European Commission

Contribution of Digitalization to the Sustainable Development in Europe

P. Koundouri, C. Landis, A. Plataniotis

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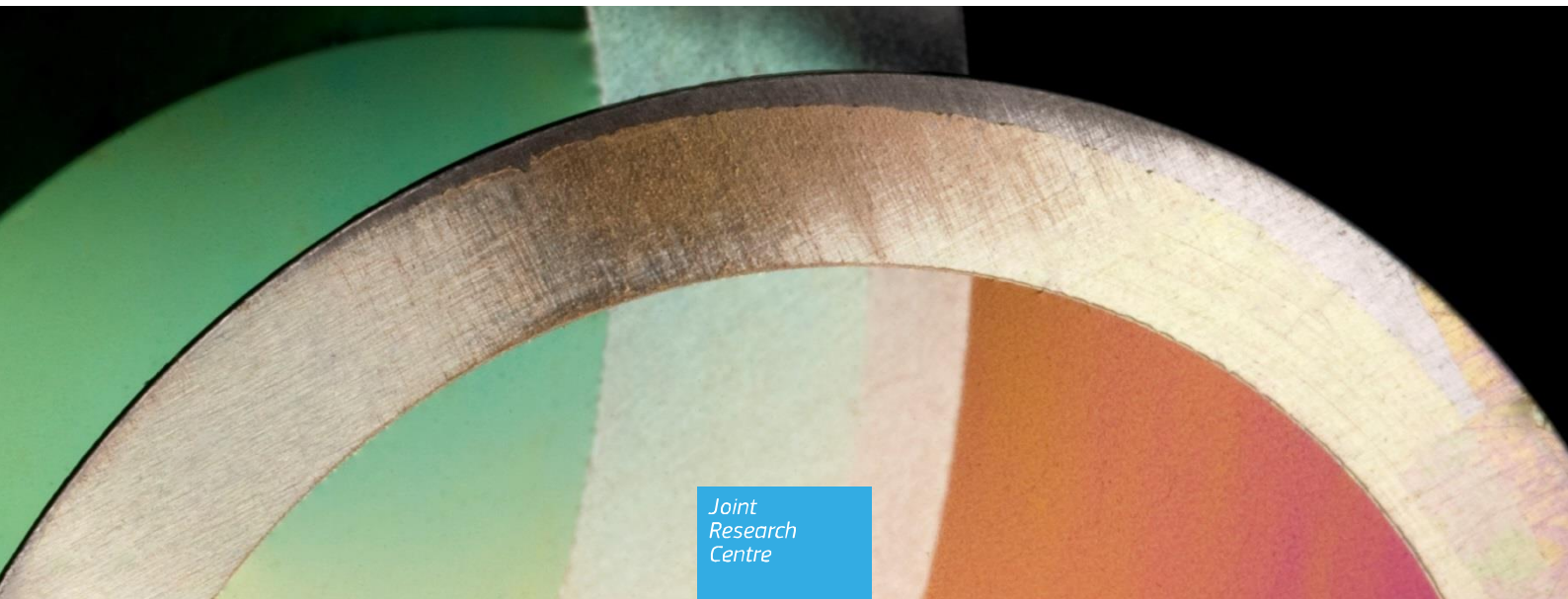

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Abstract

Digital technology is playing an increasingly key role in Europe's strategy towards achieving sustainable development goals. The Next Generation EU package, apart from its role to support Member States in recovering from the consequences of COVID-19, was also designed to make them greener and more digital. To be eligible for funding, Member States must define specific climate and digital objectives in their National Recovery and Resilience Plans (NRRPs). In this article we describe how digitalization can help European countries become more sustainable. For example, how the exploitation of digital technologies can lead to increased efficiency in terms of use of resources and energy consumption, more efficient and sustainable energy systems, broader access to clean water and sanitation, etc., and how digital tools facilitate the interaction and collaboration between policymakers, stakeholders, and citizens, and how they allow real-time monitoring and predictive analytics. Overall, digitalization can play a crucial role in sustainable development in Europe, at both national and regional level. Nevertheless, policymakers and stakeholders should take the potential challenges and risks posed by digital technologies, such as data privacy, digital disruptions, and technology dependence, into account. Future research can focus on the exploration of the potential of digitalization to develop innovative solutions and tackle the challenges of sustainable development in Europe.

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1 Introduction

The European Growth Model is founded on the triad of "green," "digital," and "resilient" (EU COM/2022/83). Admittedly, there is a wide social consensus on the priorities for the European economic model, that it must include the green and digital revolutions and the need of an increased economic and social resilience and preparedness for future shocks. Combined, these priorities contribute to the goals of a just and inclusive economic growth. This requires a comprehensive understanding for the interconnected nature of sustainability, resilience, competitiveness, and inclusivity, all of which are important for Europe to achieve sustainable growth.

With the implementation of the European Green Deal (EUROPEAN COMMISSION, 2019-640), Europe can address climate change and other environmental challenges while also get on a path towards growth that is sustainable and inclusive for all. According to Muench, S., et al., 2022 the cornerstone of a sustainable, fair, and competitive future is the proper management of the green and digital "twin" transformations. They further claim that to avoid falling into the pitfalls of promoting two different agendas, it is vital to take on the obstacles of achieving successful twin transitions by adopting an integrated approach to addressing those challenges. Both the green and digital transformations are occurring simultaneously; nevertheless, connecting them could enable us to take advantage of synergies and better manage risks.

The digital revolution of our society has been, undoubtedly, accelerated by the COVID-19 pandemic, which has also brought to light the significance of digital technology for Europe's future economic growth. According to OECD 2020, COVID-19 has elevated the stakes around digital access and participation, emphasizing the fact that connectivity and the use of digital technology are both dynamic goals. This is due to the surge in digitally enabled economic and social activities. However, as governments adapt their strategies in response, they should keep in mind that growing reliance on digitalization may risk creating new digital gaps or worsening those that have already existed.

Digitalization is playing an increasingly key role in Europe’s development towards sustainability (Mondejar, M. E., 2021). First, digital technology help countries to be more efficient in terms of use of resources, energy consumption and use of renewable energy. Moreover, a fair digital revolution open up opportunities for both consumers and businesses, thus stimulating innovation and productivity across the European Union's economy. By promoting digital skills, we can ensure that everyone can actively take part in and benefit from this shift. Additionally, digital technologies can be employed to enhance transportation networks, hence lowering traffic and emissions. Also, digitalization can boost resource efficiency. Digital applications can be used to watch and manage resources, track materials, and optimize operations, resulting in higher levels of productivity. Additionally, digital tools can be utilized to improve resource sharing and reuse, hence reducing waste.

In their report, Serger, S. S., Soete, L., & Stierna, J. (2023) highlight the importance of place-based policies for sustainable development in Europe, and suggest four key points to address related policy issues. They emphasize the need for bottom-up engagement and mobilization, trust-building partnerships among various relevant bodies, realignment of governance for transformative innovation policies, and the need to accompany firms in sustainability transitions. Digitalization can play a crucial role in addressing these policy issues. For instance, it can facilitate bottom-up engagement and communication between local stakeholders and policymakers. It can also enable the sharing of information and data among different bodies, assist in realigning governance by providing monitoring and evaluation tools, and support the identification of new business opportunities while avoiding lock-in effects. Future research can explore these avenues of digitalization and develop innovative solutions to address the challenges of sustainable development in Europe.

2 The Six Transformations to achieve the SDGs and the role of digital revolution

In 2019, the United Nations Sustainable Development Solutions Network, to help everyone, understand how the SDGs could work effectively, proposed 6 thematic areas of transformation (Sachs et al., 2019), as follows:

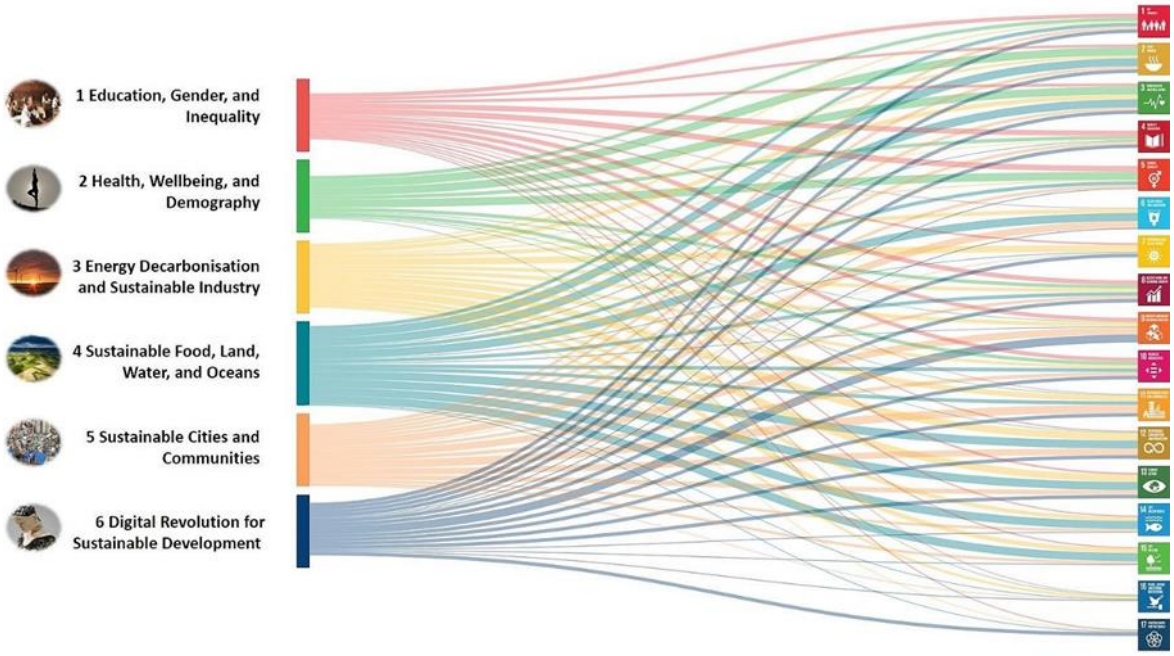

Figure 1 The Six SDG Transformations and how they achieve the 17 SDGs. Source: Sachs et al. 2019

These six transformations are vital for reaching the Sustainable Development Goals (SDGs) by 2030. In particular, the sixth transformation focuses on encouraging digital technology and boosting access to information and services. This includes digital platforms that offer crucial services like education, healthcare, and financial aid. Additionally, data analytics and AI improve how we produce, consume, and govern, making these processes more efficient and effective. Plus, embracing open data and free access policies can lead to more transparent and accountable government decisions.

Overall, digital technologies support the SDGs by providing access to new services, enhancing connectivity, and providing better data analytics capabilities (Mondejar, M. E., 2021), and by facilitating the monitoring, tracking, and reporting of progress towards the SDGs (Saner, R., Yiu, L., & Nguyen, M., 2020). The literature supply evidence that some SDGs are more linked to digital technologies than others. For example, Burinskienė, A., & Seržantė, M. 2022 investigated how SDGs represent the interrelationship between digitalization and sustainability and found a closer connection between digitalization and SDG 4 (Quality Education), SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure) and SDG 12 (Responsible Consumption and Production).

More specifically, digital technologies can be used to increase access to education, by making online learning platforms easier to use (Martín-Gutiérrez, J., et al., 2017). Further, their use can lessen all kind of inequalities, including gender inequality, reduce poverty, and promote peace and justice, by supplying access to better healthcare, access to improved water and sanitation services, and access to clean energy (Ferrata, L., 2019). Also, they can boost economic growth by making financial services more accessible, and connecting people to each other and to global markets, by creating opportunities for employment and entrepreneurship, or by increasing transparency and accountability (Mackey, T. K., & Cuomo, R. E., 2020; Sahut, J. M., et al., 2021).

As **Figure 2** implies, digital technology enables better monitoring of environmental conditions, improves the process of data gathering for sustainable agriculture, improves the efficiency of energy use and contributes to better renewable energy sources management, among others. All these factors help society reduce environmental degradation (Giuliani, G. et al., 2020). Finally, digital technologies can help foster peace and justice by supplying access to better dispute resolution mechanisms and improved information sharing (Rabinovich-Einy, O., & Katsh, E., 2014; Sela, A., 2018).

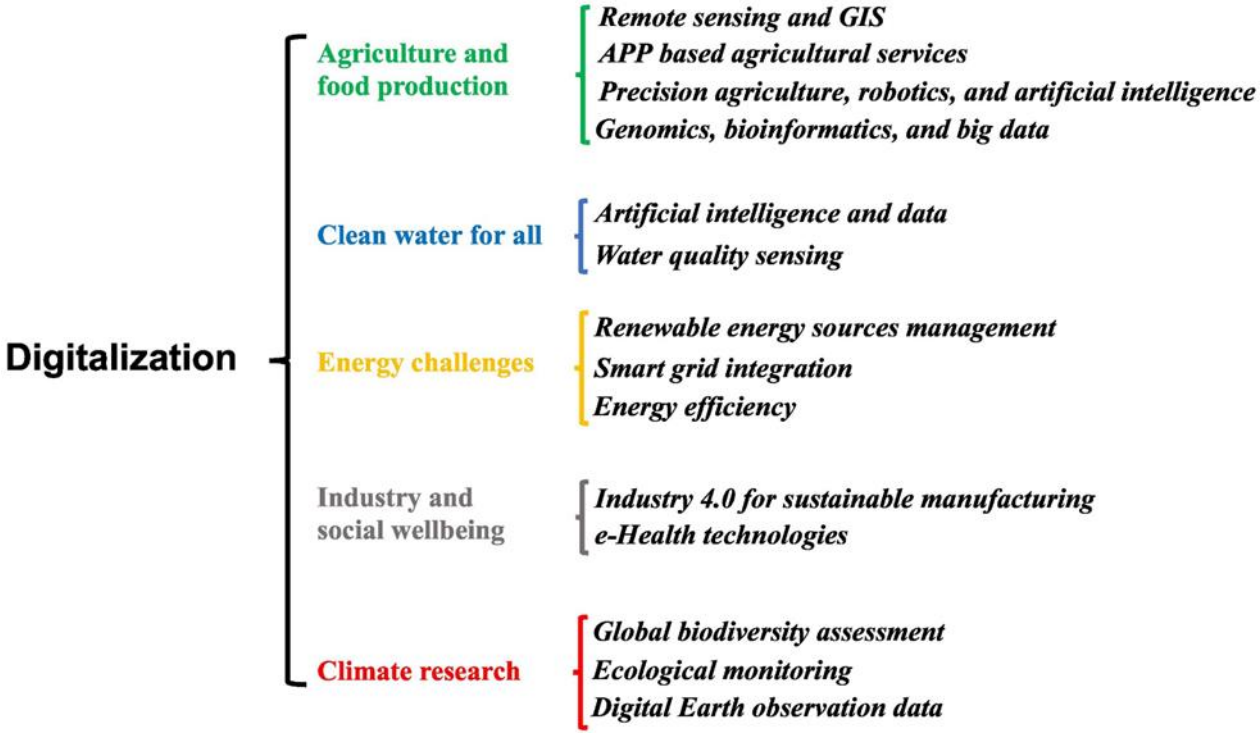

Figure 2 Summary of the digitalization aspects related to each SDG. Source: Mondejar, M. E., 2021

3 Digitalization within the European Policy Framework

The European Commission is strongly pushing for the use of digital technology and wants to make it a part of Europeans' everyday lives through well-planned policies. They call this time Europe's "Digital Decade" (European Commission, 2021). Europe needs to concentrate on data, technology, and infrastructure to improve its digital influence and create its own rules instead of using others'. The European Union (EU) aims to have a climate-neutral Europe by 2050, and their digital plan is designed to make this change helpful for both people and businesses.

The European Green Deal

The European Green Deal (EUROPEAN COMMISSION, 2019-640), which was introduced by the commission in December 2019 as part of its commitment to addressing issues related to the environment and climate change, emphasizes the prevailing role that digitalization could play in that situation. To achieve the goals of the Green Deal, Europe must take advantage of the potential of the digital transformation. To make the European Green Deal work, clean energy policies in the economy, industry, production and consumption, large-scale infrastructure, transportation, food and agriculture, building, taxation, and social benefits need to be reconsidered. To reach these goals, it is important for Europe, to give more value to protecting and restoring natural ecosystems, to using resources in a sustainable way, and to making people healthier. This is where the EU economy, society, and natural environment could benefit the most from a transformational change. The EU should also push for and put money into the digital transformation and tools that are needed to make the changes happen.

The Next Generation EU

In May 2020, European Commission launched the “Next Generation EU”, a €750 billion emergency recovery fund, in response to the economic and social crisis caused by the COVID-19 pandemic (EUROPEAN COMMISSION, 2020-456). This is a part of the European Union's broader €1.85 trillion 2021-2027 budget and recovery package. The fund will give grants and loans to EU countries to help them invest in areas like green energy, digital technology, and healthcare. It will also help places hit hardest by the pandemic recover socially and economically. "Next Generation EU" helps digital businesses in Europe grow by giving them resources and support. It also invests in digital education and skills, while helping the shift to a green economy. The plan aims to improve digital infrastructure in Europe, making sure everyone has access to fast, secure digital services. It also encourages a Digital Single Market, making it fair for businesses and customers in the digital world. Additionally, the plan invests in Artificial Intelligence (AI) to create new products and services and improve public services.

The Recovery and Resilience Facility (RRF)[1]

The Recovery and Resilience Facility is the most important part of NextGeneration EU (RRF). This is a way for the European Commission to help Member States put their national plans for recovery and resilience into action. It gives Member States financial help to help them recover from the economic and social effects of the COVID-19 pandemic and make them stronger so they can manage future shocks.

Both the European Union budget and loans from the European Investment Bank are used to pay for the Facility. It will give grants and loans to Member States worth up to €672.5 billion, which will be split among six different "Pillars" (**Figure 3**).

[1] European Parliament, European Parliament Recovery and Resilience Facility, https://www.europarl.europa.eu/recovery-and-resilience-facility/en/home

Figure 3 An overview of the Six Pillars of the RRF Regulation. Source: https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/pillar_overview.html?lang=en

The National Recovery and Resilience Plans (NRRPs)

Member States must make plans that describe the investments and reforms that will be paid for by the RRF to be eligible for funding. The European Commission looks at these plans, which are called "National Recovery and Resilience Plans" or "NRRPs". NRRPs are a set of economic and social recovery plans that member states must develop to access the financial support of the RRF. They set out the reforms, investments, and financial instruments that the country will use to address the economic, social, and environmental impacts of the COVID-19 pandemic.

In addition, plans should be developed to advance the green and digital transitions (with spending targets of 37% and 20% respectively) and to make the economy and society more resilient to deal with future crises. They must include specific targets and indicators, along with a timeline for implementation, and must address policy areas of European relevance structured in six pillars, as follows:

1. Green transition.
2. Digital transformation.
3. Smart, sustainable, and inclusive growth.
4. Social and territorial cohesion.
5. Health, and economic, social, and institutional resilience.
6. Policies for the next generation i.e., children and youth.

How do the NRRPs promote digitalization in Europe?

The NRRPs promote digitalization in Europe by supplying funding for digital investments, digital infrastructure and services, digital skills, and digital transformation of businesses. This money will help create a digital Europe by making more digital services available, putting money into digital systems and services, and teaching digital skills all over Europe. This will make a space where businesses can grow and use new digital chances, allowing them to make jobs and help the economy grow. It will also make Europe stronger in the worldwide digital market.

4 National contribution to EU digital objectives

Each Member State must distribute at least 37% of the expenditures of its recovery and resilience plan (RRP) to measures contributing to climate goals, and at least 20% of the expenditures must be distributed to digital goals. This is done so that the green and digital transitions can be accelerated. The reforms and investments proposed by Member States have gone beyond these goals. For example, the RRF is expected to spend about 40% of its budget on climate change and about 26% on digital.

In 2022, Sachs J., Koundouri P., et al., based on a method proposed by Zachariadis, T. (2021), reviewed the NRRPs of a sample of European Member States (Bulgaria, Croatia, Cyprus, Greece, Italy, Slovenia, and Spain) and assessed their alignment with the SDGs. Due to the absence of an explicit linkage, it is difficult to decide whether the stimulus packages address all significant environmental, social, and economic sustainability challenges in each country beyond the requirements for the bare minimum in terms of spending on climate and digitalization-related initiatives. According to the findings of the analysis, all the SDGs are considered in the recovery plans, albeit to varying degrees. SDGs that are largely covered, in terms of several different stimulus measures and the budget that is allocated, are not always those that present the countries with their greatest challenges in terms of sustainability. They further suggest specific "lighthouse interventions", i.e., measures yielding a more significant sustainability impact, as follows:

1. Research and innovation funding on green transition
2. Strengthening digital, green, blue and entrepreneurship skills of the unemployed or people over 55 and with particular emphasis on unemployed women
3. Upskilling the existing farmers' community
4. Valorization of livestock waste and construction of biogas production units
5. Promoting renewables and individual energy efficiency measures and tackling energy poverty in households with disabled people.

Figure 4 shows the differentiation between the EU 27, with regards to what degree their NRRPs contribute to the climate and digital targets.

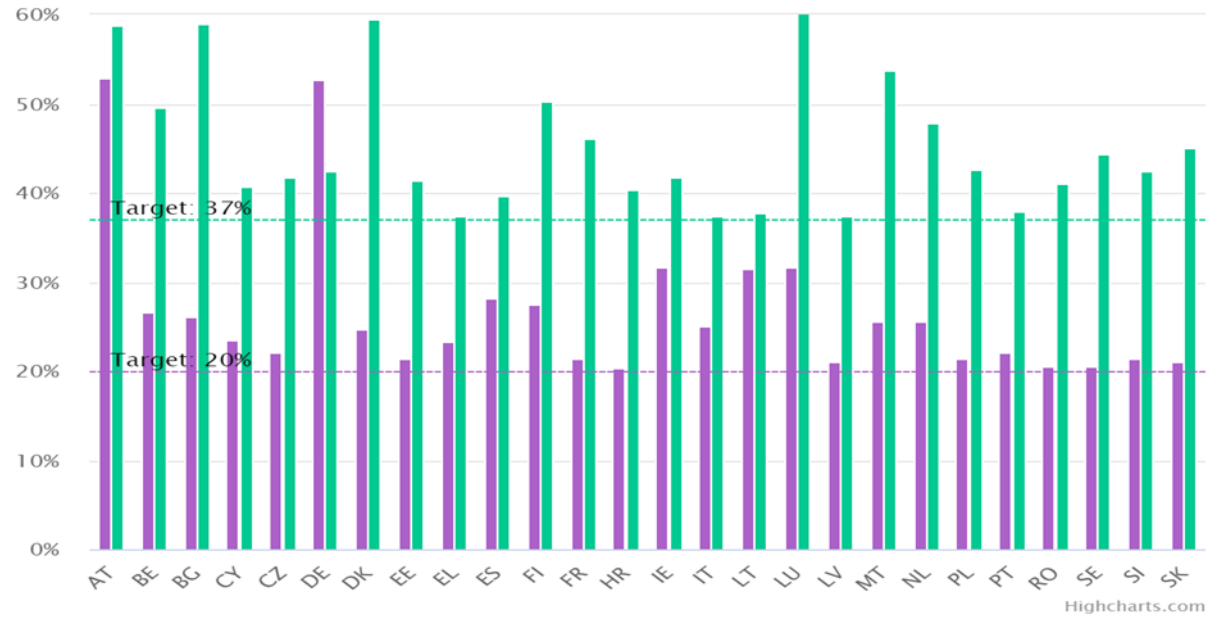

Figure 4 Share of RRPs estimated expenditure towards climate and digital goals. Source: https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/index.html

Figure 5 supplies a breakdown of the expected contribution to the policy pillar according to a list of policy areas, collectively for all the EU Countries. More than 75% of the total amount of RRF expenditure is given to the Policy areas of "e-government and public services" (36%), "Human capital in digitalization" (20%), and the "Digitalization of businesses" (19%).

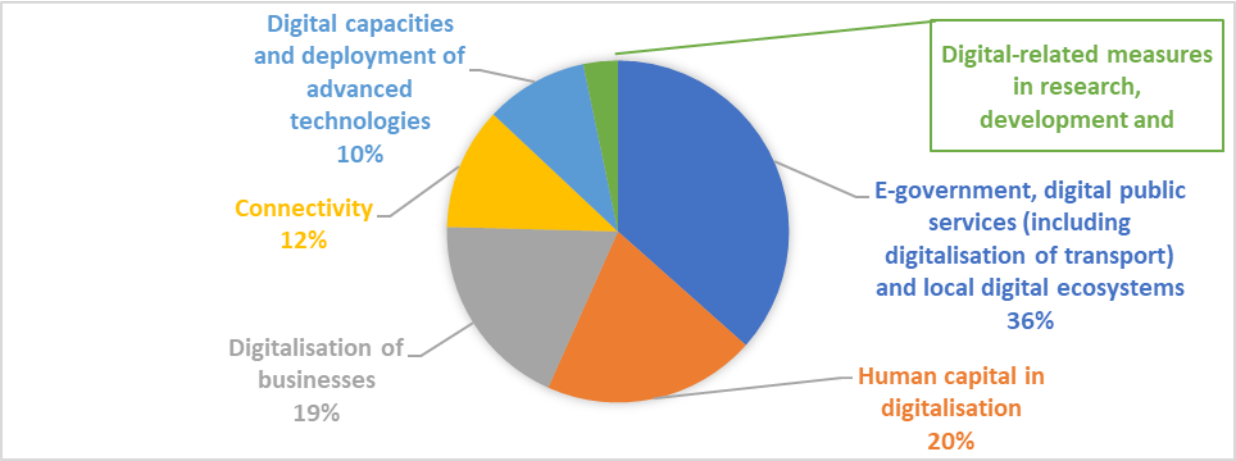

Figure 4 Breakdown of expenditure supporting the digital transformation pillar per policy area. Source of Data: https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/digital.htm l

The disbursements of funds from the RRF to the Member States are made progressively according to the agreed timelines and targets, i.e., when the reforms and investments included in the recovery and resilience plans are implemented. The Member States send a payment request to the Commission twice a year, accompanied by evidence that the reforms and investments included in the recovery and resilience plans are implemented. Each payment shows how far the RRF, and its six policy pillars have come in being put into action. This graph shows how payments made through the RRF (but not through pre-financing) relate to the pillars (**Figure 6).**

Once the Commission assesses that the milestone or target is completed in a satisfactory manner, then the requested funds are disbursed. Regarding the progress of the Member States for the implementation of the measures, the countries in all six Pillars are overall in a good status (**Figure 7**). However, if we look at the Digitalization Pillar, it seems that overall, all Member States must accelerate the implementation of the measures included in their NRRPs (**Figure 8**).

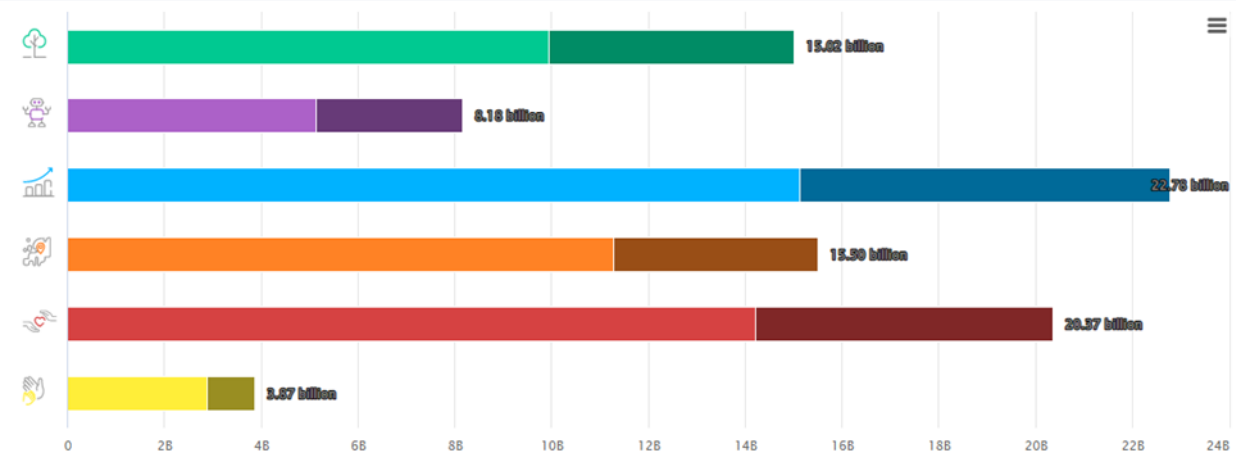

Figure 6 RRF disbursements per pillar. Source: https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/disbursements.html?lang=en

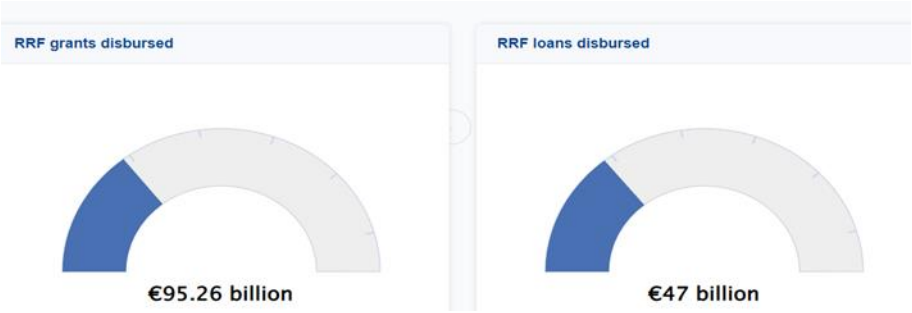

Figure 5 Grants and loans disbursed so far in the 6 pillars. Source: https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/disbursements.html?lang=en

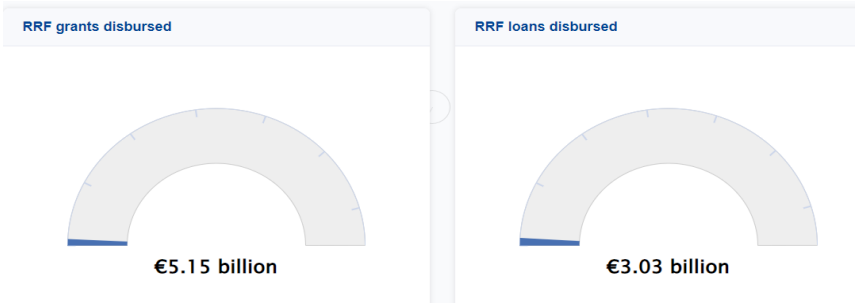

Figure 6 Grants and loans disbursed so far in the digitalization pillar. Source: https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/disbursements.html?lang=en

5 Digital tools to solve local problems and improve sustainable development in Europe

Digitalization offers potential benefits to policymakers in many ways, like identification of local issues, citizen participation, collaboration of stakeholders, data availability, performance monitoring and predictive capacity.

More specifically:

Problem diagnosis

Digitalization can be a powerful tool for policymakers, especially for regional ones, for the identification and resolution of local problems. By collecting and analyzing data, digital tools can help in the detection of issues like environmental damage, social inequality, or economic stagnation in different areas (**Batty, 2013**).

Citizens' participation

Digitalization help more people get involved through social media, online surveys, and virtual meetings (**Gil-Garcia et al., 2016**). In this way it makes it possible for more people to get involved in discussions and problem solving, through online surveys, forums, and social media, thus allowing policymakers learn about community concerns and come up with suitable solutions (**Bertot, J. C., Jaeger, P. T., & Hansen, D., 2012**).

Collaboration of different stakeholders

Digital tools can make it simpler for various groups to join forces on environmental projects. Tools like video calls, messaging apps, and work organizing software make it easy to communicate and work together, even when people are in a big distance. Also, digital tools can help policymakers and other stakeholders, like businesses, NGOs, and academic institutions, work together and share information to come up with new ideas and solutions for various local problems (**Chen et al., 2019**).

Data availability

Digitalization can significantly contribute to real-time monitoring and evaluation of sustainable development initiatives in Europe and make things clearer and more open. Using digital tools, data like information on energy use or travel behavior, can be collected and analyzed in real-time, allowing policymakers to track progress and identify areas where adjustments may be needed (**Kitchin, 2014**). For instance, sensors and IoT devices can watch environmental conditions, energy consumption, and traffic patterns, supplying real-time data for evaluating the impact of sustainable development initiatives (**Zanella et al., 2014**).

Performance monitoring

Performance dashboards can also be created using digital tools, offering real-time updates on key indicators related to sustainable development goals (**Farmanbar, M., & Rong, C., 2020**). This helps stakeholders check progress and find areas that require attention or improvement. Additionally, digitalization eases collaboration and knowledge sharing among stakeholders, allowing real-time feedback and evaluation of sustainable development initiatives through online forums and virtual meetings (**Chen et al., 2019**).

Better predictions

Predictive analytics is another area where digitalization can prove beneficial. The prospective impact of sustainable development projects can be predicted with the help of digital tools, allowing policymakers to adapt their strategy accordingly (**Wang et al., 2018**). This can be especially helpful in complex systems where it might be hard to foresee how a single move would affect the whole.

6 Conclusions

Digital technologies can support the promotion of sustainability and can help Europe achieve the 17 SDGs in many ways. For example, digital technologies can be used to create more efficient and sustainable energy systems, improve access to clean water and sanitation, and reduce poverty. They can also be used to improve healthcare, education, and access to financial services. Additionally, can be used to promote sustainable agriculture, create smarter cities, and watch the environment to find potential challenges and finally, can be used to promote gender equality and to fight against climate change.

Digitalization is a critical factor in achieving the Paris Agreement goals, as well. Smart gaugers, connected sensors, and other energy-efficiency technologies, support a more efficient use of energy which leads to reduced carbon emissions. Also, these devices can be used for the monitoring of energy usage, being in this way helpful to policymakers who can use the produced data to make informed decisions about how to reduce emissions and set targets for future emissions reductions. Finally, digital technologies can be used for the development of renewable energy sources, such as solar, wind, and geothermal power. By using on these digital technologies, Europe can make progress towards achieving the goals of the Paris Agreement.

Member states must include detailed climate and digital goals in their NRRPs In order to qualify for funding from the RRF. Specifically, they must include actions, such as investments in renewable energy sources, energy efficiency programs, and sustainable transportation, to reduce their carbon footprint and make themselves more resilient to the effects of climate change. Investments in digital infrastructure, digital re-skilling and up-skilling, and the digitalization of both public and private sector are a few more examples of the actions the Member States should take to help the digital transformation of their economies and communities.

As technology progresses and the significance of developing efficient solutions to complex problems increases, it is expected that the extensive use of digital tools in all sides of sustainable development will increase. An important aspect of digitalization, is its potential to contribute to the transformation of regional policymaking. By employing the power of digital tools, policymakers and stakeholders can better show and address local problems, streamline communication and collaboration, and track progress towards sustainable development at a regional level more effectively. Moreover, digitalization eases citizen engagement, knowledge sharing, data analysis and predictive analytics, enabling more informed decision-making and adaptive strategies.

However, as we continue to investigate the possibilities of digitalization in tackling regional issues and achieving sustainable development goals, it is critical to be aware of possible dangers and challenges associated with digital technologies, such as data privacy, digital disruptions and technology dependencies. Policymakers and stakeholders can make considerable progress towards a better future by addressing these concerns and embracing the revolutionary power of digital tools.

Digitalization can play a crucial role in addressing issues related to the importance of place-based policies for sustainable development in Europe. For example, it facilitates communication and engagement, sharing information, and supporting the identification of new business opportunities. Future research can explore these avenues of digitalization to develop innovative solutions and address the challenges of sustainable development in Europe.

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