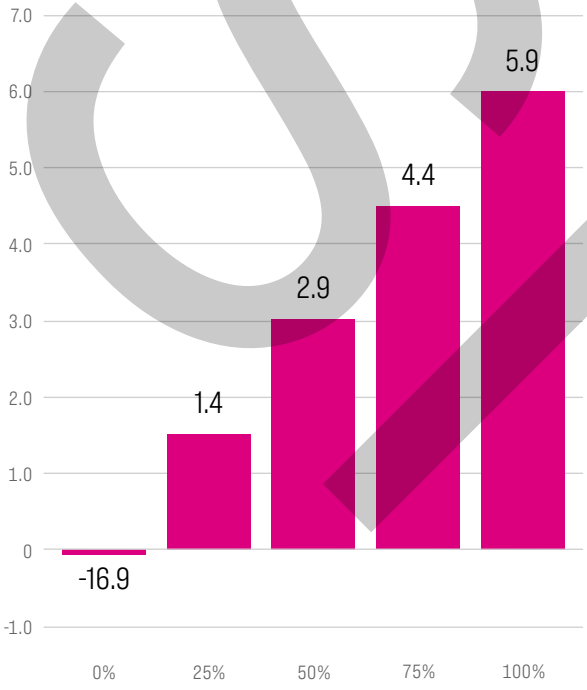
SDG 13: Climate Action

Since Park and Joy reduces the amount of harmful greenhouse gas emissions released into the atmosphere, it also positively impacts SDG 13: to take urgent action on climate change.

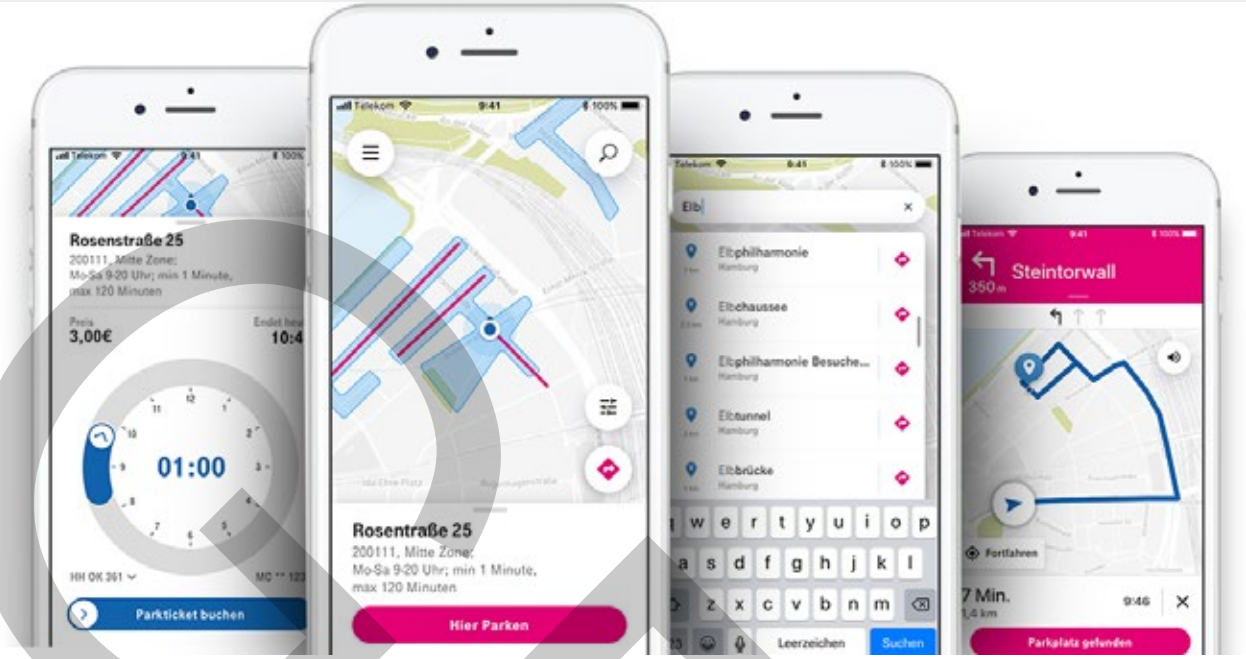
The researchers extrapolated the above data for 80 cities in Germany, each with a population of over 100,000 and together holding around 160,000 parking spots. Again, taking into account the carbon footprint of server and sensor production, installation and life cycle, and car emissions per kilometre, and under the assumption of 100% market penetration, they calculated an emissions savings potential of up to 84,000 tonnes of CO2 and 81 tonnes of NOx per year. The reduction that can potentially be achieved with Park and Joy strongly scales with the number of users of the service, and infrastructure has already amortised its emissions footprint at only 0.1% market penetration.

CO2 Savings through Park & Joy per year (Depending on market penetration)

(Kg CO2e per year) millions



CASE STUDY



Other impacts

A reduction in urban air pollution also contributes to SDG 3: Good Health and Well-being, as air pollution is associated with a number of health impacts, including lung cancer, stroke, heart disease and chronic obstructive pulmonary disease.[4] Park and Joy contributes specifically to Target 3.9 "By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination." Park and Joy also contributes to the ethos of SDG 12: Responsible Consumption and Production, through encouraging resource-use efficiency. Since Park and Joy promotes well-managed parking processes and allows local government agencies to increase their revenue from parking charges, the app also contributes to SDG 16: Peace, Justice and Strong Institutions.

How it works

In designing Park and Joy, Deutsche Telekom first considered the customer voice. When Deutsche Telekom asked customers what they would value the most from a digital parking services app, the two top priorities were a prediction of public parking availability and a real-time view of parking spaces currently available. So, Deutsche Telekom embarked on designing Park and Joy in order to do just that: to provide accurate, real-time information on parking space availability, and enable users to find, park and pay for a space of their choice at an affordable price.

Deutsche Telekom designed and trialled Park and Joy in the German city of Hamburg. Available geospatial data was first examined, e.g. data from Google Earth and data on the movement of mobile phone users. From these datasets, the app was able to predict parking space availability with up to 80% accuracy. However, 80% - despite being better than the pre Park and Joy average of 30% - was not good enough. If a Park and Joy customer experienced a wrong result that often, they could quickly stop using the app.

In order to increase accuracy, Deutsche Telekom installed in-road IoT sensors able to detect if a parking space was occupied or not. Due to the amount of data already available, the company only needed to install a few sensors per street, not on all parking spots, in order to get a more accurate and real-time picture of parking space availability. The IoT sensors increase the accuracy of parking spot availability predictions to 94-96%. Most sensors only send information on if the space is occupied or not, in order to maximise sensor battery longevity and reduce e-waste. However, in special cases (like handicapped parking) the sensors can also detect if the parking space user actually has handicap privileges. In addition to the data analytics and IoT sensors, Deutsche Telekom uses an AI-driven model to identify unusual occurrences in the city that are affecting parking space availability.

The combination of data analytics and IoT sensors makes it possible for Park and Joy app users to perform a targeted parking space search in an area of their choice, quickly find a suitable free parking space, and navigate towards it. Park and Joy users can also use the app to easily pay for parking, and to remotely top up length of park and payment.[5] Deutsche Telekom and T-Systems have been able to provide the entire solution – consisting of the Park and Joy app, infrastructure, platform, connectivity and rollout. The high computing power, which can be scaled even further, comes from a high-security cloud.[6]

CASE STUDY

User stories

A number of German cities have now rolled out Park and Joy, and some opinions of the app include:

Cottbus – formerly focussed around coal mining, is beginning to restructure into a modern day city.

"For the city Cottbus, Park and Joy is an essential project to digitalise the infrastructure, which makes our city more attractive to residents and visitors. At the same time, a high amount of emissions caused by parking search traffic can be prevented."
- Mr. Holger Kelch, The Mayor of Cottbus

Dortmund – wants to be a leading smart city, with a focus on open data collection to enable mobility.

"Our cities are becoming more navigable, with less emissions and more connectivity between modes of transport. Above all, our goal is to make our cities more liveable for people. Digital technology can help us with that. For example, smart parking solutions based on available data and intelligent algorithms reduce traffic, improve transparency for citizens and not only improve the efficiency of parking, but bring a creative solution into daily life."
- Dr. Jan Fritz Rettberg, Chief Innovation Officer, City of Dortmund

Tübingen – a green party leads Tübingen city council, and therefore the city has a large focus on reducing the city's environmental impact.

"Traffic caused by searching for a parking place is a major disruptive factor in inner cities. If it were possible to avoid the resulting detours, it would be an improvement in quality of life for all and a benefit to the environment. In Tübingen, we therefore want to provide real-time information about free and occupied parking spaces in the centre, through solutions such as Park and Joy."
- Mr. Boris Palmer, Mayor of Tübingen

Moers

"The city of Moers wants to analyse the parking situation more intelligently. Only with this analysis, we succeed in avoiding unnecessary emissions through parking search traffic. For us, this is also an important contribution to reducing the environmental impact and relieving the burden on our road network. And of course, an intelligent parking system protects the nerves of motorists."
- Christoph Fleischhauer, Mayor of Moers

Scaling

Park and Joy is currently aimed at individual consumers. However, Deutsche Telekom has plans to move into preparing dashboards for city administrators so they can have a real-time traffic map of their cities, in order to improve traffic control and give cities an idea of where they could reduce parking spots or convert unneeded parking spots into bike parking. The ultimate goal for Deutsche Telekom is intermodality – the inclusion of public and different types of transport (i.e. bikes) in the same service, to reduce overall use of and need for cars in the first place.

Park and Joy already has thousands of users in Hamburg, and is continuing to scale in Hamburg itself, with Deutsche Telekom aiming to install an additional 1,000 sensors across the city and integrate public transport information into the app.[7] Park and Joy is also being rolled out to over 80 additional cities in Germany. Outside of Germany, Deutsche Telekom has emerging partnerships with its first city in Europe, but its vision is much bigger. The company believes that it can help cities around the world to better understand parking, not just by rolling out the Park and Joy app, but by sharing the AI models that have been built around it. Deutsche Telekom wants to leverage its work to help other cities improve their own data models. By improving everyone's data models, it will be able to achieve maximum impact on 'parking prognosis', mobility, and the environment.

Deutsche Telekom also expects to scale its impact through partnerships with car manufacturers, in order to be able to capture data from parking sensors directly into the on-board dashboards of cars. The company is also looking to combine its sources of data with data from the cars to build new models of parking availability. The company expects that this can be done even without installing IoT sensors in city streets.

Looking forward

Deutsche Telekom is open to discussing its models with all cities and believes it can help in all situations. The company ideally wants to work worldwide in order to achieve a global positive impact. The company sees Park and Joy as the 'proof-point' that systems such as this can have a big effect, and so is open to sharing its knowledge with any cities, mayors, town planners, traffic and street management officials and Chief Digital Officers who are interested.

CASE STUDY

Introduction

EIT Climate-KIC is a knowledge and innovation community, supported by the European Union and established in 2010.[1] It brings together diverse actors including cities, NGOs, think tanks, researchers, educators, entrepreneurs, and innovators to catalyse the system transformation needed to achieve a prosperous, inclusive, and sustainable climate-resilient society through innovation.[2]

The convening power of EIT Climate-KIC means partners across business, academia, cities and non-profits can join together to create networks of expertise, researching and innovating together.[3] Over 400 formal organisational partners across 25 countries are involved, making it Europe's largest public-private organisation with the purpose of catalysing systemic change in areas of human activity that have a critical impact on GHG emissions and resilience, e.g. cities, land use, materials and finance.[4]

EIT Climate-KIC has almost a decade of successful climate innovation experience illustrated by a range of education programmes that empower participants with knowledge and best practice. EIT Climate-KIC also runs a successful accelerator programme supporting entrepreneurs to transform their ideas into climate-positive businesses.[5] So far, over 1,400 climate-positive companies have been incubated, raising over €930 million in external investment, and creating over 2,000 full time jobs.[6] Additionally, EIT Climate-KIC has leveraged €3.4 billion of private finance for its full range of innovation activities in policy, education, urban transformation, materials, finance, agriculture and forestry.

EIT Climate-KIC takes a system innovation approach to incubation, to make integrated, co-ordinated interventions in economic, political and social systems along whole value chains. The innovation experiments are discrete, but assessed in terms of their individual contribution to EIT Climate-KIC's missions, and their synergies with other activities in the portfolio to drive wider change. Innovation experiments are triggered in response to the identification of problems by cities, industry, investors, governments, or citizens. EIT Climate-KIC is then able to connect the demand for solutions with a supply of innovative ideas through providing the funding and support required to scale.

One example of the EIT Climate-KIC innovation approach is described alongside, demonstrating the powerful impact digital technologies can have on achieving the 2030 Agenda. WINnERs is an established example of how digital access enables new business models. It improves the resilience of agriculture practice by incentivising small-scale farmers in Africa to change their traditional farming patterns.

CASE STUDY

WINnERs

WINnERs (Weather Index based Risk Services) offers risk management services to create sustainable supply chains from the smallholder to the global retailer in food production and supply chain operations. The project models weather and climate risk exposure through state-of-the-art technology, investing in smallholder farmers to improve farming practices and creditworthiness, sharing risk across supply chain actors with weather and climate index-based insurance services, and promoting supportive regulatory environments for insurance products in developing countries.

Smallholder farmers typically have been unable to create long-term deals with buyers, as they cannot guarantee crop yield year-on-year. This is due to factors such as weather disruption, poor environmental conditions and a lack of capital to purchase fertilisers and pesticides to improve the likelihood of a successful crop. Farmers are often unable to access finance to break out of this cycle.

At the farm level, the likelihood of an extreme weather event and its severity can be predicted across areas as small as 5km2. This information is then integrated into agricultural insurance contracts that share risk between the various actors of a particular supply chain.

The project also focuses on improving the well-being of smallholder farmers who often bear the brunt of the risk when it comes to farming. WINnERS partnered with the WFP Farm to Market Alliance to offer its services, improved inputs, training, finance and guaranteed market access, to participating farmers' organisations. Insurance contracts are established between farmers, traders and end-buyers, rather than the traditional model of farmers being linked only to traders. International buyers are the ultimate policy holders, instead of individual smallholders, which can reduce farmers' risk and expand reach. Offering insurance to connect these previously unconnected parties increases trade and improves the efficiency of the global agricultural market. The new business model therefore improves the resilience of the entire value chain.

EIT Climate-KIC contributed to WINnERs through funding and incubation support, helping with prototype finalisation, product implantation, and impact studies. The scheme was first rolled out in 2016 in Tanzania[7] where insurance has reached 25,000 farmers, and has since expanded to other countries including Zimbabwe, Uganda and Ghana.[8] The programme has been so successful that the United Nations World Food Programme has been able to buy at least $120 million agricultural product each year from smallholder farmers.[9]

CASE STUDY

SDG Benefits

Although WINnERs delivers systemic transformation in the agriculture sector (SDG 2), the solution has positive contributions to several other SDGs, given that some of the world's most abject poverty is concentrated in farming communities.[10]

SDG 2: Zero Hunger

By guaranteeing an income for farming communities, WINnERs will help end hunger and ensure access to sufficient food throughout the year for those in vulnerable situations, reducing malnutrition and ensuring the sustainability of food production systems.

SDG 1: No Poverty

WINnERs will help reduce extreme poverty through provision of a more stable income, acting as a social protection system, and ensuring access to the basic financial services required to improving economic standing.

SDG 8: Decent Work and Economic Growth

Imperial College London estimates the project will contribute 2% to Tanzanian GDP through increasing maize production, and across sub-Saharan Africa the impact on maize yield is projected to improve GDP by 2.6%, equating to an approximate economic benefit of $62.9 billion.[11]

CASE STUDY

How it works

The key underlying innovation in the WINnERS project is the creation of a weather index-based risk service which offers insurance to farmers and global food buyers against weather and climate-driven risks.

There are multiple elements leading to the index-based risk service in the WINnERs programme that include:

- Specialist tools, e.g. machine learning, are used to collect and analyse climate data to predict the likelihood of extreme weather events occurring in small geographic areas up to 5km2
- Crop modelling simulations translate weather data into agricultural risks, such as drought and crop yield loss[12]
- Agricultural risk data is used to build insurance contracts to ensure weather and climate risks are fairly distributed across the supply chain, to outline incentives to actors for establishing long-term relationships. The contracts trigger individual relationships amongst buyers and single farms, which means the risk of crop loss is then shared[13]
- Impact assessments. Researchers seek to measure the impact of the WINnERS projects on the well-being of participating small holder farmers[14]
- New insurance frameworks. Researchers ensure insurance frameworks are contracted, regulated and supervised.

Scaling

WINnERs is planning rapid expansion. In 2019, the project secured over €1.5 million in funding from the Climate Resilience Fund and the African Development Bank.[15] The fund will go towards improving the financial inclusion of women in Tanzania, and to expanding the geographical reach of WINnERS. By 2022, the programme aims to roll out schemes across an additional 10 African countries.

WINnERs has had a direct positive impact on thousands of farming households across Sub-Saharan Africa[16]:

"I think all crops should be backed by this kind of insurance because it is a game changer. Farmers will be sure of borrowing each year"

- Alex Mubiru, Country Manager Tanzania, African Development Bank.

Source – The Citizen, 30 July 2019, Dar Es Salam

CASE STUDY

Introduction

T-Mobile is a mobile telecommunications company, providing wireless voice and data services. The firm is redefining the way consumers and businesses buy wireless services through leading product and service innovation. Through its Un-carrier campaign, T-Mobile has laid out a strategy focused on customer experience, a culture that values diversity and inclusion, and a responsibility for communities and the environment. The company is leading the rollout of 5G networks throughout the US by building its network and expanding its coverage year on year.

T-Mobile is committed to making sustainability a fundamental part of its strategy, culture and activities, and has committed to use 100% renewable energy for all its operations by 2021. This commitment is the driving force behind the company reaching an ambitious carbon emission reduction target, alongside implementing energy-efficiency savings in facilities and networks.

According to Chad Wilkerson, Director of Sustainability & Infrastructure Sourcing at T-Mobile, T-Mobile's focus on sustainability is not solely "on buying green energy, but [on] taking a whole-systems approach to sustainability".[1]

CASE STUDY

T-Mobile's second wind farm, Solomon Forks, located in Colby KS and operated by ENGIE US Wind

Sustainability strategy for 2021

As part of their commitment to sustainability, in 2018 T-Mobile became the first telecommunications company to join RE100, a collaborative, global initiative uniting more than 100 influential businesses working to massively increase demand for, and delivery of, renewable energy. Organisations joining RE100 commit to a public goal of sourcing 100% of their global electricity consumption from renewable sources by a specified year. T-Mobile has now committed to using 100% renewable energy by 2021, disclosing its progress annually.[2]

The company's commitment to 100% renewable energy usage and minimising its ecological footprint through a systems-approach to sustainability has manifested in four broad areas: (i) renewable energy, (ii) efficient networks and operations (iii) device recycling and waste reduction and (iv) sustainable employee practices and facilities.

i. Renewable energy

T-Mobile has a number of initiatives to reduce the carbon footprint of its operations. Central to this aim is its portfolio approach to its renewable energy program, with an energy mix of several wind and solar projects through a power purchasing agreement (PPA) financial structure. In 2019, T-Mobile reduced emissions by over 300,000 metric tons through a wind farm project in Oklahoma, and combined with a similar wind farm in Kansas, added 320MW of new green energy capacity, accounting for a projected 41% of total energy needs by its goal year of 2021.

The company has also pursued a portfolio approach to its renewable energy programme. In addition to the two large wind farm projects it has added to its energy mix several solar projects through the PPA financial structure. It has also diversified its project size and locations. While the company started with wind projects based in the centre of the country in the 150MW range, T-Mobile has since worked on solar projects that range from 15MW-250MW, from Texas to Virginia.

Additionally, T-Mobile through the Puget Sound Energy "Green Direct program", is powering its Bellevue, Washington headquarters with 100% renewable energy, whilst its data centres in Wenatchee, Washington are consuming 100% hydro-electricity. By 2021, T-Mobile plans to use over 3,000 GWh of renewable energy annually, utilising over 900MW of renewable energy capacity.

CASE STUDY

ii. Efficient networks and operations

To reduce its carbon footprint further, T-Mobile undertook in-depth research and built capabilities to boost energy efficiency and reduce energy usage across the entire business, prioritising the optimisation of its network's operations. Even though data flowing through T-Mobile's network has increased by over 49 times in the last six years, using energy-efficient technologies has allowed its energy intensity to decline by 97%.

Efficiency gains in cell towers have been made primarily through improvements in heating and cooling. By implementing new methods of efficiently controlling the on-site temperature of cell towers, T-Mobile is reducing the amount of propane, diesel and electricity needed for power. Other innovations in lighting controls, power factor improvements and on-site solar technology are continuously being developed to improve the performance and reliability of cellular equipment.

iii. Device recycling and waste reduction

T-Mobile delivers substantial positive ecological impact by incorporating sustainability into the management of the electronic devices of its customers. Of the 3.9 million used devices and accessories collected by T-Mobile in 2018, T-Mobile reused or resold 96% of the hardware. The remaining 4% is responsibly recycled by its partners. As a result of this effort, over 14 million customer devices have been reused or resold since the programme's inception in 2008. For every one million devices that are recycled, 35,284 pounds of copper, 772 pounds of silver, 75 pounds of gold and 33 pounds of palladium are recovered which can be used again in new devices, preventing over-extraction.

Beyond recycling consumer phones, T-Mobile reduces material waste in its own operations. Over 86% of its customers are billed online, saving natural resources by decreasing paper use. T-Mobile is also minimising its environmental footprint by recycling or composting waste produced by its headquarters, annually downsizing on printers, and eliminating paper cup use from many of its customer care centres.

iv. Sustainable employee practices and facilities

T-Mobile is committed to ensuring its sustainable internal practices extend to its workforce. It encourages carpooling and energy-efficient commuting by providing location-specific benefits to its employees. T-Mobile also offsets the carbon impact of its air travel, by working on a reforestation project that supports reforestation in Haiti and Madagascar – an effort that has resulted in more than 1.2 million trees planted to date. T-Mobile has also collaborated with the Nature Conservancy for the #TreeMobile campaign, which donated enough to plant more than 300,000 trees in locations in North America, Latin America and Asia.[3]

Finally, T-Mobile is showcasing its commitment to sustainability at its corporate headquarters where it has achieved LEED Certification from the U.S. Green Building Council on one of its buildings and it is pursuing a certification for a second building.

CASE STUDY

SDG Benefits

T-Mobile's sustainability strategy has direct positive impacts on the 2030 Agenda:

SDG 3: Good health and well-being

Using less diesel and other non-renewable energy sources in radio cell towers emits fewer pollutants into the air, reducing respiratory infections and contributing towards SDG 3.

SDG 7: Affordable and clean energy

T-Mobile directly supports SDG 7 with its transition to 100% renewable energy usage, for example by signing long-term PPAs to power its facilities and operations with a portfolio of green energy including wind, solar, and hydroelectricity and increasing the energy efficiency of its business operations.

SDG 11: Sustainable cities and communities

With device recycling in all stores, a number of LEED Certified buildings, lowered emissions and pollutants from cell towers and a long-term PPA with local Puget Sound Energy Green Direct energy deal to power its headquarters, T-Mobile is doing its part to create more sustainable cities in all the locations where it operates.

SDG 12: Ensure sustainable consumption

Reusing precious metals in old phones prevents the unnecessary extraction of additional resources, and the emission of GHGs. Additionally selling over three million used devices annually, reducing thousands of tonnes of waste through recycling and composting and eliminating unnecessary plastic in packaging are examples of responsible production and consumption, contributing to the goal of a circular economy and supporting SDG 12.

SDG 13: Climate action

By transitioning to 100% renewable energy, T-Mobile directly answers the call of SDG 13.

T-Mobile is committed to making sustainability a fundamental part of its strategy, culture and activities, and has committed to use 100% renewable energy for all its operations by 2021.

CASE STUDY

verizon

Introduction

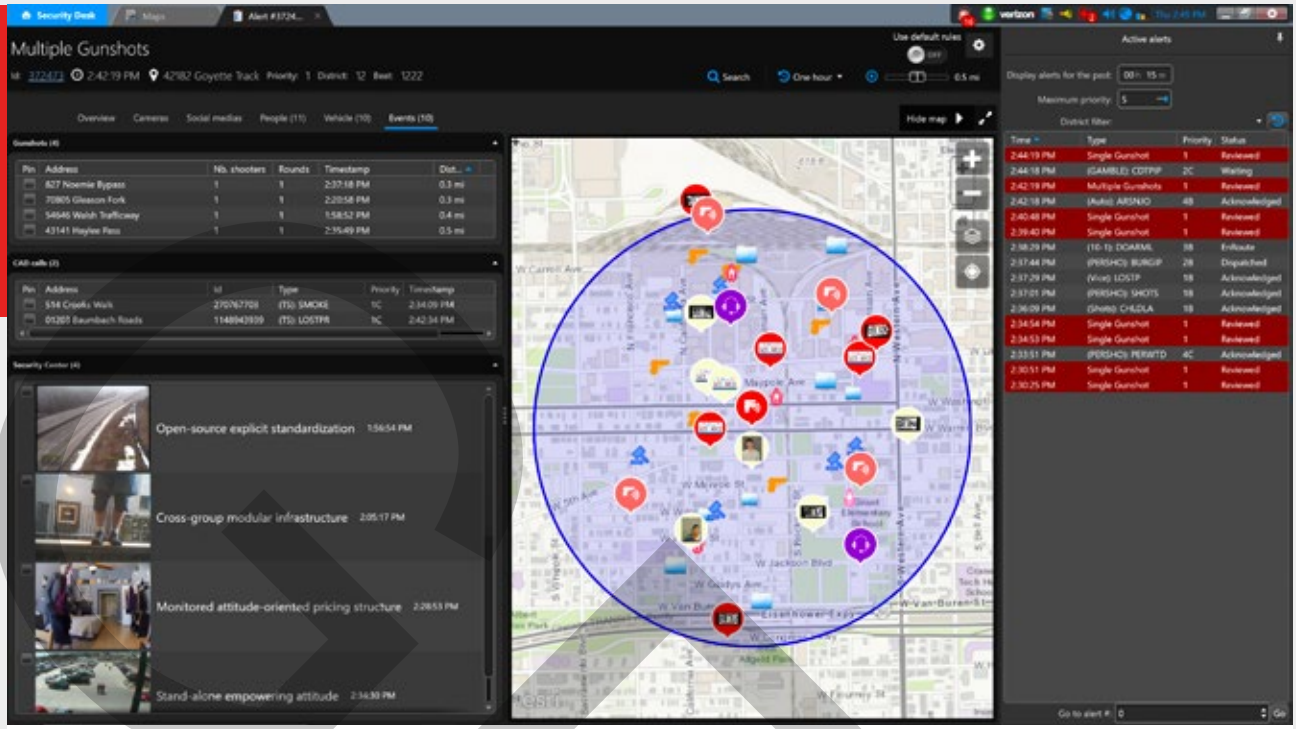
Verizon is a US provider of innovative communications and technology solutions that improves consumers' lives and ways of working. Through these solutions, Verizon aims to deliver its promise to "make the world better than yesterday". The company was the first in the world to launch a commercial 5G mobile network, alongside a commercially available 5G-enabled smartphone, in April 2019.[1]

Verizon sees digital solutions as enablers for the achievement of the Sustainable Development Goals (SDGs), and in 2018 set particular aspirations to help progress SDG 4: Quality Education, SDG 8: Decent Work and Economic Growth, and SDG 13: Climate Action.[2] It has made ambitious pledges towards addressing its carbon footprint – committing to go carbon neutral in its Scope 1 and Scope 2 emissions by 2035.[3] Verizon's efforts were recognised when it was named one of the top 100 most sustainable companies in the US.[4]

As the world's population becomes increasingly urbanised, with over 70% of the population estimated to be living in cities by 2050,[5] cities must harness digital technologies to protect and provide for residents and to help manage their environmental impact. Verizon has developed a set of Verizon Connect and Smart City Solutions to enable communities to stay connected and safe; key aims of SDG 11. The solutions centre on the collection and analysis of data, providing stakeholders with increased knowledge of their communities, their vehicles, and a better ability to respond to their needs.[6] Some current examples include:

- **Fleet Management:** Verizon Connect utilises automation and connected data to produce telematic services and solutions, allowing drivers to be safer, more efficient and more productive. Customers who use Verizon Connect's products and have an internal program established around it, e.g. use the data to coach drivers or run optimised routes, have experienced a 13% decrease in idle time and an 11% reduction in harsh driving events, which lead to reduced fuel consumption (SDG 13), fewer accidents and greater safety (SDG 3).[7]
- **Intelligent Lighting:** Verizon Intelligent Lighting is a networked lighting control system that enables remote control, monitoring and diagnostics for street and area lighting. The implementation of intelligent lighting reduces energy consumption (SDG 7) and therefore reduces the carbon footprint of cities (SDG 13). It can also increase safety in areas of particular risk. Using the system, pilot cities have saved up to 20% of energy on street lighting.
- **Intersection Safety Analytics:** an integrated managed solution to detect interactions among motorists, pedestrians, and cyclists by collecting, processing, analysing and correlating behavioural analytics data. It has improved road safety (SDG 3) in cities that have implemented it.
- **Intelligent Traffic Management:** IoT sensors in roads gather real-time data to reduce traffic, commute times and emissions (SDG 13).
- **Real-Time Response System:** a solution designed to improve public safety in urban areas. This is explored in detail below.

CASE STUDY



Real-Time Response System

Description of the initiative

First responders[8] are trained to react to critical events in a short space of time.[9] The use of public safety technologies could help first responders reduce fatalities in cities by up to 10%.[10] Verizon invests its efforts to help with first responders and disaster recovery, from building a Responder Private Core for first responders to keep them better connected and provide them priority access during emergencies, to deploying mobile cell sites to areas that need enhanced coverage as a result of natural disasters.

Verizon's Real-Time Response System (RTRS) is one of Verizon's solutions for first responders, designed to collect and provide essential data to improve decision-making in critical moments.

RTRS integrates data from a swathe of sources to provide one accurate and real-time view of the city for first responders and city agencies. The solution can then identify patterns and trends to provide insights for users, for example providing an alert if a gunshot is identified. Additionally, these insights can inform changes to improve response time to an incident. In the example of an identified gunshot, insights from RTRS could be used to change traffic signals from red to green, allowing first responders to be routed efficiently to the scene.

SDG benefits

The RTRS solution targets three SDGs in particular:

- **SDG 3 – Good Health and Well-being:** Improving the reaction time to accidents and emergencies in urban areas can reduce fatalities caused by road traffic accidents, a target under SDG 3. When Genetec (who operated a legacy version of the solution) introduced the system in Chicago in 2017, it reduced response times to events in the city's two most at-risk districts by 24% and 39% respectively.[11]
- **SDG 11 – Sustainable Cities and Communities:** The solution increases urban security and the efficiency of emergency services within cities, having a positive impact on SDG 11. In addition, in the case of natural disasters, RTRS can be used to provide a clearer picture of changing conditions, improving urban resilience to these situations.
- **SDG 16 – Peace, Justice and Strong Institutions:** RTRS equips law enforcement agencies to better deal with crime and violence, promoting peaceful urban societies as outlined by SDG 16.

CASE STUDY

How it works

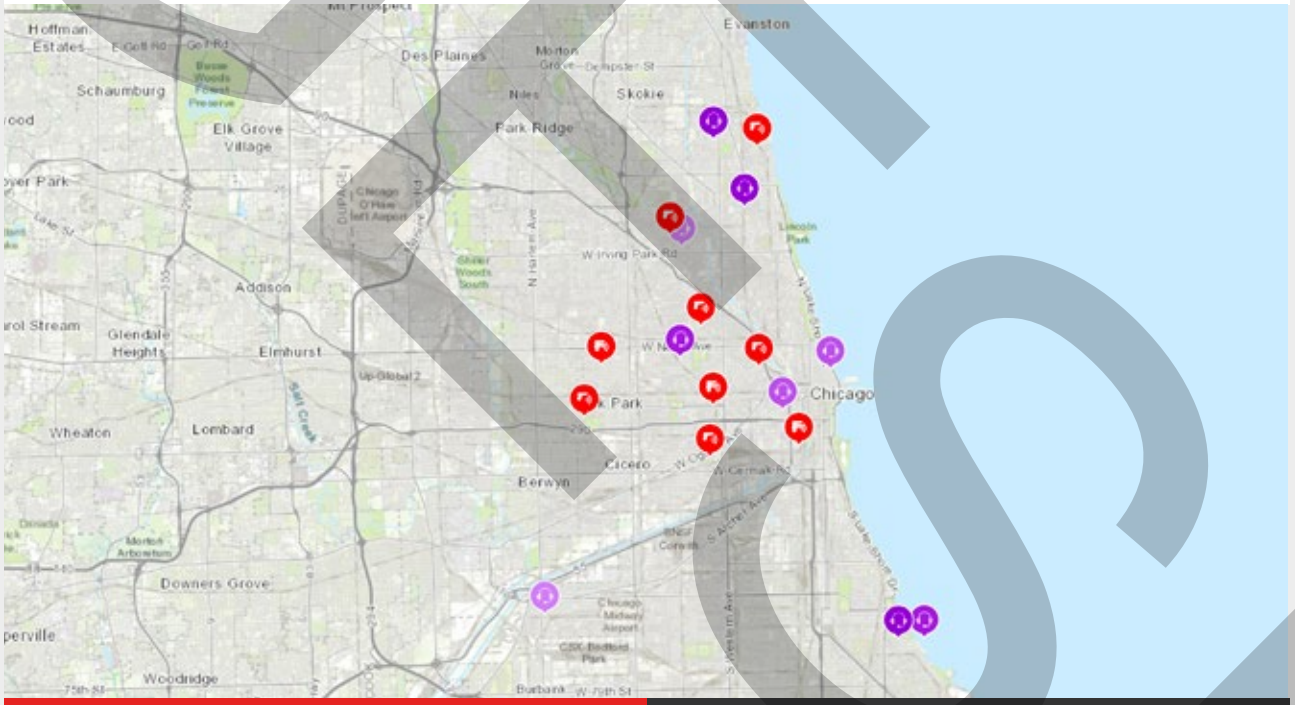
RTRS collects data from a number of sources, including video sensors, record management systems, and third party datasets, using Verizon's fibre-optic 4G LTE and, soon, 5G mobile networks. The solution correlates data, based on time and location, and user-defined rules (e.g. if a license plate shows up multiple times within a specified time) to then deliver alerts to the central system. It can also send relevant information to connected vehicles, communicating real-time information to first responders in the field.

The disparate data sources are assimilated on a single interface, hosted on the AWS GovCloud, where further analysis is undertaken. The RTRS interface not only allows users to monitor events as they arise, but also to make informed decisions based on the insights returned, for example, determining the most appropriate emergency service or team to dispatch to an incident. Additionally, the interface allows users to plan for future events in the city and to analyse the effectiveness of public safety policies.

Scaling

Cities can adopt this technology to enhance public safety capabilities, and connect previously isolated sources of information. Collating data into one interface offers clarity about new public safety measures and incident patterns, allowing more informed responses to high-risk areas. As RTRS is hosted on the cloud, it requires minimal in-house IT investment and support and can be scaled as needed.

As this is a relatively new solution, Verizon is in discussions to roll out RTRS with a number of potential partners.



User stories

" A unified solution that provides a common operating picture enhances situational awareness and allows better planning, detection, response and prevention of incidents."

- Jason Friedberg, Business Development Manager, Genetec Inc. (former Chief of Police at Bucknell University)

User stories

" When I was an acting Chief of Police, connecting information from our disparate systems to get a clearer picture of a situation was a difficult and time-consuming task which often could lead to delays in responses."

CASE STUDY

Looking forward

As Verizon continues its nationwide deployment of 5G in the US, it will be able to support the creation of new products and services to promote further progress towards the SDGs. A number of solutions are being developed and trialled internally. However, Verizon will also partner with companies that are developing promising technologies to deliver change with 5G in the future. For example, the following companies are part of Verizon's 5G First Responder Incubator Program, and may provide a view into the future first responders:

- Qwake Tech designed C-THRU, a product that uses computer vision assisted AR to guide firefighters through an active fire with low to no visibility. 5G allows command and control to see a firefighter's exact location; this improves the safety and efficiency of firefighters, to promote safer living spaces for all (SDG 11).[12]
- Aerial Applications is working with Verizon's Skyward drone automation platform to improve the future of public safety. Aerial is looking to use 5G to optimise the performance of its AI-driven analytics of drone videos. This could allow near real-time insights to be delivered by drones, improving situational awareness, and the ability to respond, during natural disasters and emergencies (SDGs 3 and 11).[13]
- BlueForce Development has developed software for body-worn sensors and smartphones that can communicate the location and status of individual police officers to command and control, as well as other officers. This solution provides near-immediate feedback to improve the coordination of efforts and the operational efficiency of police forces (SDG 16).[14]
- Adcor Magnet Systems is developing solutions with smart sensors and AR that provide airborne, ground-based and sea-based situational awareness using 5G, therefore improving public safety efforts (SDG 3).[15]
- Kiana Analytics is working to enhance physical security at airports, campuses and large public venues by analysing human behaviour, e.g. movements through an airport, using location-based services, advanced analytics and 5G (SDG 3).[16]

Wrap up

In recent years, central government debt has remained high, or risen in some cases, in many developed countries,[17] which has stretched the capacity of emergency services. In Europe, for example, the number of police officers per capita has been declining since 2007.[18] Emergency services must therefore innovate to increase their efficacy and uphold the aspirations of SDG 11 and 16. Verizon's RTRS provides the means to improve the efficiency of public safety services, through more coherent and comprehensive access to data.

It is evident from this example and the 5G-enabled solutions that Verizon and its partners are working to deliver, that digital technologies will be increasingly central to providing safe and lasting communities. They will enable residents to thrive, whilst limiting cities' impact on the world around them.

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To fully support the transformation required by the SDGs, digital technologies need to be developed and deployed with positive societal impact in mind and within a context of shared aspiration: **digital with purpose.**

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