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**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

on the Mid-Term Review on the implementation of the Digital Single Market Strategy

A Connected Digital Single Market for All

{SWD(2017) 155}

EN

"Digital technologies and digital communications
are permeating every aspect of life.
We need to work for a Europe that empowers our citizens and our economy.
And today, both have gone digital."

President Juncker in his State of the European Union speech on 14 September 2016

1. Introduction

Successive waves of technological change have transformed human societies and economies, with long-term benefits for both economic growth and quality of life. The current digital revolution has the power to do so again.

> Two-thirds of Europeans think that the most recent digital technologies have a positive impact on society, the economy and their own lives. A majority of respondents is of the opinion that the EU, Member States' authorities and companies need to take action to address the issues raised around digitisation.[1]

People and businesses in the EU have the inherent strengths needed to take advantage of the Digital Single Market (DSM). These include a strong manufacturing base and fast-growing startup ecosystem, which combined with newly digitised industrial processes and a skilled workforce, can drive growth for the foreseeable future. To fully unlock the data economy, the EU must also harness such assets to maximise the digitisation of the European service sectors, in particular health and care, energy, transport and finance.

However, these strengths can only be used to the full if there is substantial additional investment in digital skills and infrastructure, from the EU level, Member States and the private sector. The completion of the EU Single Digital Market also needs a clear and stable legal environment to stimulate innovation, tackle market fragmentation and allow all players to tap into the new market dynamics under fair and balanced conditions. This will provide the bedrock of trust that is essential for business and consumer confidence.

This was the goal of the Digital Single Market strategy.[2] Through improved access and fair conditions, this strategy means an open market where it is easy for businesses and people to operate as effectively anywhere in Europe as it is at home. In the two years since the adoption of the strategy, the Commission has made proposals on all the 16 key measures~~major measures~~ identified. They focus on areas where the EU can bring specific added value, concentrating on European digital projects whose scope and scale cannot be realised by individual countries alone. It is critical for all parties to ensure that the measures are adopted, fully implemented and effectively enforced in a timeframe that is coherent with the fast development of a digital economy. The Commission will bring to bear the full range of policy instruments and funding opportunities to help make this happen, but the full support of Member States, the European Parliament, the Council and stakeholders is essential; otherwise the Digital Single Market will simply not become a reality.

The decisive role that digital will play in transforming Europe is also underlined in the White Paper on 'The Future of Europe'[3]. Digital technology impacts on every aspect of EU policy: how we produce and consume energy, how we move from one place to another, how capital flows throughout Europe. People will soon be able to travel throughout the EU without worrying about mobile roaming charges or losing access to music, games, films, sport events and series for which they have already paid.

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[1] European Commission, Special Eurobarometer "Citizens' Attitudes Towards the Impact of Digitisation and Automation on Our Daily Lives", 2017 [Eurobarometer Survey conducted in March 2017- not yet published.]
[2] COM (2015) 192.
[3] COM (2017) 2025.

It is essential that EU businesses grasp the opportunities of digital technology to remain competitive at global level, that EU startups are able to scale up quickly, with full use of cloud computing, big data solutions, robotics and high speed broadband, thereby creating new jobs, increased productivity, resource efficiency and sustainability. The provision and use of eGovernment solutions would also bring enormous benefits for people, businesses and public administrations and opens the door to new cross-border opportunities, particularly by using electronic signatures.

At the same time, the digital infrastructures on which the digital economy depends need to be robust, resilient and able to adapt to evolving threats. Otherwise the trust of people and businesses will be eroded and digital uptake held back.

This mid-term review assesses progress towards the implementation of the Digital Single Market, identifying where more efforts are needed and where the changing digital landscape calls for new action at the EU level. It is accompanied by the 2017 European Digital Progress Reports[4] outlining the progress made at both EU and Member State level and a staff working document setting out the evidence that has informed this review.[5]

2. A call for timely delivery and effective implementation

The Joint Declaration on EU legislative priorities highlighted a political responsibility for the EU institutions to finalise key legislation under the Digital Single Market by the end of 2017[6]. Delays would leave people less protected; unable to use better, faster and cheaper connections; and blocked from access to more online content.

The 'triple win' for consumers starts to deliver concrete benefits

Benefits from the first series of Commission proposals are now starting to flow, following the agreements of the European Parliament and the Council. **Retail roaming charges[7]** will be abolished from 15 June 2017. Mobile users periodically travelling in the EU will be able to call, text and surf the web for the same price as they pay at home. National regulatory authorities will be monitoring developments closely to ensure the new rules are observed and consumers benefit.

34 % of Europeans travel abroad within the EU at least once a year.[8] In 2014, about half of Europeans said they would not use mobile internet abroad because it was too costly.[9]

Cross-border portability of online content services[10] means that, from early 2018, consumers will be able to access their online subscriptions to films, sport events, e-books, video games or music services when travelling in other EU countries.

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4   European Digital Progress Report (EDPR) 2017, SWD (2017) 160.
5   SWD(2017) 155.
6   https://ec.europa.eu/priorities/sites/beta-political/files/joint-declaration-legislative-priorities-2017-jan2017_en.pdf .
7   COM(2016) 399.
8   Special Eurobarometer 414 (2014).
9   Ibid.
10 COM(2015) 627.

The final part of this 'triple win' package would come with the swift adoption of the proposal to address **unjustified geo-blocking.**[12] Traders would no longer be able to discriminate against consumers from other Member States without objectively justified reasons.

Internet connectivity for all

To boost connectivity and the further development of new services from 2020, Member States will take coordinated action to make the **high-quality 700 MHz band** available for wireless broadband use**.** This cross-border coordination on spectrum is an essential building block. Without it, 5G networks and the new services that they bring – such as connected cars, remote healthcare, smart cities or video streaming on the move – will not be able to operate effectively. To fully equip the EU with high quality and fast telecommunications networks, it is critical that Member States continue having a coordinated approach to spectrum policy.

If the benefits of the digital revolution are to be enjoyed by everyone, Europe needs a regulatory framework for electronic communications that promotes the deployment of infrastructure which is capable of delivering seamlessly everywhere in the EU, including rural areas[14], whilst safeguarding effective competition. Much of the investment required will come from the private sector, building on an improved regulatory environment. Rapid adoption of the proposals for an **Electronic Communications Code**[15] and the Regulation on the **Body of European Regulators for Electronic Communications** (BEREC)[16] is therefore also essential.

Swift broadband roll-out will also be supported by the measures proposed in the European Electronic Communications Code to enhance spectrum coordination, foster competition in telecoms markets and encourage investment in high capacity networks. Swift implementation of Directive 2014/61/EU on measures to reduce the cost of deploying high-speed electronic communications networks is also needed.[17]

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[11] Flash Eurobarometer 411 (2015).

[12] COM(2016) 289.

[13] GfK Belgium, Mystery Shopping Survey on Territorial Restrictions and Geo-Blocking in the European Digital Single Market, May 2016.

[14] IHS and Point Topic: Total Next Generation Access coverage in Europe is 76% while in rural areas it is only 40 %.

[15] COM(2016) 590.

[16] COM(2016) 591.

[17] As of end of February 2017, only 15 Member States notified complete transposition of the Directive 2014/61/EU on measures to reduce the cost of deploying high-speed electronic communications networks, European Digital Progress Report (EDPR) 2017, SWD (2017) 160. Measures in the Directive include the sharing and re-use of existing physical infrastructure, coordination of civil works and improved permit-granting procedures.

[18] COM(2016) 587 p. 8.

To further stimulate the investment now under way in high-speed broadband roll-out, the EU is also mobilising ~~public and private resources through~~ the European Structural and Investment Funds (around EUR 6 billion up to 2020 to provide more than 14,5 million households with high speed broadband access) and instruments such as the European Fund for Strategic Investments (around EUR 3.2 billion[19] of public and private investment) and the Connecting Europe Facility. A **Connecting Europe Broadband Fund**[20] will help private investors to join up the efforts to support digital network infrastructures in under-served areas and trigger up to EUR 1.7 billion of additional investment up to 2021. This work will also receive a boost with the rapid adoption and implementation of the proposal on promoting internet connectivity free to users in local communities (**WiFi4EU initiative**). This would enable up to 8,000 local communities to benefit from a total funding of EUR 120 million up to 2020. In this context, it should be noted that the Commission regularly clears national broadband state aid schemes ~~which~~ and this also constitutes an important EU-level action to stimulate investments.

~~It should also be noted that connectivity by satellite technologies should be promoted, especially in remote areas.~~

All stakeholders need to work together to meet the EU's connectivity ambitions for 2025[21] and ensure that Europe takes a leading global role in the deployment of 5G services by implementing the **5G Action Plan**.[22]

A better online marketplace for consumers and businesses

Boosting **cross-border e-commerce** is one of the main objectives of the Digital Single Market. A series of proposals now on the table need to be adopted swiftly for the benefits to start to flow. Fully harmonised **digital contract rules**[23] and strengthened rules on **cooperation between national consumer protection authorities**[24] will improve consumer protection and conditions for businesses selling products and services across borders. The fully harmonised set of rules on 'digital contracts' will reduce the differences between national consumer contract laws and remove one of the main reasons why businesses 'geo-block'. Business take-up of e-commerce opportunities also depends on **affordable cross-border parcel delivery services**[25] and **simpler VAT declaration procedures.**[26]

Building an innovation-friendly environment through effective enforcement

The Commission launched a **competition sector inquiry** into e-commerce in May 2015 to identify possible competition concerns arising from companies' business practices. The results of the sector inquiry[27] will help to target **enforcement of competition law** on e-commerce business practices that have the most damaging consequences for competition and

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[19] Financing of about EUR 1 billion has been approved under EFSI for broadband related projects and has triggered around EUR 3.2 billion of total EFSI related investments for these broadband projects by April 2017. The list of projects is available on http://www.eib.org/efsi/efsi-projects/index.htm?c=&se=4.
[20] http://europa.eu/rapid/press-release_IP-16-4351_en.htm .
[21] COM(2016) 587 and SWD(2016) 300.
[22] COM(2016) 588
[23] COM(2015) 634 and COM(2015) 635.
[24] COM(2016)283.
[25] COM(2016)285.
[26] COM(2016)757.
[27] COM(2017) 229.

cross-border trade. The Commission has already opened three investigations into alleged anti-competitive practices in consumer electronics, video games and hotel accommodation.

National authorities have also carried out consumer law enforcement and cooperation actions.[28] Together with ongoing efforts to increase capacity building for online enforcement, a well-functioning **online consumer dispute resolution system**,[29] and the updated **guidance on the Unfair Commercial Practices Directive,**[30] help to ensure that consumer rights are effectively enforced in practice.

Respect for **intellectual property rights** is essential for promoting creativity and innovation and creating trust in the marketplace. The Commission is finalising its evaluation of the current legal framework for the enforcement of all intellectual property rights, including copyright.

Making protection of privacy and personal data a reality in the internet

The **General Data Protection Regulation** (GDPR)[31] is an essential tool to safeguard individuals' fundamental right to the protection of personal data in the digital age. It offers businesses simplified rules, creates new business opportunities and encourages innovation. The Commission is working closely with Member States, the independent Data Protection Supervisory Authorities, and with businesses and civil society to prepare for the application of the Regulation from 25 May 2018.

The proposal for a revised ePrivacy **Regulation**[32] would complement the GDPR while also ensuring alignment with the relevant rules of the GDPR. It will further increase legal certainty and **the protection of users' privacy online**, while also increasing business use of communications data, based on users' consent. Swift adoption of the ePrivacy Regulation will allow consumers and businesses to benefit from the full digital privacy framework when the GDPR applies in May 2018.

Improving the conditions to create and distribute content in the digital age

The proposed revision of the **Audiovisual Media Services Directive**[33] will create a legal framework updated to the needs of the digital age. It will ensure a balance between competitiveness and consumer protection, reinforce the promotion of European works and enhance the independence of regulators.

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[28] Press release of 17 March 2017 on the CPC actions on social media: http://europa.eu/rapid/press-release_IP-17-631_en.htm .
Press release of 23 March 2017 on cooperation between data and consumer protection authorities: http://europa.eu/rapid/press-release_MEX-17-741_en.htm .

[29] Press release of 24 March 2017 (http://europa.eu/rapid/press-release_IP-17-727_en.htm?locale=en): in its first year of operation the Online Dispute Resolution platform attracted more than 24 000 consumer complaints.

[30] SWD(2016)163.

[31] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016, which entered into force on 24 May 2016 and shall apply from 25 May 2018. In this context, tThe Radio Equipment Directive 2014/53/EU, Article 3(3)(e), empowers the Commission to adopt delegated acts *inter alia* on safeguards in radio equipment to protect the personal data and privacy of users.

[32] COM (2017) 10.

[33] COM(2016) 287.

67% of individuals in the EU who used the internet in the last three months read news online. More than half (51%) used the Internet to play or download games, images, films or music. 31% listened to web radios.[34]

The EU also needs modern **copyright rules** that ensure consumers and creators can make the most of the digital world. The Commission's proposal[35] aims to ensure more cross-border access to online content, wider opportunities to use copyrighted materials in education, research and cultural heritage, and a better-functioning, fairer marketplace for online content.

Since the launch of the Digital Single Market strategy in May 2015, the Commission has delivered on all the key measures, presenting 35 proposals in total. One, so far, has been adopted by the co-legislators. The Commission calls for swift agreements by the European Parliament and the Council on the proposals under the Digital Single Market Strategy and for all parties to ensure that the measures proposed are rapidly~~swiftly~~ adopted and implemented to allow people and businesses in the EU to fully benefit from a functional Digital Single Market

3. Ensuring a fair, open and secure digital environment

The digital world is by definition a fast-moving environment where policy needs to adapt to changing circumstances. As new technologies become mainstream, they can bring profound benefits to the economy and to our daily lives. However, it is essential that they be grounded in a set of rules to provide confidence to consumers and business alike. This means extending the Digital Single Market Strategy to keep up to date with emerging trends and challenges such as those related to online platforms, the data economy and cybersecurity.

3.1 Promoting Online Platforms as responsible players of a fair internet ecosystem

Online platforms drive innovation and growth in the digital economy. They play an important role in the development of the online world and create new market opportunities, notably for SMEs. At the same time, platforms have become key gatekeepers of the internet, intermediating access to information, content and online trading. Online platforms organise the internet 'ecosystem' and this is a profound transformation of the World Wide Web, bringing new opportunities, but also challenges.

82 % of SME respondents to a recent Eurobarometer survey on online platforms rely on search engines to promote products and/or services online. 66 % indicate that their position in the search results has a significant impact on their sales.[36] Almost half (42 %) of SME respondents use online marketplaces to sell their products and services. In addition, 90 % of respondents to the Commission's fact-finding on platform-to-business trading practices use online social media platforms for business purposes.[37]

A majority (53 %) of respondents to a 2016 Eurobarometer survey said they follow debates on social media, for example, by reading articles on the internet or through online social networks or blogs. A large majority of those who follow or participate in debates have heard,

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[34] Eurostat Culture Statistics 2016, p.138.
[35] COM(2016) 593 and 594.
[36] Flash Eurobarometer 439 'The use of online marketplaces and search engines by SMEs', of June 2016.
[37] Ecorys/Kantar TNS 'European SMEs dealing with digital platforms', January 2017.

read, seen or themselves experienced cases where abuse, hate speech or threats are directed at journalists/bloggers/people active on social media (75 %).[38]

In its May 2016 **Communication on Online Platforms**,[39] the Commission identified two specific issues for further investigation: safeguarding a fair and innovation-friendly business environment; and ensuring that illegal content online[40] is timely and effectively removed, with proper checks and balances, from online platforms.[41]

Ensuring a fair and innovation-friendly platform economy

The Commission has conducted a fact-finding exercise on **platform-to-business trading practices**. Preliminary results indicate that some online platforms are engaging in trading practices which are to the potential detriment of their professional users, such as the removal ('delisting') of products or services without due notice or without any effective possibility to contest the platform's decision. There is widespread concern that some platforms may favour their own products or services, otherwise discriminate between different suppliers and sellers and restrict access to, and the use of, personal and non-personal data, including that which is directly generated by a company's activities on the platforms. Lack of transparency, e.g. in ranking or search results, or lack of clarity in relation to certain applicable legislation or policies have also been identified as key issues. A significant proportion of disagreements between professional users and online platforms remain unresolved, which can create important negative impacts for the affected businesses.[42] The general lack of accessible redress that would allow business users to tackle the emerging issues quickly and effectively when they arise also constitutes a key feature in the platform-to-business context, as highlighted by the emerging evidence.

In considering how to address these potential concerns, the Commission's overall policy objective is to safeguard a fair, predictable, sustainable and ultimately trusted business environment in the online economy.

Fighting illegal content online

Fighting the proliferation of illegal content online requires determined and concerted action by all stakeholders. At the same time, fundamental rights, such as freedom of speech, must be safeguarded and innovation needs to be encouraged. The Commission made the commitment to maintain a balanced and predictable liability regime for online platforms and to pursue a sectoral, problem-driven approach when it comes to fighting illegal content online.[43]

Today, trust in online social network stories is, generally speaking, weak and predominantly related to the source of the information. Indeed, a recent survey highlights this fact and notes that for 36% of respondents, the main criterion for considering a story on social media to be

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[38] Special Eurobarometer 452, October 2016.
[39] COM(2016) 288.
[40] e.g. public incitement to violence and hatred (i.e. illegal hate speech), incitement to terrorism or child sexual abuse material.
[41] Similar reflections have been carried out in some Member States, including most recently in the German White Paper on Online Platforms, supporting action in key areas at EU level. (German Federal Ministry of Economic Affairs and Energy: White Paper Digital Platforms, March 2017).
[42] SWD(2017) 155
[43] Relevant legislative measures include the 2016 copyright package and the proposed revision of the Audio-visual Media Services Directive.

trustworthy is the perceived reliability of the source. However, only 7% of respondents consider that stories published on online social networks are, generally speaking, trustworthy[44].

To help build further trust online, the Commission committed itself to analyse the need for formal, EU-wide flagging and removal mechanisms for illegal content ('notice and action') and the need for guidance and support on the liability rules and support toof platforms that proactively put in place voluntary measures to fight illegal content.[45] In this context, there are also several voluntary public-private cooperation partnerships, dialogues and self-regulatory mechanisms in place, such as the EU Internet Forum, the Memorandum of Understanding on the online sales of counterfeit goods, the Alliance to Better Protect Minors online and the Code of Conduct on Countering Illegal Hate Speech online.

Building on the recent progress and successful work in many platform dialogues within the Digital Single Marketareas, tThe Commission considers that there is scope to better coordinate on-goingring existing voluntary initiatives closer together for further coherence, coordinated monitoring with a view to reinforcing the impact of the platform dialogues, in particular when it concerns with a view to discussing common principles for removal of illegal content. Discussing the procedural aspects and principles on removal of illegal content ("notice and action"), would form a part of the future work by the Commission together with the platforms. This These would concern issues such as minimum procedural requirements for 'notice and action' "notice and action" procedures of online intermediaries related for example to quality criteria for notices, counter-notice procedures, reporting obligations, third-party consultation mechanisms, dispute resolution systems and coordination with public authorities as well as measures against repeat infringers and abusive, bad-faith notices. This should be done in synergy with, and without prejudice to, dialogues already ongoing and work launched in other areas, such us under the European Agenda on Security. Further work in this area This could also concern the promotion of best industry practicse for example in terms of official flagger programmes.

The Commission will,

- *prepare actions to address the issues of unfair contractual clauses and trading practices identified in platform-to-business relationships, including by exploring dispute resolution, fair practices criteria and transparency. These actions could, on the basis of an Impact Assessment and informed by structured dialogues with Member States and stakeholders, take the form of a legislative instrument. This work will be finalised by the end of 2017. The Commission will also continue to use its competition enforcement powers wherever relevant;*

- *ensure better coordination of platform dialogues and partnerships with major platforms within the Digital Single Market focusing on put the diverse dialogues with the platforms under a single DSM framework, focusing on the mechanisms and technical solutions for removal of illegal content, with a view to enhancing their effectiveness in full respect of freedom of speech of fundamental rights. Wheren applicable, Tthe aim should be to underpin these mechanisms with guidance on coherent procedural aspects principles such*

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[44] Special Eurobarometer 460. "Attitudes towards the impact of digitisation and automation on daily life". May 2017

[45] COM (2016) 288

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as the notification and removal of illegal content while ensuring transparency and the necessary checks and balances to protect fundamental rights, ~~as well as~~ avoiding over-removal of legal content. The Commission will also provide guidance on liability rules and support to platforms on voluntary measures taken by platforms when they work proactively to ~~identify and~~ remove illegal content, acting in good faith. This work should produce first concrete results by end of 2017.

3.2 Developing the European Data Economy

The data economy can help European businesses to grow, to modernise public services and to empower citizens. For this to happen, data needs to be continuously accessible and able to move freely within the single market, accompanied by the necessary high performance computing capability to analyse it.

Assuming that an appropriate policy and legislative framework for the data economy is put in place in time, the value of the data economy will increase to EUR 739 billion by 2020, representing 4 % of overall EU GDP (more than doubling the situation today), and the number of data professionals will increase from over 6 million in 2016 to over 10 million by 2020[46], according to the estimates of a high growth scenario.[47]

EU legislation[48] prohibits restrictions on the free movement of personal data within the European Union on grounds connected with the protection of personal data. However, other types of restrictions — for public policy purposes in the field of taxation for instance — are not covered by the General Data Protection Regulation. In addition, non-personal data[49] are outside the scope of current rules.

Examples of non-personal data include tax records such as invoices, accounting documents or documents supporting company registration. Other examples include data on precision farming (helping to monitor and optimise the use of pesticides, nutrients and water) or from sensors communicating the data it records such as temperature or wind conditions in, for instance, wind turbines, or data on maintenance needs for industrial robots for example when they are out of paint.

In order to ensure the effective and trustworthy cross-border **free flow of non-personal data,** Member States and industry should be guided by a principle of free movement of data within the EU. Data location requirements, entailing the storage and processing of data within specific territories, would only be justified in limited cases, such as for national security purposes.

In order to foster common approaches, the Commission has undertaken a public consultation[50] as well as a detailed exchange with Member States on a EU free flow of data cooperation framework within the Digital Single Market. This framework could, in addition

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[46] European Data Market Study SMART 2013/0063, available at: http://datalandscape.eu/ .

[47] The high growth scenario is characterised by a stronger driving role of digital innovation and higher overall ICT investments as a share of GDP.

[48] Article 1(2) Directive 95/46/EC; Article 1(3) General Data Protection Regulation.

[49] Under Article 4(1) of the General Data Protection Regulation "'personal data' means any information relating to an identified or identifiable natural person".

[50] https://ec.europa.eu/digital-single-market/en/news/public-consultation-building-european-data-economy

to the principle of free flow of data within the EU, address Member States' legitimate interests on secure storage while ensuring availability of data across borders for regulatory, for example tax control purposes, but also safeguarding the economic and other benefits that arise from the free flow of non-personal data. The Commission is considering further complementary action to cover cloud contracts for business users and switching of cloud services providers, in line with the European Cloud Initiative.[51]

The Commission could also initiate infringement procedures if it finds evidence that current rules on the free movement of services are not properly implemented. In addition, the Commission will closely monitor how Member States will apply the specification clauses in the General Data Protection Regulation, for instance in relation to genetic, biometric and health data[52], to ensure that the free movement of personal data within the Union is not inappropriately restricted.

Whereas harmonised rules exist on personal data, access to and re-use of **non-personal data** in a business-to-business context are dealt with between businesses on a case-by-case, contractual basis. Drawing on the public consultation following the Communication on Building a European Data Economy[53], the Commission is assessing whether the lack of a clear framework for access to non-personal data stifles innovation and growth, particularly for SMEs, and whether initiatives are needed to foster fair and balanced access to, and use of, data. The Commission's work on access to and use of data will include looking at freeing up further public[54] and publicly funded data, as this is an important source of data for innovative services and scientific research.[55] It will additionally look at the access, under clearly defined conditions, of privately held data for public administrations for the execution of their public interest tasks.

The rollout of the **Internet of Things** brings significant new challenges in terms of the safety of connected systems, products and services, as well as for businesses' liability. Faulty sensors, vulnerable software or unstable connectivity may make it difficult to determine who is technically and legally responsible for any ensuing damage. The Commission will consider the possible need to adapt the current legal framework to take account of new technological developments (including robotics, Artificial Intelligence and 3D printing)[56], especially from the angle of civil law liability and taking into account the results of the ongoing evaluation of the Directive on liability for defective products.[57] and the Machinery Directive. Predictability on the access to patent protected technology endorsed in standards (standard essential patents) is key for the rollout of Internet of Things where a broad range of sectors will implement standards on mobile connectivity. The Commission is assessing effective means to ensure a

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[51] COM(2016) 178.

[52] For instance according to Article 9(4) of the General Data Protection Regulation 'Member States may maintain or introduce further conditions, including limitations, with regard to the processing of genetic data, biometric data or data concerning health'.

[53] https://ec.europa.eu/digital-single-market/en/news/public-consultation-building-european-data-economy .

[54] For example spatial and earth observation data, which build on Directive 2007/2/EC (INSPIRE).

[55] On the basis of Directive 2007/2/EC establishing an Infrastructure for Spatial Information in the European Union (INSPIRE) and assessment of further steps to the Public Sector Information Directive 2003/98/EC, as amended by Directive 2013/37/EU.

[56] For instance in the ongoing evaluation of the Machinery Directive.

[57] The European Parliament considers that the civil liability for damage caused by robots is a crucial issue, which also needs to be analysed and addressed at Union level: http://www.europarl.europa.eu/sides/getDoc.do?type=REPORT&reference=A8-2017-0005&language=EN .

balanced framework for the licensing of this intellectual property respecting the interests of both developers and users of technology.

The Commission will:

- *by autumn 2017, subject to Impact Assessment, prepare a [legislativeal] initiative proposal on the EU free flow of data cooperation framework which takes into account the establishment principle of a free flow of data principlewithin the EU, the principle of porting non-personal data, including when switching business services like cloud services as well as the principle of availability of certain data for regulatory (e.g. tax) control purposes also when that data is stored in another Member State;*
- *in spring 2018, based on an evaluation of existing legislation and subject to an Impact Assessment, prepare an initiative on accessibility and re-use of public and publicly funded data as well as accessibilityand further explorestudy the issue of privately held data which are of public interest.*
- *also further analyse whether to define principles to determine who is liable in cases of damage caused by data-intensive products.*
- *continue to assess the need for action concerning the emerging data issues as identified in the data Communication from January 2017, such as data producer or access rights.*

3.3 Fostering a trustworthy cyber ecosystem: Tackling cybersecurity challenges together

Society is shifting its focus from specific connected devices (computers, smartphones or wearables) to omnipresent connectivity (household items, industrial goods, etc.). By 2020 an estimated 6 billion household devices (televisions, refrigerators, washing machines etc.) will be connected to the internet in the EU alone.[58] A connected economy and society is more vulnerable to cyber threats and attacks and requires stronger defences. This increased reliance on networks means our connected environment is only as secure as its weakest link, and any breach can cause significant damage. Any vulnerability, such as an unsecured connection or product, can be exploited with effects ranging from nuisance and small-value losses to large-scale breaches of sensitive personal data, terrorism and subversion of democratic processes.

Cyberattacks are on the increase and tackling them faces the problem that while cyber-attacks are often cross-border, law enforcement competences are strictly national. More than 4,000 ransomware attacks have occurred every day since the beginning of 2016, a 300% increase over 2015[59]. These attacks damage businesses of all sizes and undermine trust in the digital economy, as well as confidence in our democratic institutions. Large-scale cyber-attacks could disrupt services across the EU and could be used by perpetrators of hybrid attacks[60]. This requires effective EU level response and crisis management, building upon dedicated cyber policies and wider instruments for European solidarity and mutual assistance[61].

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[58] IDC and TXT Solutions (2014), SMART 2013/0037 Cloud and IoT combination, study for the European Commission.

[59] How to protect your networks from ransomware, CCIPS, 2016 https://www.justice.gov/criminal-ccips/file/872771/download.

[60] JOIN (2016) 18

[61] Such as the Computer Security Incidents Response Teams set up by the Directive 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union, CERT-EU or the solidarity clause (Article 222 of the Treaty on the Functioning of the European Union)

50 % of businesses in the EU have suffered a cyber-attack and the projected growth of cybercrime is now higher than that of the internet.[62]

Europe has taken important steps to ensure cybersecurity and increase trust in digital technologies. An EU Cybersecurity Strategy was adopted in 2013[63]. The first Union legislative act on cybersecurity, the Directive on Security of Network and Information Systems (NIS Directive)[64], was adopted in July 2016. This put in place the necessary structures for strategic and operational cooperation between Member States and for making networks and information systems within the EU of critical infrastructures more resilient.

With the threat landscape so significantly changed since 2013 the **EU Cybersecurity Strategy** needs to be reviewed. An evaluation is currently ongoing to assess its effectiveness and to identify gaps in EU action. This will feed into an integrated and forward-looking review to determine how the EU can bring added value in terms of prevention and resilience, response, deterrence, crisis management and the EU's role at global level in fostering cybersecurity.

Following the recent public consultation and ongoing performance evaluation[65], there is a need also for a review of the mandate and tasks of the **European Union Agency for Network and Information Security** (ENISA), taking in particular into consideration its new role under the NIS Directive.

Connected products and systems need to be safe from the moment they are on the market. The rollout of big data and cloud applications also needs to be cyber-secure and comply with EU data protection legislation. The **creation of a European ICT security framework** setting rules on how to organise ICT security certification in the EU could both preserve trust in the internet and tackle the current fragmentation of the cybersecurity market.

There is also a need to retain and develop **essential cybersecurity industrial capacities** in the EU. Building on the public-private partnership on cybersecurity created in 2016, which will trigger up to EUR 1.8 billion of investment by 2020, there will be further reflection on how the Union and its Member States could invest more resources together to jointly bolster cybersecurity resilience, boost research and ensure a robust cybersecurity industry across sectors (e.g. energy, transport, financial, health) facing common cybersecurity challenges.[66]

By September 2017, the Commission will:

- *together with the High Representative/Vice-President, review the 2013 EU Cybersecurity Strategy to address the risks faced today, help improve the security in the Union and Member States and increase the confidence and trust of businesses and people in the digital economy and society. This will build on an assessment of the achievements of the 2013 EU Cybersecurity Strategy;*
- *review the mandate of ENISA to define its role in the changed cybersecurity ecosystem, including aligning it to the requirements of the NIS Directive, based on the recent public consultation and results of the ongoing evaluation;*

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[62] European Commission, Special Eurobarometer 423, 'Cybersecurity', 2015.
[63] Cybersecurity Strategy of the European Union: An Open, Safe and Secure Cyberspace; JOIN (2013)1.
[64] Directive (EU) 2016/1148 concerning measures for a high common level of security of network and information systems across the Union.
[65] http://ec.europa.eu/smart-regulation/roadmaps/docs/2017_cnect_002_evaluation_enisa_en.pdf
[66] https://ec.europa.eu/research/sam/pdf/sam_cybersecurity_report.pdf#view=fit&pagemode=none .

> • *develop measures on cyber security standards, certification and labelling, to make ICT-based systems, including connected objects, more cyber-secure.*

4. Managing the digital transformation of our society and economy

There are several policy actions under way within the Digital Single Market Strategy, which need increased efforts in order to seize the opportunities and address the challenges of digitisation. By making companies more productive, digital technologies are of particular importance to the EU economy. They can preserve jobs in Europe that would otherwise move to lower-cost alternatives. Supporting high-growth startups and firms scaling up brings innovation and employment benefits, as these companies typically create new jobs.[67] Digital transformation helps traditional industries produce new goods in a more resource-efficient way and allows public authorities to deliver better, faster and cheaper services. Entirely new economic sectors have thus emerged, such as the app economy. However, this digital transformation can also trigger economic and social challenges or disruption.[68]

In this context, we need to ensure that individuals and businesses benefit from these technologies and new services, as well as making a particular effort to prevent some people or regions being left behind. The EU needs to help ensure the right mix of policy actions to manage the digital transformation process.

4.1 Digital skills and opportunities for all

Digitisation, like previous technological advances, will have repercussions on labour markets: some jobs will be replaced, some jobs will be created, and many jobs will be transformed. Even if it is, for the moment, impossible to estimate the real impacts, it is evident that a digital transformation needs to be smoothened and accompanied by public policies.

> Over the past 10 years, employment of ~~EU~~ ICT specialists in the EU has grown by around 2 million[69], but 4 in 1~~0 %~~ of companies in Europe which needed ICT specialists in 2015 reported difficulties in filling vacancies.[70]

Already 90 % of all jobs require at least some level of digital skills, and such skills also become increasingly important for those who want to engage in social and civic activities.[71] Europe is improving its digital skills, but progress is slow and there are significant variations.[72] In 2016, 44 % of the EU population and 37 % of the labour force had insufficient

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[67] COM (2016) 733.
[68] Regarding the challenges and the impact of digitalisation on labour market and economy, see the Employment and Social Developments (ESDE) Review 2016, SWD(2016) 477, Part 6/8.
[69] Eurostat 2016. Figures for 2006-2015.
[70] Eurostat, ICT specialists – statistics on hard-to-fill vacancies in enterprises, http://ec.europa.eu/eurostat/statistics-explained/index.php/ICT_specialists_-_statistics_on_hard-to-fill_vacancies_in_enterprises .
[71] European Digital Progress Report (EDPR) 2017, SWD (2017) 160.
[72] 70 % or more of the population have basic or advanced digital skills in Finland, Luxembourg and the United Kingdom, compared to less than 40 % in Italy, Cyprus, Greece, Bulgaria and Romania, European Digital Progress Report 2017.

levels of digital skills.[73] Worryingly, nearly half of European businesses are still not implementing strategies to reskill their workforces.[74]

Workers need new skills to allow them to capitalise on the introduction of new technologies. This will require a massive investment. In June 2016, the **New Skills Agenda for Europe**[75] set out ~~the~~ that digital skills ~~that~~ should be seen as part of the essential skill set for the future, which was further underlined in the European Pillar of Social Rights.[76] This includes an action to raise adult basic skills, including digital skills which was adopted by the Council in a Recommendation in December 2016 and foresees national action plans by mid-2018[77]. The **Digital Skills and Jobs Coalition**[78] mobilises businesses, social partners and public authorities to improve digital skills and can help optimise the use of EU funds to raise skill levels and employability. The partnerships thus created can also help the Commission with the launch and realisation of its "**Digital Opportunity**" pilot scheme in 2018, which will aim to give graduates hands-on experience through cross-border traineeships in the digital domain.

However, despite a large number of reforms across the EU, the Commission is concerned and sees a clear need for more action and progress on skills at national level. Whereas our economy and society are changing fast, changes in how we teach and train our people have only been incremental. At the current pace, the gap is widening between the skills our people have and the skills they need. Member States need to act and the Commission is ready to help, by providing them with policy support, research, and practical tools to modernise their education and training systems.[79]

The swift implementation by Member States of the skills agenda and initiatives must be a priority to accompany the digital transformation.

The Commission:

- *calls on the Member States to implement swiftly the New Skills Agenda, especially the Council Recommendation on Upskilling Pathways: New Opportunities for Adults, and their national commitments in the Digital Skills and Jobs Coalition ~~initiative~~.*
- *will launch the "Digital Opportunity" scheme for cross-border traineeships in the digital domain in 2018.*

4.2 Startups and digitisation of industry and service sectors

The pace of technological change means that companies that fail to make the transition will fall behind. The process of boosting digital skills must go hand in hand with the up-take of digital technologies by companies of all sizes and industries. This is an opportunity, in particular for startups and SMEs, to create new and better products and services at a lower

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[73] European Digital Progress Report 2017.
[74] European Commission, Digital Transformation Scoreboard, January 2017.
[75] COM(2016) 381.
[76] COM(2017) 250, C(2017) 2600 and SWD(2017) 201, p. 6-7.
[77] Council Recommendation of 19 December 2016 on Upskilling Pathways: New Opportunities for Adults (2016/C484/01)
[78] https://ec.europa.eu/digital-single-market/en/digital-skills-jobs-coalition .
[79] In particular in the context of the Strategic Framework, 'Education and Training 2020' through which a dedicated working group discusses digital education and skills http://ec.europa.eu/education/policy/strategic-framework/expert-groups/digital-skills-competences_en .

cost and with fewer resources, and EU policies are being shaped to help businesses make the most of this.

To help European businesses reap the full benefits of digital technology, in April 2016 the Commission adopted a comprehensive strategy on **Digitising European Industry**[80], which included measures to encourage national initiatives on digitising industry to cooperate and learn from each other. To this end, the 'European Platform of National Initiatives' was launched at the Digital Day in Rome on 23 March 2017.

Over the next three years, Horizon 2020 plans for an additional EUR 300 million for activities related to **digital innovation hubs**, which are essential to support local startups and innovation**. A continued investment of close to EUR 3.2 billion in key technologies including nanoelectronics, photonics, robotics, 5G, high performance computing, big data, cloud computing, and artificial intelligence and their integration along the value chains with pilot lines, testbeds, is also planned. Of this investment, EUR 300 million has been specifically planned for the development of **next generation of digital industrial platforms**, in particular through new reference architecture models leading to smart factories and services. A key success factor to the digitalisation of EU industry is to mobilise a critical mass of investments through leveraging the total European R&I investment by further private and national public investments, notably through Public-Private Partnerships to increase its impact on all sectors of the economy. This brings the total European R&I to around €5.5 billion, which is will be further leveraged by private and national public investments, notably through Public-Private Partnerships to increase its impact on all sectors of the economy.

The **energy** sector is undergoing a deep transformation. The proposals in the '"Clean Energy for All Europeans'"[81] package proposals will consolidate existing provisions for free access by consumers to their consumption data. This can be used, amongst other things, to identify and address energy poverty or to improve the energy efficiency of the buildings. The proposed measures will also improve access to metering data, which is important to help consumers to benefit by optimising their consumption, and energy companies and service providers to tailor their offers to specific consumers. Furthermore, digital technologies are contributing to **more efficient use of resources** along the product lifecycle, which is at the centre of the EU Plan for the Circular Economy[82]. Full incorporation of digital technologies (automation and robotisation) into production processes can improve product recycling and dismantling, as well as the development of automated high quality sorting and recovery systems.

In **transport,** the shift towards **cooperative, connected and automated mobility** can reduce road accidents, pollution and congestion, and enhances traffic and capacity management and vehicleas well as energy efficiency. It also strengthens the competitiveness of transport and digital industries and helps integrate different modes of transport into one mobility ecosystem tailored to the needs of its users, be it freight logistics or people, including those in need of special assistance. In this context, Open standards ensuringe interoperability across transport infrastructure, data, applications, services and networks are key. Deployment of highly automated and connected vehicles is one of the key challenges for the EU automotive industry

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[80] COM(2016) 180.
[81] https://ec.europa.eu/energy/en/news/commission-proposes-new-rules-consumer-centred-clean-energy-transition .
[82] COM(2015) 614 final, Closing the loop - An EU action plan for the Circular Economy.

Field Code Changed

~~to stay competitive at international level.~~ Through a Letter of Intent signed in March, 27 EU Member States, Switzerland and Norway[83] have expressed their readiness to cooperate on cross-border trials on road safety, access to data, data quality and liability, connectivity and digital technologies. <u>Clearly, the deployment of highly automated and connected vehicles is one of the major challenges for the EU automotive industry to stay competitive at international level.</u> The Commission is <u>also</u> working on a comprehensive package of <u>mobility</u> measures ~~on sustainable, fair and connected mobility~~ planned <u>in two sets later in</u> ~~for spring~~ 2017.

New approaches in the **financial** sector made possible by digital technologies ('**FinTech**') can improve businesses' access to finance, reinforce competitiveness, produce consumer benefits and stimulate the growth of startups. A public consultation[84] has been launched to help prepare actions at EU level as part of the Capital Markets Union. **Blockchain**[85] is also one of the breakthrough technologies which can have a huge potential impact in the financial sector, but also far beyond. A European observatory on Blockchain technologies is planned, to map and monitor developments, build expertise and promote use cases.

Across all of the industrial and services sectors ICT standards, in particular open standards, play an important role in digitisation, by ensuring interoperability, lowering market barriers and promoting innovation.[86] Promoting these standards worldwide helps ensure European influence in the globalised economy beyond the single market.

The Commission:

- *calls on the Member States to implement fully the strategy on Digitising European Industry and to take stock of results achieved by early 2018.*
- *will present a comprehensive mobility package with due consideration of digital aspects in spring 2017; it will continue to actively cooperate with Member States <u>and stakeholders</u> to implement the action<u>s</u> ~~plan~~ foreseen in the Letter of Intent signed by Member States on 23 March 2017.*

4.3 Digital innovation for modernising public services

Modernising public administration

Digital technologies allow public authorities to deliver services more quickly, more precisely, and more efficiently. Many Member States already have major programmes of modernisation bringing widespread benefits to their citizens. At the EU level, the **eGovernment Action Plan 2016-2020**[87] seeks to accelerate and broaden the scope of <u>digitisation</u>~~public administrations'~~<u>, thereby</u> ~~digitisation by~~ increasing the<u>ir</u>~~ir~~ efficiency <u>of public administrations</u> and facilitating the free movement of businesses and citizens. Savings can flow from simpler

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[83] http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=43821.

[84] https://ec.europa.eu/info/finance-consultations-2017-fintech_en .

[85] Blockchain technology refers to a public register containing all transactions that have taken place across a peer-to-peer network. It is a decentralised technology that enables participants of peer-to-peer networks to make transactions, such as online payments, without having to go via a trusted central authority (a 'middleman'), https://www.enisa.europa.eu/topics/national-csirt-network/glossary/blockchain .

[86] https://ec.europa.eu/digital-single-market/en/news/communication-ict-standardisation-priorities-digital-single-market .

[87] https://ec.europa.eu/digital-single-market/en/news/communication-eu-egovernment-action-plan-2016-2020-accelerating-digital-transformation .

administrative procedures for individuals and companies, such as the **'digital-by-default'**[88] and the **'once-only'**[89] principles. As an example, companies participating in eProcurement procedures would only need to provide one document.[90]

> The 'once-only' principle at EU level could generate total net savings of around EUR 5 billion/year.[91]

The recently proposaled for a **Ssingle Ddigital Ggateway,** adopted on 2 May 2017[92], will help would mean that people and businesses to face fewer administrative burdens when moving and/or doing business across borders in the Single Market., It will offer easy access toby being able to find relevant information and assistance services, it will enable users to and complete certain key administrative procedures, online[93] and guarantee non-discriminatory access to national online procedures for users from other countries. It will also set the first step towards implementing the once-only principle in cross-border scenarios.

The planned initiative on **Digital solutions throughout a company's lifecycle** will allow companies to fulfil administrative requirements (register, file and update company documents) online and across borders, bringing the benefits of digitisation to the process of setting up and maintaining a business.

> The European Student e-Card in the Erasmus+ exchange programme will allow students to access university services across the EU, relying on their national electronic identification means. Many other services could be provided for the approximately 19 million people that live in another EU country[94].

The public sector can increase the interoperability of their cross-border services by following the recently updated recommendations of the **European Interoperability Framework**[95] and by sharing their data and services in conformity with the INSPIRE Directive.[96] Use of the ICT standards referenced in a **European catalogue**[97] would scale up the size of the market for digital products and services.

Given the dynamic nature of the Action Plan, the Commission will constantly update it to strengthen the **transformation of public administrations** and to ensure citizens have easy,

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[88] Providing public services by digital means as the preferred option. This can be facilitated by, facilitated by technical building blocks using eIDAS services, eInvoicing and eProcurement services, and their related technical building blocks developed under the Connecting Europe Facility.

[89] This avoids citizens and companies having to submit the same information to public authorities repeatedly. A Large Scale Pilot (funded under Horizon 2020) to test the application of the once-only principle for businesses in the EU started in January 2017 with the participation of 21 countries (20 Member States) and more than 50 organisations (TOOP, 'The Once-Only Principle', http://www.toop.eu/). A Coordination and Support Action (funded under Horizon 2020) was launched in November 2016 to discuss the possible application of the once-only principle for citizens in the EU (SCOOP4C, https://scoop4c.eu/home).

[90] Through the European Single Procurement Document a business can gives consent for the authorities having published the procurement to retrieve the needed documents also from other the authorities holding the document. Similar principles apply to the European services e-card.

[91] Study on eGovernment and the Reduction of Administrative Burden (SMART 2012/0061).

[92] COM(2017)256.

[93] For specific sectors the European Services e-card, proposed in January 2017, will make it easier for self-employed persons and companies providing services in another Member State to comply with administrative formalities that apply in line with EU law.

[94] Eurostat, 'Migrants and migration population statistics'.

[95] COM(2017) 134.

[96] Directive 2007/2/EC establishing an Infrastructure for Spatial Information in the European Union (INSPIRE).

[97] https://joinup.ec.europa.eu/community/european_catalogue/home .

trusted, and seamless access to the public services they want and expect, whenever and wherever they need them. The Commission is adding a set of new actions to the Action Plan to increase its impact.[98]

The Commission will

- *add further actions to the eGovernment Action Plan and urges Member States to follow the 'once only' principle in line with legislation on the protection of personal data.*
- *propose amendments to the company law framework, to facilitate digital solutions throughout a company's lifecycle.*

Digital transformation of health and care

Digital technologies can help improve people's health and address systemic challenges for healthcare systems. They can offer cost-effective tools to support the transition from a hospital-based health care model to a patient-centred and integrated one, improve access to care, and contribute to the sustainability and resilience of healthcare systems. It is essential that such tools be developed with full respect for data protection rules.

The Commission is working with Member States to ensure that citizens can transfer their basic medical information electronically when receiving treatment in another Member State and use e-prescriptions to get their medication dispensed. This should be operational by 2020 in most Member States. However, more needs to be done so that all citizens can, in full privacy and confidence, access and transfer their complete electronic health record when receiving healthcare abroad.

High performance computing can unlock the potential of big data for health through advanced data infrastructure and data analytics. The European Reference Networks created this year are a striking demonstration of what Europe can achieve by pooling medical expertise and data for faster diagnosis and treatment of rare and complex diseases. Further EU action in this area can provide high added value and critical mass. EU-wide hHealth data generated in the EU, and used processed with patients' explicit consent or other legal grounds permitted by the GDPR[99] and subject to appropriate safeguards, can advance research in an unprecedented way. It can also enable the early detection of infectious outbreaks and accelerate development of medicines and medical devices, and stimulate innovative healthcare solutions such as telemedicine and mobile health applications.

Two new Regulations on medical devices have been adopted in April 2017[100] and they will become progressively applicable over the next five years. They foresee the establishment of a new comprehensive EU-wide database on medical devices ('Eudamed'), whose big data

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[98] These actions are detailed in the accompanying SWD and include: 'IT platform for exchange of electronic evidence between judicial authorities'; 'Electronic Official Control of food and plant products'; 'Enforcement of EU agri-food legislation in online sales'; 'Digital Government for Citizens Charter' and 'Urban Digital Transition' actions.

[99] General Data Protection Regulation ("GDPR") in its Article 9 (processing of special categories of personal data) prohibits the processing of personal data concerning health unless one of the conditions set out in Article 9(2) apply.

[100] Regulation on medical devices, amending Directive 2001/83/EC, Regulation (EC) No 178/2002 and Regulation (EC) No 1223/2009 and repealing Council Directives 90/385/EEC and 93/42/EEC; Regulation on in vitro diagnostic medical devices and repealing Directive 98/79/EC and Commission Decision 2010/227/EU.

deployment will serve the development of innovative digital diagnostic and therapeutic solutions and the early detection of safety issues.

The Commission will adopt a Communication in 2017 addressing the need and scope for further measures in the area of digital health and care, in line with legislation on the protection of personal data, patient rights and electronic identification, in particular as regards:

- *citizens´ ~~use of e-prescriptions and~~ secure access to electronic health records and the possibility to share it across borders and the use of ~~.~~ e-prescriptions.*
- *supporting data infrastructure, to advance research, disease prevention and personalised health and care in key areas including rare, infectious and complex diseases.*
- *facilitating feedback and interaction between patients and healthcare providers, to support prevention and citizen empowerment as well as quality and patient-centred care, focussing on chronic diseases and on a better understanding of the outcomes of healthcare systems.*

4.4. Stepping up investments in digital technologies and infrastructures

A successful Digital Single Market requires excellent infrastructure.[101] The EU is already mobilising investments in the order of EUR 50 billion of public and private investments for the digitisation of industry from a targeted EUR 5.5 billion of EU research and innovation investment over 2016-2020. The EU has also made EUR 21.4 billion of European Structural and Investment Funds available for digital and broadband once national and regional digital growth strategies as well as~~nd~~ broadband strategies are in place, strengthening the link between policy and funding objectives at all levels.

More than two thirds of respondents (69%) think that a faster and more reliable Internet connection would encourage them to make more use of recent digital technologies.[102]

However, much more investment is needed in digital, in particular in fields where the **investment needs go far beyond the capacity of any one Member State acting alone**. There is potential to be more effective in combining and complementing EU funding programmes[103] with other sources of public and private financing, including under the European Fund for Strategic Investments, (EFSI). As of April 2017, EFSI related investments in the digital sector accounted for around EUR 17.8 billion including public and private funding (10 % of the overall amount of investment mobilised at that date).[104]

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[101] Connectivity based on physical and services infrastructures, and efficient and smart data processing capacities.

[102] Special Eurobarometer 460. "Attitudes towards the impact of digitisation and automation on daily life". May 2017.

[103] European Structural and Investment Funds (ESIF); Connecting Europe Facility (CEF); European Fund for Strategic Investments (EFSI); Horizon 2020 (including the European Institute of Technology); Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME), etc.

[104] Financing of about EUR 3.2 billion has been approved under EFSI and has triggered around EUR 17.8 billion of total EFSI related investments into the digital sector by April 2017. The list of projects is available on http://www.eib.org/efsi/efsi-projects/index.htm?c=&se=4. The EFSI ~~investments~~ funds are intended to

Developing a European Open Science Cloud, High Performance Computing and European Data Infrastructure

The deployment of a world-class European Cloud for scientists, the public sector and businesses, as announced in the Communication on a **European Cloud** Initiative[105], will improve the capacity of businesses, especially SMEs and the non-tech industry, to innovate and create higher value digitised products. By 2020 the European Open Science Cloud will offer a virtual environment within which to store, share and re-use data across disciplines and borders.[106] It will also provide links to other initiatives such as the Data and Information Access Services (DIAS) for Copernicus Earth Observation data.

High Performance Computing is critical for the digitisation of industry and the data economy. It enables the transition to higher value products and services. Certain European sectors have successfully adopted High Performance Computing powered applications, like manufacturing, oil and gas, energy or transport. However, overall Europe is losing its place in the top rankings for High Performance Computing infrastructure capabilities, having been overtaken by China, the US and Japan. Without world-class High Performance Computing facilities, Europe will not achieve its ambition of becoming a vibrant data economy.

Europe cannot take the risk that data produced by EU research and industry will be processed elsewhere because of the lack of High Performance Computing capabilities. This would increase our dependency on facilities in third countries and would encourage innovation to leave Europe.

Substantial investments are needed to develop, acquire and operate high-end machines and no single European country has the resources to do this alone. Therefore, the European Commission and the Member States must come together to coordinate their efforts and share their resources in order to ensure the success of this European flagship project. The European Parliament and the Council have given strong political support to regaining EU leadership, by aiming to have its High Performance Computing facilities in the top-three by 2022-2023, and to building up a strong EU High Performance Computing industry.

High Performance Computing has given excellent returns on investment in Europe: a recent study showed that each euro invested in High Performance Computing on average returned EUR 867 in increased revenue and EUR 69 in profits. 97% of companies that adopted High Performance Computing said they could no longer compete without it.[107]

On 23 March 2017 at the Digital Day in Rome, seven Member States[108] signed a declaration in support of the next generation of computing and data infrastructure. Upgrading European computing and data infrastructure to exascale[109] capacities requires additional resources in the order of EUR 5 billion. However, current funding instruments have limitations when applied

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trigger EUR 315 billion of investment in total for the EU economy in three years.

[105] COM (2016) 178.

[106] https://ec.europa.eu/digital-single-market/en/%20european-cloud-initiative .

[107] "High Performance Computing in the EU: Progress on the Implementation of the European High Performance Computing Strategy" (2015) available at: https://ec.europa.eu/digital-single-market/en/news/study-high-performance-computing-eu-progress-implementation-european-hpc-strategy-final-report .

[108] France, Germany, Italy, Luxembourg, the Netherlands, Portugal and Spain.

[109] Exascale refers to computing systems that are about 1.000 times faster than today's computers.

to large mission-oriented initiatives. The Commission will therefore explore how to set up a framework to support the development of a pan-European High Performance Computing and data infrastructure. The blending of different EU financing sources with national and private funding would be the best way to stimulate investment.

In the long-term, quantum computing holds the promise to solve computational problems beyond those addressed by current supercomputers. Therefore, the Commission is also stepping up efforts to fully unlock the potential of quantum technologies.

The Commission intends:
- *to draw on the ongoing consultations with stakeholders and, by end autumn 2017, come forward with the implementation roadmap for the European Open Science Cloud and provide the necessary financial support under the Horizon 2020 work programme for 2018-20.*
- *By end 2017 the Commission intends to propose, by end-2017, a legal instrument that provides a procurement framework for an integrated exascale supercomputing and data infrastructure.*

Building artificial intelligence capacities

Artificial intelligence can bring major benefits to our society and will be a key driver for future economic and productivity growth. Equipping devices and services with some form of intelligent behaviour can make them more responsive and autonomous.

A recent estimate shows that the market for robots and artificial intelligence solutions will grow to EUR 142 billion by 2020[110]. The combined economic impact of the automation of knowledge, work, robots and autonomous vehicles is estimated to reach between EUR 6.5 trillion and EUR 12 trillion annually by 2025[111], including gains in productivity and benefits in areas such as healthcare and security.

Use of artificial intelligence in different technological solutions can lead, for example, to fewer fatalities on roads, smarter use of resources such as energy and water, less pesticide use on farms, and a more competitive manufacturing sector. In healthcare, robots already help with higher precision in surgery, among other tasks. They also assist in dangerous situations, for example in rescue operations following earthquakes or nuclear disasters.

The European Union needs to build on its scientific and industrial strengths, as well on its innovative startups, to be in a leading position in the development of artificial intelligence technologies, platforms, and applications. In this regard, the European Union is funding projects aiming to ensure that humans can work and interact with robots in the safest and best possible way[112] and the Commission will continue to monitor the opportunities and challenges brought by artificial intelligence solutions.

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[110] Bank of America, Robot Revolution – Global Robot & AI Primer, 16 December 2015.
[111] Disruptive technologies: Advances that will transform life, business, and the global economy; McKinsey Global Institute, 2013.
[112] See SWD(2017) 155

5. The Digital Single Market: Europe's main asset in the global digital economy and society

A strong European Union rests on a fully integrated internal market and an open global economic system. In the digital world, this ~~implies~~ includes the free flow of information and global value chains. ~~~~facilitated by a free, open and secure internet. The transition to an EU Digital Single Market based on support for fair competition and anchored in our core values and fundamental rights and freedoms can help Europe address the many global economic challenges ahead.

> Approximately 40 % of the world's population is currently connected to the internet, up from 4 % in 1995[113]. Between 2008 and 2012, worldwide cross-border trade in data increased by 49 % while trade in goods or services rose by just 2.4 %[114].

Europe's regulatory model, from the Regulation on electronic identification and trust services for electronic transactions[115] to the net neutrality rules and the telecom framework, is a strong reference point for many outside Europe who see the need for a stable and predictable legal framework to address the complexities of the digital economy and society.

Privacy is not a commodity to be traded[116]. Rather, respecting privacy and guaranteeing the protection of personal data is a condition for stable, secure and competitive global commercial flows. The Commission aims to facilitate such cross-border data flows while ensuring a high level of protection, both in the area of law enforcement cooperation and in the commercial sector. For the commercial sector, there is a huge potential for trade in data as well as in connection to trade in goods and services, provided partners match EU standards on data protection. The Commission will prioritise discussions on possible adequacy decisions with key trading partners, in East and South-East Asia, starting with Japan and Korea in 2017, but also considering other strategic partners such as India, countries in Latin America, in particular Mercosur, and the European neighbourhood.[117] On 20th March 2017, the Commission opened a dialogue with Japan on a possible adequacy finding. The Commission will also explore other possible tools for cross-border data transfers, such as using Standard Contract terms, in line with the new EU data protection framework, which can be adapted to specific types of business or processing operations, thereby providing a high degree of flexibility.

The EU's dialogues with partners worldwide, support for multi-stakeholder models and active participation in international networks will help to sustain support for an open internet, underpin consistent enforcement of Intellectual Property Rights and consolidate the EU's leading role in promoting the common standards needed for the deployment of 5G and Internet of Things technologies.

The Commission will continue to seek access to markets in third countries, while looking at means to protect the EU's strategic interests and fundamental values. **Economic diplomacy can play an important role in this effort.** Particular consideration should also be given to how to

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[113] OECD Going Digital, MARCH 6 2017.
[114] EPSC, Enter the Data Economy: EU Policies for a Thriving Data Ecosystem, EPSC Strategic Notes, Issue 21, 11 January 2017.
[115] Regulation EU 910/2014 on electronic identification and trust services for electronic transactions in the internal market.
[116] COM(2017) 7.
[117] COM(2017) 7.

deal with cases where strategic investments are made in European ~~high-tech~~ companies by actors benefiting from public subsidies and which are based in countries which themselves restrict investment from European companies. These concerns need careful analysis and appropriate action.

Free trade agreements will ensure market access by removing unjustified barriers that distort trade flows and investment. The Commission will seek to use EU trade agreements and economic diplomacy to set rules for e-commerce and~~, if appropriate,~~ cross-border data flows and tackle new forms of digital protectionism, ~~like data localisation,~~ in full compliance with and without prejudice to the EU's data protection rules.[118]

A sound cyber security policy is also key to ensure that Europe is equipped to confront cyber threats while maintaining an open, free and safe cyberspace.[119] It is important to continue the dialogues with EU's main trade partners on the measures on cyber security standards, certification and labelling in order to increase resilience and security of connected objects globally.

As part of its support to the Sustainable Development Goals, the Commission intends to mainstream the use of digital technologies and services to broaden the reach of the EU's Development Policy. The Digital4Development approach[120] promotes digital solutions as part of the fight against poverty, ~~and~~ inequality and resource scarcity with the initial focus on Africa, where actions such as mobile payments have been shown to have the biggest impact. The EU will launch flagship projects in areas like e-agriculture, digital skills, e-governance and cooperation on startups.

The ~~EU~~ Commission will continue to promote the Union's objectives through accession negotiations and selective approximation with the neighbouring countries to the south and the east, and networks of EU and Eastern partner countries are working to ensure progressive approximation of legislation and share best practice.

The Commission will:

- *Prioritise discussions on possible adequacy decisions with key partner countries in order to ensure a high level of personal data protection.*
- *Seek agreements on convergence towards harmonisation of spectrum management.*
- *~~Step up dialogue~~ Explore with Member States how to ~~closely~~ monitor Foreign Direct Investment ~~in ICT~~ strategic industries, while strengthening cooperation with partners in third countries to develop common, open ICT standards for the Internet of Things, 5G, cloud computing and big data.*
- *Enhance its international cybersecurity cooperation with EU's main trade partners to work towards stronger cybersecurity for connected objects.*
- *Support Africa by increasing the role played by digital technologies and services in the EU development policy.*
- *Integrate digital considerations fully into the EU's external development policy and support instruments. For the Neighbourhood countries, this includes supporting legal approximation and establishing independent supervisory structures.*

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[118] COM(2015) 497, p. ~~1~~27.
[119] A Global Strategy for the European Union's Foreign and Security Policy, June 2016.
[120] SWD (2017) 157~~xxx~~

- *Promote cooperation among regulatory authorities worldwide.*

6. Conclusion

There is nothing inevitable about the impact of digital technologies. They will continue to change our society and economy, but how they do so depends largely on how European citizens, businesses and public authorities decide to use them and how we shape the regulatory framework for those technologies.

The Digital Single Market Strategy outlined the path for the EU to build the right digital environment: one in which a high level of privacy, protection of personal data and consumer rights are ensured, businesses can innovate and compete, and cybersecurity strengthens the fabric that weaves our societies together.

This Mid-term Review makes clear that there is no more time to lose to turn political commitments into reality. It calls for the focus to stay on the big things that require a common response, and substantial investments in infrastructures and skills, to create the conditions that allow Member States, businesses and citizens to innovate and reap the rewards of digitisation. Those benefits go far beyond ICT markets and touch every aspect of our economy and our society.

The Commission is committed to move forward with Member States, stakeholders and social partners. A first step should be swift agreement by co-legislators on the proposals under the Digital Single Market Strategy that are now before them. The European Council plays a crucial role in providing the necessary political momentum for the timely adoption and implementation of the proposals. Only the determined commitment of all will allow the EU to make a functional Digital Single Market a reality.