

Digital for Europe

Collaboration.
Innovation.
Transformation.

Foreword

Over the past year, the COVID-19 crisis has tested the resilience of our societies. Public services have been stretched to the limit to support citizens through this pandemic. However, despite collective best efforts, what started as a health crisis is now having multiple ramifications for our citizens, societies and economies. We face a growing backlog in treatments of other health conditions and a lockdown generation of children missing out on education. Among businesses, according to the OECD, more than half of small and medium enterprises (SMEs) face severe losses in revenue, with one third fearing for their future, and some sectors are on the verge of collapse. With many economies now in deep recessions, the impact of the virus and lockdowns will be felt for years, with increasing unemployment and lower levels of growth.

We all must now lean in to meet these challenges, to redress the imbalances and to close the gaps exposed, or widened, by the pandemic. In doing so, we must also learn from this crisis. One such key learning is how digital connectivity, services and tools transformed our daily lives and became a lifeline allowing people to work, learn, stay in touch with friends and family, access remote healthcare and more.

Going forward, this digital transformation in the way we live will be essential to Europe's recovery and growth, building a more competitive, sustainable and inclusive society in the future. **The European Commission has highlighted that the cumulative additional GDP contribution of new digital technologies could amount to €2.2 trillion in the EU by 2030.**

In this report we go further, looking positive benefits in terms of social, environmental and economic terms and the essential enablers to address these challenges in a manner that – for once – can help EU close its investment gaps. And these gaps are not insignificant. **The European Commission has highlighted that there is a gap of €125 billion** per year to meet the investment needs of the digital and green transition. Connectivity infrastructure alone amounts to €42 billion of this gap.

Our series of Europe.Connected papers which accompany this report identify how the digital transformation can be achieved in practice. For example:

- Our paper on eHealth shows how telemedicine can increase life expectancy and cut costs by almost €50 billion.
- We show how making cities smarter can create future proof, sustainable places that improve citizens' lives and drive annual energy savings equivalent to one third of the energy needs of Denmark.
- Our experience of rolling out Gigahubs in Ireland has demonstrated how digital can turbo-boost small businesses and reinvigorate rural communities. Digitising just 10% of small businesses which are currently not digitised in Europe could lead to a total increase in turnover of up to €148 billion.
- Investment in innovation, such as OpenRAN technology, can ensure secure and resilient networks and strengthen European supply chains, essential for critical infrastructure.
- Most importantly, digital can deliver significant climate benefits, helping Europe achieve its carbon targets.
- Finally, underpinning many of these opportunities is 5G, which is powering the digital industrial revolution. **A review of 5G use cases conducted by IHS Markit** estimated that global rollout of 5G could enable an approximate €11 trillion increase in global cross-sector output by 2035.

The most important lesson from this pandemic is that we all need to work together. Industry, governments, policy makers and civil society must find better ways to collaborate in investing in Europe's digital future, to drive the 5G industrial revolution, to democratise access to healthcare, to close the digital divide and to digitise SMEs.

Only if this is done can Europe establish the strong foundations we need to generate a digital dividend for current and future generations. In turn, this will enable Europe to recover faster from the crisis, creating jobs and growth opportunities and positioning Europe as a global leader.

Joakim Reiter

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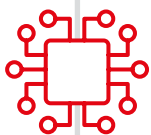
Executive Summary

The pressing need to kick-start the COVID-19 recovery, presents a once-in-a-generation opportunity to not just rebuild the economy but to 'build back better'. If successful, the benefits to Member States, their citizens and their businesses could be transformative - economically, socially and environmentally.

This paper, commissioned by Vodafone as a companion to its recent series of **Europe.Connected** papers, explores a series of digital opportunities that will help deliver on the EU's ambition for **Europe's Digital Future** and the **European Green Deal**. It examines the case for Member States to put digital transformation at the heart of the recovery agenda, and illustrates how a 'digital by design' agenda could deliver benefits that include:



Enhanced quality of life for citizens, including improved welfare, health and personal safety;



A more resilient society built on high-skill jobs and digital autonomy;



Long-term economic growth driven by home-grown innovation;



Lower resource consumption and environmental impact; and



A more equitable society in which the benefits are enjoyed by all.



An **increase in adoption of Telemedicine** of just of five % points across the EU could deliver a **3.7% reduction in the cost of patient care**, a **1.7% increase in citizens' healthy life years** and a **3.6% fall in mortality**.



During the COVID-19 crisis, digitalised small businesses have identified **new opportunities at more than twice the rate** of less digitalised counterparts.



12,000 tonnes



350,000 tonnes

Extending the use of **IoT technology across 50% of the EU's largest farms** could **reduce pesticide use by 12,000 tonnes** and **fertiliser use by over 350,000 tonnes**.

Delivering these benefits is achievable but will require a well-coordinated and strategic approach to policy design and implementation. This approach will need to address several key issues:

Which digital opportunities to invest?

What benefits to expect as a result?

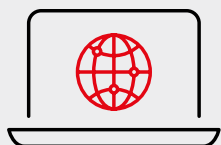
The necessary conditions for these benefits to be realised?

How to ensure that the benefits are distributed equally and sustainably, and therefore that the plans will indeed help Member States to 'build back better'?

Europe's current level of digitalisation varies widely. While disparities in levels of digitalisation have real economic and social consequences in those markets with lower levels of adoption, the implications apply to the whole.

Internet Access:

In Denmark, Sweden and the Netherlands, 95% of citizens use the internet at least once a week, whilst in Bulgaria (33%) and Romania (28%), over a quarter of citizens do not regularly go online.



Digital Skills:

Across the EU, 82% of young individuals (16-24) have basic digital skills. Only 35% of those aged 55-74 and 30% of the retired and inactive possess basic digital skills.



Digital Business:

Whilst six EU member states (Ireland, Finland, Belgium, Netherlands, Denmark, Sweden) score more than 60 on the DESI for digitisation of business and e-commerce, six score less than 30 (Bulgaria, Romania, Hungary, Poland, Greece, Latvia).



These disparities limit the ability of the European market to realise the full potential of its combined economic scale, could lead to policy fragmentation and reduce innovation potential across the Union.

If returns on investments are to be maximised, it will be essential that scale benefits afforded by size of the European market are realised. That digital divides between and within Member States are reduced. This requires collaboration across Member States as well as coordination between the public and private sectors, to help avoid fragmentation and realise the economies of scale and scope that will make digital investments economically sustainable in the long term.

This paper identifies critical policy levers that need to be in place to enable a digitally driven recovery:

Partnerships and collaboration

within public and private sectors to promote 'digital by design' across business and public administration, to encourage non-personal data-sharing and to help lower barriers to digital adoption;

Policy reform and harmonisation

to drive common approaches and collective action to promote digital adoption across the Digital Single Market;

Governments leading by example

to accelerate digital adoption by implementing 'digital by design' stimulus packages and by developing digital capabilities across all public services and administration.

Throughout, there must be a clear focus on investing where returns will be greatest, and where **strategic investments can be transformational** such as in the regions, business sectors and social groups that are the furthest behind.

Beyond these critical enablers, there are additional steps that governments can take to enhance economic and social gains as Europe rebuilds. These will include embedding **digital for green** to drive change across European value chains, in support of a sustainable recovery that starts to decouple economic growth from a negative environmental impact. Investment in **digital skills** and **connectivity for a digital society** will also be essential to driving growth whilst ensuring that no one is left behind.

Digital investment and policy reforms are essential foundation stones for ensuring that the recovery will be:



Environmentally sustainable, by innovating to drive emissions reduction and enable a circular economy;



Economically sustainable, by generating the competitiveness and economic returns that will limit the financial burden on future generations; and which drives growth and jobs, creating a digital dividend for future generations.



Socially sustainable, by addressing existing digital divides and building in resilience by design.

Europe.Connected - Recovery Papers



eHealth



SMEs



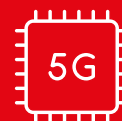
Smart Cities



Digital for Green



OpenRan



5G



Rural



5G Corridors



Submarine Cables

If digital-driven transformation is to provide a robust foundation for the future, policy makers will need to address the underlying causes of existing digital divides. These divides go beyond access to connectivity. Current inequities in the distribution of digital skills and access to digitalised public services and banking, could lead to an unequal distribution of the benefits of recovery. The opportunity to build back better for all would be lost.

Policy-makers will need to embed digital solutions to these inequities in their National Plans, if the recovery and the broader benefits to society are to be enjoyed equitably across Member States' economies and societies.

Contents

Important notice from Deloitte.....

Executive summary.....

Introduction.....

The COVID-19 Crisis and the Role of Digital

COVID-19 has accelerated pre-existing digital trends

Digital adoption has provided resilience in the face of COVID-19.....

COVID-19 has highlighted existing digital divides

Building Back Better: Benefits and Enablers of Digital Transformation

Post COVID-19 recovery - The European response

Benefits of using digital to build back better

Enhanced quality of living, including improved welfare, health and personal safety.....

A more resilient society and economy built on high skill jobs and digital autonomy

Long term economic growth driven by home-grown innovation

Lower resource consumption and environmental impact.....

A more equitable society

Critical enablers to deliver digital benefits

Policy reform

Governments leading by example

Partnerships and collaboration

Extension and proliferation of digital skills.....

Embedding Digital for Green as an enabler

Connectivity for a digital society.....

Conclusion

Introduction

The global crisis brought about by the COVID-19 pandemic is unprecedented in modern times. Europe, as with other parts of the world, has suffered severe impacts to its public health, society and economy. Digital technology and connectivity have offered respite from some of the worst effects, allowing citizens to adapt their lives in order to cope with the disruption and enabling key sectors, such as healthcare and education, to reconfigure rapidly to counter the impact of the virus.

European policymakers have stepped up to coordinate a stimulus package to support the response to, and recovery from, COVID-19. The objectives of the package are clearly forward looking, not only supporting the return to normal but delivering a better future for Europeans based on green and digital foundations - 'building back better'.

The threats to achieving these goals have also been exposed by the crisis. Prevailing social and economic inequality have meant that the burden of the crisis has not been borne evenly. This poses a serious risk that sections of European society could be left behind as the rest of society recovers.

Meeting the recovery challenge requires an ambitious response that will need to be shaped by extensive collaboration between all stakeholders to the recovery – governments, infrastructure owners, digital innovators, skills developers and citizens. This collaboration will be required in order to maximise the impact of investments and reforms, and to avoid imbalance in the distribution of the benefits from recovery.

The objective of this report is to highlight the essential role of digital as a primary pillar of the recovery; it also highlights where collaboration will be required, and the historic inequities that will need to be addressed to limit the risk of an unbalanced recovery. If authorities and businesses do not partner and collaborate to prevent fragmentation, this once-in-a-generation opportunity to build back better could be lost.

The report identifies a range of opportunities for digital investment and reforms, the benefits that can be expected, and the key enablers that will need to be in place in order to ensure long-term social and economic returns that are shared across European society. The report is set out across three sections:

- The first section describes the role of digital in providing COVID-19 resilience, and its potential role in driving recovery;
- The second section identifies a series of opportunities for digital investment and the benefits that they can be expected to deliver; and
- The final section provides an overview of the enablers that will need to be in place in order for benefits to be realised.

This report accompanies the recent Europe. Connected series of papers published by Vodafone Group. These papers explore key opportunities for digital investment and reform and are referenced throughout this report.

The COVID-19 Crisis and the Role of Digital

The COVID-19 crisis represents a defining moment for the EU. The impact on European families has in many cases been devastating. Even for citizens who have not lost loved ones, the broader impact on their jobs and the education of children has been immensely challenging.

Whilst Europe has weathered numerous economic storms over the past hundred years, the COVID-19 crisis has brought about perhaps the greatest economic shock that the European Union as an institution has faced. The crisis has placed unprecedented pressure on healthcare systems, generated deep and broad disruption to businesses large and small, and amplified existing disparities in resources and skills that have the scope to expand social and economic inequalities. The COVID-19 crisis has also coincided with increasingly urgent environmental sustainability challenges, as well as an inflexion

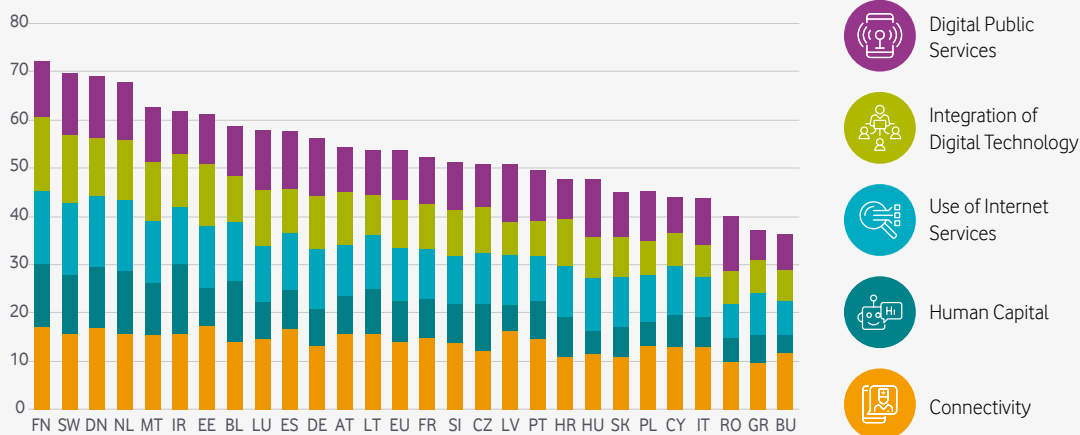
point in the role of technology and the EU's technological autonomy.

COVID-19 has accelerated pre-existing digital trends

The digitalisation of European economies and society was already in progress prior to the crisis. The long-term potential benefits of investment in digitalisation were understood, and progress towards the acceleration of digitalisation was already tracked by the **Digital Economy and Society Index (DESI)**.

However digital investments and adoption were often uncoordinated and the most progress had been made by Member States with the greatest resources and historic investment in infrastructure. This variation in progress was reflected across the DESI dimensions as illustrated below.

DESI 2020



DESI Categories



Connectivity – Focusing on the roll-out of the very high capacity fixed and mobile networks that are key to enabling the widespread use and development of digital technologies.



Human capital – Reflecting that digital skills are the backbone of the digital society and key to ensuring that citizens benefit from the socioeconomic benefits of digital transformation.



Use of internet services – Tracking the use of internet services to understand how citizens are using digital tools and benefitting from digitalisation.



Integration of digital technology – Measuring the extent of the adoption by private enterprise of advanced digital technologies, such as AI and cloud, which enhance productivity, efficiency and open up new economic opportunities



Digital public services – Capturing the use governments make of digital public services, such as eHealth, that can make government more efficient and help drive economic recovery.

As outlined in Deloitte's forthcoming report for Vodafone, 'Digitalisation – an opportunity for Europe', there is a strong link between digital transformation and economic performance; if all EU countries were to reach a score of 90 on DESI, EU GDP could increase by 2.5% per annum, 7.5 million extra jobs could be created, and there would be significant economic convergence between Member States. Moreover, **achieving the '90 for 27' target would place Europe in a leading position** in digital development globally.

The lockdowns that have characterised many governments' response to the COVID-19 crisis, helped flatten the curve of COVID-19 cases and have provided a stimulus to the digitalisation of economic and social activity. This has resulted in an acceleration of the pre-existing trends and the creation of new trends that can now be expected to persist in the longer term.

Following the implementation of restrictions expecting people to stay at, and work from, home as much as possible, network operators reported a **substantial increase in internet traffic**, to as much as **50% above pre-COVID-19 levels**. Underlying this rise in traffic are some marked increases in the use of a range of digital services and applications:

For example, Deloitte's 2020 Digital Consumer Trends survey found that:

40% of respondents did more shopping online during lockdown,

14% of people had more remote medical appointments

1/3 increased their use of video streaming services.

Businesses are also looking more to digital services. For example, in recent surveys of Small and Medium Sized Enterprises (SMEs), **77% stated they had increased their usage of some form of digital tool** and **51% indicated that they had increased online interaction with their clients.** According to Deloitte's 2021 TMT Predictions Report, businesses are also turning to cloud services, with **cloud traffic rising by 100% during the first quarter of 2020** and cloud spend growing consistently faster than non-cloud IT spend. Moving forward, the European Commission sees **cloud computing as 'fundamental for a genuine and competitive single market for data and services'** and essential for an innovative economy.

These dynamics driven by COVID-19 have accelerated momentum towards a digital Europe by creating an urgent need for people, businesses, and governments to digitalise faster and further.

However, the impact of these trends has varied significantly between Member States. For example, a 2019 DESI report on Digital Public Services, found that whilst **18% of EU citizens had used online health and care services, this was much higher for some countries** (e.g. Estonia, Finland, and Denmark) than for others (Malta, Germany, Hungary, and Cyprus). Even before COVID-19, there was work to be done to ensure the equitable distribution of the benefits from digital investment.

Digital adoption has provided resilience in the face of COVID-19

The need to accelerate and level-up progress towards a digital society has been amplified by the COVID-19 crisis; digital adoption has been a key contributor towards societal and economic resilience. This applies to citizens

and their ability to work, educate and entertain themselves at home, and to businesses and their ability to continue to trade.

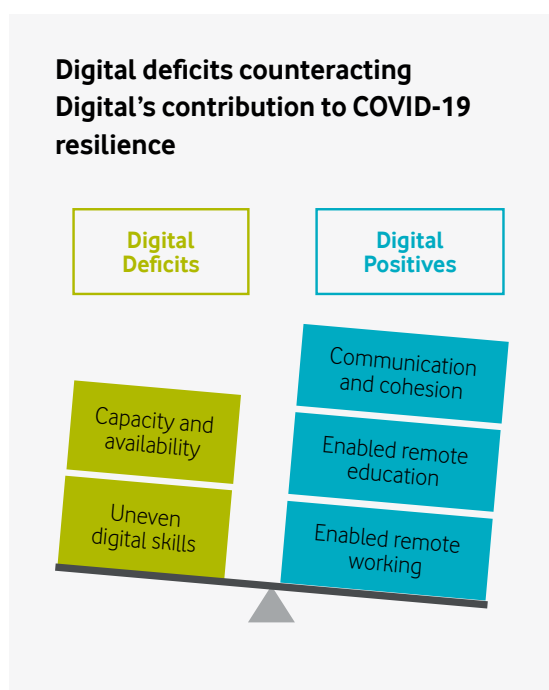
Whilst the economic shock of COVID-19 has been pervasive, digitalised companies have tended to fare better. A recent study by Vodafone and Deloitte found that the **most 'digitalised' SMEs identified new opportunities as a result of COVID-19 at more than twice the rate** of their least digitalised counterparts. Another recent study found that **SMEs using digital tools were 3.8 times more likely to target new customers and 3.5 times more likely to launch new products.** In general, eCommerce has been a critical enabler of business resilience, allowing enterprises large and small to continue to operate and engage with their customers.

Employees have also had to adjust to new ways of working, and evidence collected by the EU's Joint Research Centre demonstrates how **employees in high skilled professions have been able to adapt readily to remote working.** Likewise public services, in particular education and healthcare, have had to undergo rapid, sometimes overnight, digitalisation in order to continue operating. For example, 65% of European clinicians stated that their organisation had **increased adoption of digital technologies to support operations and patient access.**

COVID-19 has highlighted existing digital divides

The COVID-19 crisis has highlighted the critical role that digital connectivity plays in enabling communication and social cohesion, and – beyond connectivity – in providing the data-driven insights and applications that have enabled public services and business to continue to function.

Notwithstanding the positive impact that digital technologies have had on the resilience of European economies and society, the crisis has also exposed some important divides that affect the adoption and exploitation of digital. These divides will need to be addressed if digital is to be at the heart of Europe's endeavour to build back from COVID-19 in an equitable and cohesive way.



The compelling need for high quality, high resilience network technologies is better understood than ever; so, too, is the need for innovation across the value chain to develop new applications to leverage these technologies. However, the crisis has also highlighted the social and economic challenges presented by inequitable historic investment in digital infrastructure and skills.

On the infrastructure side, while many urban areas already benefit from next generation fibre and 5G networks, many of Europe's rural and remote areas still suffer from patchy coverage and lower network speeds. Of households in rural areas, **10% are not covered by any fixed network and 41% are not covered by any NGA technology.**

There is also divergence at the Member State level, national coverage of very high capacity networks ranges from over 90% in Malta, Denmark and Luxembourg while Greece, Cyprus and Austria have coverage of less than 20%. In this context, Europe is expected to continue to lag the US and China in terms of 5G adoption; by 2025 the GSMA expects **just 34% of European mobile connections to use 5G networks, compared to 48% in North America and 47% in China.**

Digital skills and access to training are critical if opportunities arising from the availability of digital infrastructure are to be maximised; a lack of digital skills in the workforce prevents companies from finding the talent and experience needed to embrace digital. In this context, the European Commission's DESI analysis found that a **majority of European businesses report difficulties in hiring IT specialists**, and that this is a constraint on overall digital transformation. Without support, SMEs - which are generally in greater need of digitalising also less likely to be able to provide the training required to advance digital skills.

As illustrated by the DESI, there are also disparities in the extent and distribution of skills between Member States. While Finland, Sweden, Denmark and the Netherlands, score highest on the index, Bulgaria, Greece and Romania trail substantially, both in terms of overall score and progress since 2015. The **shortage of digital skills is most acute in countries such as Romania and Czechia**, where 80% of enterprises recruiting IT specialists reported challenges in filling vacancies. Europe must modernise and accelerate eEducation and training systems. This means better connectivity for schools and digital skills training on a lifelong learning basis to enable workers to better adapt to change.

Building Back Better: Benefits and Enablers of Digital Transformation

Post COVID-19 recovery - The European response

As the EU emerges from the COVID-19 crisis, it faces a once-in-a-generation opportunity to rebuild and has also set out the ambition to use the recovery to reshape the economy. With strong foundations, technology can be democratised in every quarter of society – for businesses, public administrations and citizens.

The Commission has highlighted its key priorities in this respect:

- Comprehensive high-quality connectivity for all European citizens and businesses;
- Support for the development of digital skills for all;
- Strengthening Europe's digital capabilities and readiness for next generation technologies;
- Twinning the digital and green transformations, in particular in terms of energy, resource efficiency, mobility and circular economy; and
- Developing public services and administration fit for the future.

In order to deliver the benefit of digital transformation, Europe will need to ensure progress in all areas of digitalisation according to their potential. Connectivity is of course essential, but skills development, digitalisation of businesses and government, and policy reform will also be required. Digital reform and investments will need to build-in resilience and environmental, economic and social sustainability from the outset.

Europe is standing up to this challenge and is **investing huge sums to recover from the COVID-19 crisis and to accelerate sustainable digital transformation**. This comprises long-term budget plans combined with NextGenerationEU, the €750 billion temporary recovery instrument that provides immediate economic support to Member States in their recovery from COVID-19 and funding for initiatives to improve European resilience. The largest component of NextGenerationEU is the €672.5 billion Recovery and Resilience Facility.

In recognition of the importance of digital to Europe's recovery, and to support the EU's transition to a climate neutral economy, the EU President has set out **her ambition for Europe's Digital Decade**. This ambition is reflected in the EU's target for **20% of Recovery and Resilience plans to be directed at fostering the digital transition, and 37% to drive green investments and reforms**.

The Digital and Green Deal funding packages pledged by the EU are focused on:

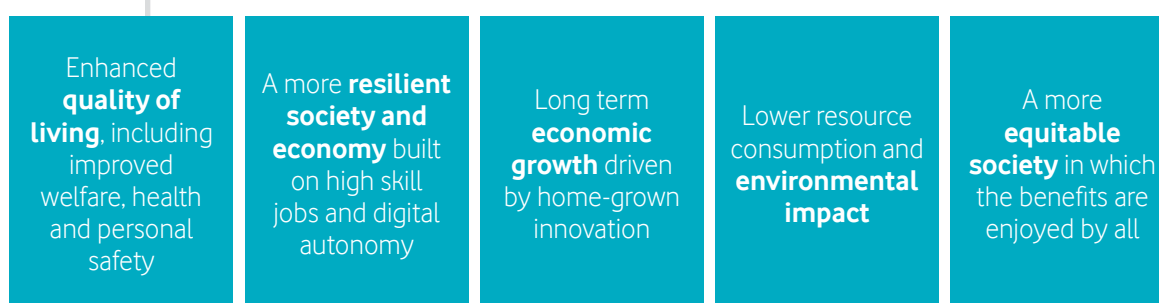
- **Pulling through together** by protecting lives and livelihoods, improving healthcare, and by creating high-skilled jobs that pay; and
- **Propelling Europe forward**, specifically through the EU Green Deal aim to make the EU climate-neutral by 2050, and the NextGenerationEU lighthouse investments in projects with the biggest 'green' impact.

Benefits of using digital to build back better

The Eurostat Quality of Life Metrics, illustrated above, highlight a series of factors that contribute towards citizens' quality of life:

In the remainder of this section, each of these benefits is described in further detail, identifying

how investments in digital generates these benefits, providing examples of how this works in practice, and identifying the enablers that need to be in place in order for these benefits to be realised.



Enhanced quality of living, including improved welfare, health and personal safety

Background

Investment in digital technologies can make material improvements in EU citizens' quality of life. Digital investment, and policy reforms to support wider adoption can:

- contribute to absolute improvements in quality of life;
- extend the duration of the healthy life years across which those improvements can be enjoyed;
- and help reduce current inequities in the societal and geographic distribution of high quality of life measures.

Eurostat Quality of Life Metrics



Environment



Governance



Safety



Social relationships



Health



Material living conditions



Housing conditions



Employment



Time-use



Education

Benefits realisation

The Eurostat Quality of Life Metrics, illustrated above, highlight a series of factors that contribute towards citizens' quality of life.

The use of digital technologies in the healthcare sector is a particularly powerful contributor to quality-of-life improvements. For example, eHealth innovations such as in health monitoring 'wearables' and **telemedicine applications are expected to improve the healthy life years enjoyed by European citizens** by providing early warning of emerging health issues and easier access to healthcare professionals.

Material living conditions and employment prospects can also be enhanced. The digitalisation of small businesses is expected to enhance the economic sustainability of communities beyond urban centres, creating wider high-skill employment opportunities, and improving the distribution of higher living conditions as a result.

Beyond health, employment, and time-use enhancements, IoT-based smart city technologies can improve citizens' welfare and safety in urban environments and can drive meaningful reductions in emissions and natural resource consumption.

Benefits case studies

Some key case studies that illustrate how digital investments can be expected to generate material improvements in EU citizens' quality of life are shown below.

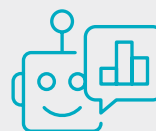


Telemedicine

Digitally enabled telemedicine allows patients and healthcare professionals to connect remotely, improving access to care.

Digital communications and remote monitoring of patients also frees-up healthcare professionals' time, allowing them to dedicate more time to high priority cases.

Automation of monitoring and non-patient facing work



The use of connected devices and AI to drive automation, can increase the time healthcare professionals dedicate to patients and improve health outcomes by better predicting health events, for example in patients with cardiovascular disease.



Secure and trusted health data collection and analysis

Increasing the use of mobile apps, connected devices and wearables, increases the amount of data available to healthcare professionals, researchers, public organisations and businesses.

Leveraging this data via appropriate data policy frameworks and partnerships, is key to delivering better treatments and innovation in healthcare.

In the longer term, healthier citizens living better quality lives generates sustainable economic value. By enabling citizens to remain active for longer periods of their lives, the burden of an aging population on healthcare systems is reduced. However, the quality of life improvements enabled by digital go well beyond health outcomes:



Employment: Rural regeneration

The benefits of digitalising SMEs (as explored further in the following section) will be important in ensuring economic sustainability and resilience, particularly in communities outside of urban centres. Enabling businesses to digitalise and thrive in traditionally less connected areas, provides the opportunities and support to livelihoods that are required to improve quality of life in these areas.



Safety: Safer environment

Digital services connecting security systems and transport can help reduce crime and the occurrence of accidents.

Emergency service response times can also be shortened, and responders provided faster, better quality information, to help ensure better health outcomes.



Environment: Cleaner environment

Digital technologies will be instrumental in delivering the green transition (see Lower energy and resource consumption), which will result in quality-of-life gains under the environmental measure.

For example, in cities where air pollution is a threat to health, more efficient smart mobility and environmental monitoring technologies can help reduce emissions.

Enablers

To realise the full scale of quality of life benefits available from digital applications such as those outlined here, support is needed for those seeking to develop and implement these digital applications.

Partnerships and collaboration across a range of stakeholders and industries will also be essential, and these will need to be underpinned by data frameworks that enable sharing of data and insights, while maintaining privacy protection.

Policymakers also have an opportunity to act as leaders and role models in digital adoption, accelerating and incentivising adoption by applying a 'digital-first' mindset in which the default first choice option is to apply digital solutions to existing and challenges that affect citizens' quality of life.

Digital technologies and applications across a wide variety of sectors including health, transport, education and public services have the scope to generate material and sustainable improvements in European citizens' quality of life. Digital investments will underpin quality of life benefits across almost every aspect of Member States' Recovery and Resilience Plans.

A more resilient society and economy built on high-skill jobs and digital autonomy

Background

The development and expansion of digital capabilities will continue to be a key driver of social and economic resilience as Europe builds back from COVID-19. However, the pandemic has exposed some key resilience challenges and pervasive societal and economic divisions that need to be addressed. Long-term resilience will also require EU Member States to work together to develop the EU's digital autonomy, built on a highly skilled workforce and EU-led innovation in the next generation of digital technologies.

Benefits realisation

In order to truly build back better, policymakers will need to build resilience by focusing on investments that provide enhanced digital skills and capabilities, as well as a more equitable distribution of the benefits and opportunities. Small and medium-sized enterprises will be

amongst the most immediate beneficiaries of a more highly skilled workforce.

The digitalisation of SMEs has been shown to deliver greater performance through access to larger markets via digital channels, optimised revenue flows from better customer and revenue management, as well as reduced costs due to greater efficiency in operations. Better performance, enabled by digital, improves the resilience of Europe's SME community; improvements in economic opportunities, productivity and sustainability are also enjoyed more widely due to the higher proportion of SMEs outside the urban centres.

More widely, the development of deeper and wider digital skills across the European workforce will help safeguard European competitiveness and digital autonomy.



Equality

Sustainability

Economic growth

Resilience

Well-being

Why digital

European Response

Conclusion

Critical enablers to deliver digital benefits

Building Back Better: Benefits and Enablers of Digital Transformation

The COVID-19 crisis and the Role of Digital

Introduction

Benefits case studies

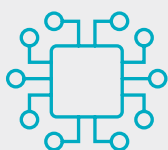
The ways in which digital investments can help enhance resilience and autonomy at the individual, organisational, national and international levels, are illustrated below.



Individual – skills

According to the DESI, in 2019 more than 40% of the European population lacked the basic digital skills required to enable them to participate fully in the digitalisation of society. Investment in these foundational digital skills will be an essential driver of digital adoption and will help **mitigate the risk of enduring digital divides excluding parts of society** from the benefits of broader investment in digital infrastructure.

Beyond basic participation in society, investment in digital skills also provides new opportunities for employment, enabling the benefits of digital transformation to be shared across the whole of the workforce. This prevents large sections of the workforce from being left behind and enhances the ability of businesses large and small to develop and exploit their own digital capabilities and opportunities.



Organisational – capacity and use of digital tools

Increasing digital capabilities at the organisational level creates new economic value, opportunities for growth and expansion, increased efficiency and creates jobs. The impact may be particularly high among SMEs, which have historically lagged larger businesses in leveraging digital tools and which therefore, have the most to gain from catching-up.



Industry/national – digital ecosystems

Developing digital ecosystems at industrywide and national levels, built on supportive policy and investment, creates opportunities for individuals and businesses and improves international competitiveness and autonomy in the global digital market

By investing in digital infrastructure and skills across national economies, Member States can generate and retain a greater proportion of global digital value chains, rather than transferring this value outside the EU. Europe can also retain greater control over the development of new technologies and networks on which critical digital infrastructure will be built.



International – resilient connectivity

Investments in European submarine cables will help deliver better digital connectivity, including lower latency on which new use cases in manufacturing, healthcare and entertainment will rely. It will also enable the development of European data centres to compete with other global data hosting hubs.

Enablers

Policymakers will need to collaborate with technology companies and SME leaders to help ensure that SME capabilities are aligned to emerging digital technologies, so that these businesses are not left behind. This could take the form of access to R&D facilities or digital community hubs, including advisory support, for SMEs to learn about and experiment with digital technologies, as well as financial support for them to upskill and develop digital capabilities.

Providing policy support and public funding to help reduce fixed and mobile network deployment costs, will also help enable roll-out of next generation infrastructure to rural areas that would otherwise remain relatively unconnected, and in which smaller businesses tend to make up the majority of employment opportunities. Voucher schemes that support connectivity as well as innovation funding, such as those envisaged in the **European Digital Innovation Hubs under the Digital Europe Programme**, will help provide this stimulus. Beyond financial support to network deployment, this will also depend on reforms to address legacy policy barriers that have tended to increase the cost and practical challenge of infrastructure deployment.

The extended network deployments on which this more resilient society and economy will depend, will require partnerships between network operators and between EU, national and local authorities. Support for key strategic investments and policy reforms, to reduce the cost of deployment, will incentivise and accelerate infrastructure development and the realisation of associated social and economic benefits.

Further, support to the development of new technologies that offer high quality, lower cost connectivity, such as OpenRAN, has the potential improve the business case for wider mobile infrastructure deployment, as well as to create a more resilient network equipment supply chain, economic growth and jobs in digital sectors with global export potential.

Policy support and reform are key to encouraging the uptake and development of digital capabilities. Collaboration between governments and private companies is also an important enabler. For example, initiatives like digital hubs can provide a community for individuals and businesses to support skill development, and investment incentives such as voucher schemes and R&D tax credits for SMEs encourage this further.

Long-term economic growth driven by home-grown innovation

Background

Digital investments, particularly in critical forward-looking infrastructure such as 5G, have the potential to transform the European economic landscape and kick start a new wave of digital innovation across a wide range of industries.

Benefits realisation

A review of 5G use cases, conducted by IHS Markit, estimated that the global rollout of 5G could enable a **€10 trillion increase in global cross-sector output by 2035**. A key driver of this growth is expected to be the impact of 5G-enabled use cases on sectoral productivity and the value created by use cases as diverse as industrial automation, smart cities, autonomous vehicles, smart agriculture, remote health monitoring and smart grids.

Benefits case studies

Promotion of these new drivers of economic growth will be key to the long-term recovery of Europe from the COVID-19 pandemic and will need to reflect wide-reaching digital strategies across a host of areas. 5G enabled growth drivers include:



Agriculture

Digital technologies, driven by connectivity and real-time data analysis, will allow agricultural producers to use resources such as water more efficiently, reduce costs of inputs such as fertiliser by applying precision agriculture or monitor crops and livestock better. This has the potential to improve yields, lower costs and improve the sustainability of agricultural practices, including helping to restore biodiversity

For example, by being able to automate irrigation and better monitor crops and livestock. This has the potential to improve yields, lower costs and improve the sustainability of agricultural practices.



Health

Connectivity within care settings, such as hospitals, as well as outside, may transform the way that patients are monitored, and resources allocated. In addition, Augmented Reality (AR) and robotics will improve procedures and surgeries. The result is an improvement in the quality of care through innovation and optimisation.



Transport infrastructure

Improving mobile broadband connectivity, and particularly 5G networks, along European road and rail travel corridors can enable new mobility technologies such as connected autonomous vehicles. This will drive a range of benefits from greater efficiency, safety, and capacity of existing transport infrastructure.

Improved connectivity along transport routes will generate broader benefits for the surrounding areas, potentially attracting additional investment and leading to agglomeration benefits outside established urban and industrial centres.



Manufacturing and industry

5G and other related digital technologies, such as IoT and AI, have the potential to transform industry through greater productivity and efficiency. Connected machines will allow tasks to be automated and enable reconfigurations of production-lines, at price. Mixed reality devices and computer vision also aid quality assurance. Moreover, the increased level of data from production processes will enable greater levels of optimisation.



Entertainment

5G will enable new media and immersive technologies, such as in-car entertainment and holographic displays. These are expected to scale quickly, with the potential to **generate more than \$67bn annually** by 2028.

Enablers

Many of these applications will rely on fast, reliable and low latency connectivity, potentially delivered via managed private networks (MPNs) and mobile edge computing (MECs), which allow networks to be adapted and optimised for specialised purposes.

The realisation of benefits from these growth drivers will be dependent on coherent 5G national plans and on harmonised 5G enabling policies across EU members states. Facilitation of cross-value chain partnerships, and frameworks to support the sharing of non-personal data will also be essential.

European investment in innovation around open-architecture network technologies, such as OpenRAN is also expected to drive innovation in mobile network services, and could also help bolster the capability and autonomy of Europe's digital ecosystems.

As global demand for new digital technologies increases, so too does the value of becoming an international leader in 5G. The innovation, productivity benefits and sustained international competitiveness in a critical growth sector will help sustain long-term economic growth.

Lower resource consumption and environmental impact

Background

Beyond providing economic stimulation, digital technologies will also be essential to drive and enable more efficient use of resources such as water and energy, both on the supply side and the demand side. Investments in digital are part of the transition to an economy that does not damage and indeed, even helps to protect the environment. Investments in digital can deliver economic growth whilst at the same time reducing impact on resource consumption and emissions, and are therefore essential to building a greener economy and society, as set out in the **European Green Deal**.

Benefits realisation

To achieve Europe's ambitious green targets and to help arrest global warming, significant changes will be required across industrial value chains, from the point of resource extraction and input production, through to the behaviour of consumers.





Digital technologies can underpin this change by helping deliver smart ecosystems that will connect previously fragmented value chains, to provide better quality information about environmental impact to citizens, businesses and governments. This empowers stakeholders across society, including consumers, businesses and governments, to embed sustainable thinking in their decision making.

Beyond this, emerging technology solutions built on, for example, IoT applications and machine learning, will support the development of new sustainability use cases, from smart logistics and smart cities, through to smart agriculture and energy meters.

New technologies can also, in themselves, deliver greater energy efficiency and reduced emissions. For example, not only will 5G enable many of the use cases outlined here, but it is also inherently **more energy efficient than legacy network technologies**. Accelerating the shift from legacy generation technologies to 5G will help bring forward these energy efficiency outcomes.

Benefits case studies

Achieving a just and sustainable transition to a climate-neutral Europe by 2050 will require investments to scale digital solutions across multiple sectors, including agriculture, energy, mobility and construction. Digital solutions driven by 5G enabled IoT applications, can deliver reductions in energy consumption and emissions across a wide variety of applications:

Application	Commentary on impact	Benefit estimate
Smart agriculture 	Enables farmers to manage their crops and livestock more efficiently and sustainably through connected monitoring devices and farming equipment.	Reductions in input requirements of up to 20% have led to reduced damage to local environments and habitats , through lower natural resource consumption and fertiliser use.
Smart logistics 	Embedded IoT technologies in vehicles optimise route management, vehicle maintenance and driver behaviour.	Vodafone's IoT vehicle solutions are delivering cuts in fuel consumption of up to 30%, saving an estimated 4.8 million tonnes of CO²e last year.
Smart cities 	Improve the efficiency of energy-intensive services such as public transport, road networks and street lighting.	In Guadalajara (Spain), 13,500 LED streetlights were connected to a central management system, reducing energy consumption by 68%.
Smart energy meters 	Enable households and businesses to monitor and reduce their energy use, lowering energy bills and the environmental impact of energy production.	Worldwide, Vodafone's IoT platforms have connected over 12 million smart energy meters , saving c.1.6 million tonnes of CO²e last year.

These applications have the potential to drive impact across the entire length of key industrial value chains; production, transportation, communication and consumption all becoming more efficient enabled by greater information transparency and data-sharing.

Digital for Green Value Chain Impacts.



Smart agriculture

- Lower impact on natural resources
- Less emissions from fertilisers
- Biodiversity restoration
- Regenerative agriculture
- Better animal welfare
- Smaller land-use



Smart logistics

- Lower fuel consumption
- Fewer emissions
- Continuous incremental efficiency gains
- Less waste (including food)
- Supply chain traceability



Smart manufacturing

- Greater resource efficiency
- Circular economy potential
- Lower energy consumption
- Less pollution and waste
- Improved health and safety
- Greater precision, fewer faults



Smart cities

- More energy efficient delivery of services
- Better traffic flows, less congestion
- Less waste
- Improved air quality (lower pollution)



Smart energy meters

- Empowerment of people to change behaviours
- Reduced energy consumption
- Transparency
- Next generation grid management

Source: https://www.vodafone.com/sites/default/files/2021-01/europeconnected_digital_for_green.pdf

Enablers

Whilst the scale of funding available through the EU Green Deal and the Recovery and Resilience Facilities provide a much-needed financial stimulus for progress on sustainability objectives, other key enablers will need to be in place.

Strong and enduring partnerships between policymakers, industry and citizens will be required. Beyond these partnerships, connectivity providers will play a key role in connecting value chains and digital applications will empower consumers and businesses to collaborate to effect change in consumption behaviours.

Consistent digital standards frameworks will be needed to provide cross-member state alignment on the digital applications – driven by AI, automation and IoT – required to deliver on sustainability objectives. The collection, analysis and sharing of non-personal data enabling these applications, will also be central to ensuring a consistent evidence base for decision-making and measuring the impact of sustainability initiatives.

The EU has recognised the intrinsic role of digital in the green transformation. Leveraging applications across value chains, can support progress towards a healthier environment and a more energy and resource efficient future for all. The realisation of these benefits will be dependent on collaboration and data-sharing across government, industry and the public.

A more equitable society

Background

The COVID-19 pandemic has exposed some key underlying social and economic inequalities. There have been significant variations in the impact on individual Member States, and within Member States there have been wide variations in regional impact.

If digital investments and reforms are to underpin a recovery that genuinely builds back better, they will need to help drive benefits that are equitably distributed so that no region, industrial sector or demographic is left behind. These inequalities go beyond variations in the availability of high bandwidth and fixed and mobile connectivity between urban and rural communities, although this is particularly important.

Benefits realisation

Investments in digital connectivity and applications will be critical to addressing legacy inequalities. As digital technologies become increasingly embedded in the provision of key public services, as well as the basis for citizens' interactions with businesses, digital investments will be essential to ensuring that legacy barriers to equitable economic growth are tackled. As set out in Deloitte's forthcoming report for Vodafone **'Digitalisation – an opportunity for Europe'**, the positive impact of digitalisation will be greatest in lower income countries and would also contribute to the economic convergence across EU Member States.

Benefits case studies

The dimensions across which digital can generate more equitable outcomes for society are highly diverse.



Rural connectivity

The wider availability of fixed and mobile broadband connectivity in rural areas, enables communities to participate in, and benefit from, the modern digital economy.

Rural businesses will be better able to digitalise as a result, enabling farmers to roll-out digital agriculture applications, and rural communities to enjoy improved access to digital public services.



Digital public services

Digital healthcare technologies can deliver material improvements to health outcomes for citizens in rural areas, where a higher proportion of people have unmet medical needs - 2.0% of adults in rural areas compared to c.1.6% in urban areas. This urban-rural divide can be addressed through eHealth applications that make more efficient use of resources, provide better diagnosis, and ultimately by making healthcare provision more inclusive for all.



SME digital capabilities:

As set out earlier in this report, support for the development of SME digitalisation and the development of citizens' digital skills, will enable them to access new markets and to compete more effectively with larger-scale firms. A greater number of more digitally enabled European SMEs will help provide wider employment opportunities, particularly outside traditional urban centres.

Enablers

Digital connectivity for all drives social inclusion and creates further opportunity. Digital inequalities, between those who have and those who don't have access to, and the ability to use digital tools, may compound social inequalities. Ensuring good levels of fast connectivity across the population is crucial.

Digital skills – Availability of connectivity is not sufficient, if communities have not been supported in developing the skills to take advantage of the applications that connectivity enables. This applies to essential skills required to access digitalised public services, including health and education, but also to the value generative skills required to take advantage of high-skilled jobs as firms use more widely available connectivity to locate outside of urban centres.

Access to opportunities – Benefits are only realised from infrastructure and skills when there are also the opportunities to leverage these. This implies that a holistic approach to developing digital, in particular where adoption is relatively low, is required. Vodafone's Gigahub initiative in Ireland provide a case study on the importance of bring infrastructure and skills together to create opportunities for local communities

If Europe is to build back better, the recovery and long-term benefits of the transition need to be shared by, and accessible to all. The digital transformation, supported by investments in infrastructure and skills, has the potential to democratise access to public services, markets and information. Realising these benefits, however, requires active engagement by policymakers to address current digital divides.

Critical Enablers to Deliver Digital Benefits

The Recovery and Resilience Facility funds will be a cornerstone of the substantial funding required to deliver the benefits outlined in this paper. However these funds will also need to be supplemented by private investment. Member States' Recovery and Resilience plans will need to be constructed so as to crowd-in private investment, whilst seeking to achieve a sustainable equilibrium between consumer outcomes and healthy returns on investment. Leveraging the scale of the EU digital market will also help ensure that maximum value is delivered by every Euro of public and private investment.

Beyond capital investment, the public and private sectors will need to coordinate through public policy reform and open discussion to co-create, develop and maintain markets and ecosystems, and to train and develop citizens to lead the change.

In the longer term, policymakers will need to ensure that the investments and reforms outlined in national Recovery and Resilience plans are embedded in longer-term industrial strategies. These strategies will need to focus on future-facing industries with the scope to generate long-term returns and secure connectivity, and with a view to enhancing Europe's competitiveness in global digital markets.

The realisation of the benefits of a sustainable digital transformation will depend on six broad categories of enablers. Progress on these will be mutually reinforcing and will therefore require collaboration and coordinated action between stakeholders to deliver.



Policy reform

The European Commission has been clear that Recovery and Resilience Plans should be composed of policy reform as well as investment proposals. Investments in digital technologies will contribute to the creation of new ecosystems and value chains, which will at times disrupt existing markets; policy reform will be required to facilitate the development of these new ecosystems and to ensure that they deliver on Europe's digital and green objectives.

Policy reform will have a significant impact on the speed and extent of digital transformation, by setting the incentives and constraints on stakeholders through the development and implementation of digital technologies.

Policymakers will need to explore options for the revision and harmonisation of policy that will accelerate and reduce the cost of transformative technologies, to encourage non-personal data sharing, and to promote 'digital by design' both for business and public administration.

Policymakers will need to consider the broad impacts of policies on:

- **Incentives** – To maximise the impact of the Recovery and Resilience funds and to deliver value for money, policy must continue to incentivise businesses to act in support of digital and green transformation. This includes providing the right price signals, reducing costs and red-tape associated with infrastructure deployment, and providing meaningful mechanisms to encourage public-private collaboration on digital initiatives.

- **Enabling innovation** – Policymakers will need to consider new categories of regulation, to govern the development and use of the emerging technologies that will underpin digital transformation, including Artificial Intelligence (AI), big data and the Internet of Things (IoT). Regulation will need to be crafted in order to create sustainable and fair competition between European businesses large and small, as well as to encourage returns from competition in global digital markets.

Many digital applications across different sectors and services will rely on access to data in order to train, operate and optimise operations. Policymakers will need to further develop agile data sharing frameworks in order to enable this to maximise social value whilst maintain individual privacy protection.

- **Collective action** – National budgets are stretched and in the COVID-19 crisis, pressures on public services have taken priority over longer-term investments. There needs to be a more coordinated response between Member States given the size of the challenge, overall and across particular areas such as infrastructure deployment across nations. Beyond funding, collaboration and enablement will be critical.

- **Connectivity** - Policy reform targeted specifically for the delivery of high quality fixed and mobile broadband connectivity for all, will be an essential enabler of digital transformation.

Continued progress towards implementation of the **Broadband Cost Reduction Directive**, and adoption of the Commission's Recommendation on a common Union **toolbox for Connectivity** will be two important components of policy reform. Reform of access and permit regimes, and non-discriminatory access to physical infrastructure will help lower current deployment barriers and, in turn, deployment costs. Whilst this will be a key driver of extended rural connectivity, these interventions will also support the emergence of 5G travel corridors along Europe's highways and railways.

Policymakers will need to act to provide an environment that enables the European economy to leverage the benefits of 5G. Member States must collaborate towards greater harmonisation of spectrum policy and auctions that support investment and sustainable competition. Europe will also need a common approach, and common rules, on key 5G enablers, for example the development of a vendor agnostic and risk-based certification system, and clarity on the time-frame and potential compensation for network swap-outs, to mitigate possible impacts on quality of service.

Europe requires a faster transition to 4G LTE and 5G networks, driven by policy reform that incentivises network investments, infrastructure sharing and accelerated spectrum release.

Governments leading by example

Given the ambition to embed digital at the heart of the COVID-19 recovery, it will be essential for European governments to lead by example through implementing digital first stimulus packages and by developing and leveraging digital capabilities across all public services and administration.

Not only will this help drive the development and expansion of new digital markets, it will expose the widest possible number of citizens and businesses to the benefits of digital transformation, and enable Europe to gain a competitive advantage in global digital markets. This is particularly the case for the digital use cases that require national or supra-national scale, for the fullest extent of potential benefits to be realised, for example eHealth and the realisation of sustainability objectives.

Beyond the adoption of digital as an enabler of change, governments will need to evolve to become more adept at reacting to change. This will require agility and flexibility in policy formulation and adaptation to enable public administration to keep pace with the continually evolving opportunities and challenges.

Governments have an active role to play in ensuring access to digital health solutions and enabling digital transformation of healthcare. eHealth investments and support to healthcare organisations, in digitalising their operations and services, need to be prioritised and include support for behavioural changes in institutions and digital upskilling of healthcare staff.

Partnerships and collaboration

Delivering digital transformation will require partnerships and collaboration across a wide ecosystem of stakeholders. Working towards a common goal will support the development, standardisation and implementation of new technologies, as well as ensuring that the benefits are spread across society, rather than concentrated among particular sections.

Essential partnerships required to drive the transition include those between:



EU and Member States:

Policymakers at national and international levels are responsible for setting overall desired outcomes for digital transformation, and for directing the significant resources available. They have a key role in ensuring the intra-national collaboration that will be required to deliver the EU's twin digital and green objectives, particularly in those areas that will depend on the development of consistent digital standards. For example a harmonised carbon measurement methodology would simplify compliance monitoring, providing economies of scale and more effective use of resources, and would help create the right conditions for green business models



National, regional and local

policymakers: Within Member States, policymakers at national, regional and local levels will be responsible for ensuring local policies are aligned to the objectives outlined in National Plans. Coordination and monitoring at the national level will be required in order to ensure a consistent framework for the allocation of Recovery and Resilience funds; this coordination will be essential to avoiding a fragmented approach in which economies of scale benefits could be lost, and which could ultimately cause funds to be distributed in a way that fails to achieve the most cost effective and equitable outcomes. Local and regional

policymakers will need to translate broad policy direction from the EU and national governments into on-the-ground action; designing strategies to deliver on local and community needs, as well as ensuring that local public services and infrastructure planning rules are aligned with national digitalisation strategies.



Infrastructure owners and

policymakers: If the connectivity infrastructure that will underpin the digital transformation is to be available as widely and as cost effectively as possible, infrastructure owner/operators and policymakers must work in partnership to overcome existing barriers to network deployment and infrastructure sharing. This collaboration will be essential to ensure an equitable distribution of benefits, and that no region or demographic is left behind.



Private enterprise and other

public organisations: Across a range of industries, the benefits

of digital transformation will be realised through businesses' adoption of the next wave of digital technologies and applications. However, businesses will require support from policymakers in making sure that infrastructure and labour skills are available, and public administration will require support from the owners of digital infrastructure and applications to ensure that technologies meet the needs of essential public services on which all members of society, particularly the vulnerable, depend.

Within DESI, there are several indicators related to the **extent and quality of partnerships between these stakeholders and how the use of particular digital tools such as data-sharing, big data and cloud are being adopted amongst them**. Based on the latest DESI assessment, progress still needs to be made; for example, there are significant variations in the extent of digitalisation of public

services across Europe, and the extent of SME digitalisation remains inconsistent, with large enterprise more than twice as likely to use cloud and big data tools compared to SMEs.

To unlock value from the opportunities presented by smart cities technologies, public data needs to be shared between a wide variety of systems and platforms. Integration and interoperability at the scale required, demands close collaboration between national governments, regional authorities, municipalities, infrastructure owners, and data generators.

Extension and proliferation of digital skills

The extent and distribution of digital skills will be a key determinant of the success of digital transformation and the extent to which benefits can be shared across European society. However, **according to DESI**, 42% of the EU population still lacks basic digital skills, even though most jobs require such skills. There also remains a shortage of ICT specialists in Europe, with 57% of enterprises experiencing difficulties in recruiting ICT specialists, holding back digital progress at all levels.

Upskilling citizens prepares them for the opportunities of digital transformation, creating new jobs and access to new markets, whilst driving European competitive advantage in global digital markets and providing empowerment of citizens to adopt and engage with new digital technologies.

Absent investment in digital skills means Europeans are less likely to adopt the digital technologies that will underpin future jobs as well as essential public services. Digital skills deficits would also constrain the scope for innovation and development of technologies within the Union, a key driver of value generation, in the absence of which Europe's long-term international competitiveness and autonomy will be undermined.

Beyond the need to invest in the depth of digital skills, there are also **imbalances in digital skills between rural and urban communities**, as well as between SMEs and larger businesses. Digital transformation cannot drive sustainable and equitable recovery for the whole of Europe if these skills imbalances are not addressed. Comprehensive investment in digital skills will include support through educational institutions, centres supporting lifelong learning, training provided to and by enterprises, as well as fostering talent in government and public organisations.

The expansion of connectivity in rural areas will need to be complemented by programmes to improve digital skills in these areas, to maximise the return on digital investments. SME-focused digital hubs, facilitated through partnerships between public organisations and digital technology/infrastructure firms, are proving effective in providing SMEs and local labour markets with the support, skills and resources required to overcome barriers to digitalisation.

Embedding Digital for Green as an enabler

As the European Commission has recognised, if the Recovery and Resilience funds are to support the European Green Deal target of reaching climate neutrality by 2050, national recovery and resilience plans will need to focus on policy reforms as well as investments.

This will require 'digital for green' to be embedded as a key enabler of the EU's carbon neutrality and emissions reduction objectives, and will drive significant change across the value chain, from the point of resource extraction and input production, through to the behaviour of consumers.

Key elements of digital for green as an enabler will include:

- **A policy environment** that guides and incentivises stakeholders across all sectors of the economy to consider the environmental externalities of their decisions and investments. Policy Makers will need to include carbon enablement technical criteria in their allocation of funds, reflecting that digital and connectivity

solutions support other initiatives in reducing their environmental impact.

- **Collaboration between Member States**, to provide alignment across national recovery and resilience plans on sustainability measures, and objectives to help prevent gaps, duplication and inconsistencies, and seize the potential of cross-EU initiatives. This should include demand-side measures and incentives.
- **Transparent and common methodologies and approaches** to measure Member States' progress towards Net Zero.

Key example:

Evaluation frameworks for expanding connectivity, investment in digital technologies and facilitating data sharing, will need to provide a clear focus on green objectives in order to improve the sustainability outcomes of reform and investment.





Connectivity for a digital society

High quality, highly resilient and widely available connectivity is an essential prerequisite of digital investments as a driver of post COVID-19 recovery. Given pre-existing disparities in the availability of gigabit capable broadband connectivity, Europe will need an ambitious and consistently applied framework to help Member States to reduce the cost of fixed and mobile broadband network deployment.

However, connectivity for a digital society is about more than the 'last mile' connectivity to citizens' mobile devices, homes and business premises. Connectivity for a digital future is also about secure and resilient interconnectivity between public administrations, enterprises and citizens. As well as investment in the cloud infrastructure and applications on which the sharing and analysis of personal and non-personal data depends. Investments in secure and agile applications, and appropriate governance frameworks, to support the rapid and secure exchange of information across networks will be as essential as the networks themselves.

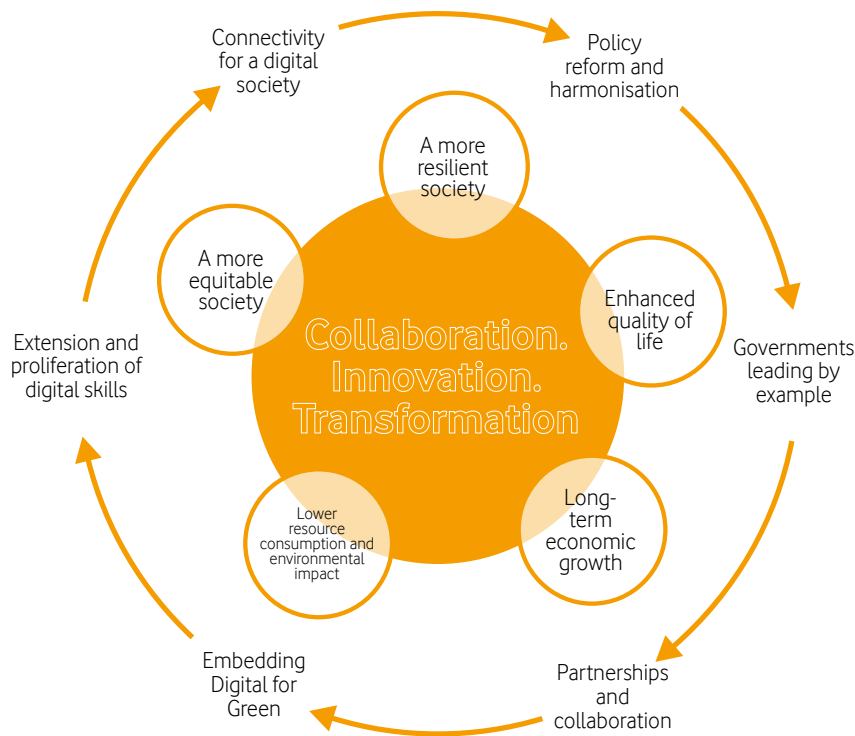
Connectivity for a digital society also goes beyond land-based infrastructure; the resilience of European networks and the level of latency that can be achieved are also dependent on continued investment in submarine cable connectivity. In this respect investment in submarine cables will be an essential enabler of Europe's ability to develop and exploit strategic resources such as the high-performance super computers that will underpin the data intensive critical applications of the future.

Finally, a common EU framework for funding support to emerging open interface radio access network technologies such as OpenRAN, has the potential to generate long term capex and opex savings from the adoption and deployment of OpenRAN networks. This in turn will help reduce the cost of rural network deployment, as well as improve the opportunities for network sharing in remote areas. There are also potential benefits to Europe's digital autonomy from enabling a wider ecosystem of network hardware and software vendors to compete on price, product features and security capabilities to provide the next generation of Europe's networks.

Conclusion

Europe, with its sizeable financial commitment to the Recovery and Resilience funds, has a unique opportunity to transform its economy by breaking down value chain silos, integrating systems and creating new markets and ecosystems. Adopting a digital-by-design approach will deliver greater benefits than applying a digital sticking-plaster to legacy processes and systems.

This paper has identified a series of opportunities for investment in digital skills and technologies and illustrated the mechanisms by which these investments and the enabling reform, can generate a wide range of economic, social and environmental benefits.



A successful digital-by-design approach will require extensive partnerships between public and private sectors, between central and local governments and between Member States. These partnerships will enable significant economies of scale and scope, building on the establishment of the Digital Single Market, and will help ensure that maximum value for money is generated from each Euro invested.

Europe will need to move quickly to create the necessary conditions to enable these partnerships to thrive, and there are further

challenges to be overcome. For digital to be the foundation stone of sustainable recovery, and for the benefits to be enjoyed equitably by all, existing inconsistencies in digital skills, access to digital public services and the availability of digital infrastructure will need to be addressed.

Otherwise there's a real risk that some groups of citizens, businesses, and regions could be left behind, leading to existing social and economic divides widening. The opportunity to use this once-in-generation opportunity to build back better will have been lost.



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