Digitalization for the Green Transition in the Mediterranean

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The implementation of mutually reinforcing green and digital policies presents itself as a promising path to address the climate emergency in an era characterized by a lack of sustainable growth and a proliferation of novel technologies. As a result, the European Union has created a dual green and digital transition agenda that aims to integrate its hitherto independent policy sectors. The fact that this new strategy has a geopolitical component and is both inward and forward looking is notable. This can be seen in the 2021 New Agenda for the Mediterranean, which broadens the project's geographic focus to include the Southern Neighbours of the EU.

The Green New Deal is a set of proposed economic stimulus packages and policy changes aimed at addressing climate change and economic inequality. The European Union (EU) has established ambitious targets to reach carbon neutrality. The European Green Deal, a comprehensive blueprint for making Europe the first climate-neutral continent by 2050, was introduced by the European Commission in December 2019. The major goal is to achieve net-zero greenhouse gas emissions by removing or offsetting the remaining emissions. However, the implementation of a Green New Deal in some of the north Mediterranean countries is a challenging issue. The gaps between the New Green Deal and the real requirements and priorities of the north and south Mediterranean should be taken into consideration (Santaniello et al., 2022). The specific measures and strategies can vary based on the region's unique circumstances, priorities and resources.

Although there is political and economic instability in the south Mediterranean countries, there is a noticeable move towards sustainability. Most of these countries have their Nationally Determined Contributions (NDCs) which highlight that technologies are key for low carbon transition. South and east Mediterranean countries have set ambitious targets for the adaptation and mitigation of climate change. Tunisia aims to reduce carbon emissions by 45% by 2030 compared to 2010 (NDC Tunisia, 2021). Morocco's overall updated target represents a reduction in GHG emissions of 45.5% by 2030, including an unconditional target of 18.3% compared to 2010, which corresponds to a change in emissions in the "ordinary course of business" (NDC Morocco, 2021).

In this context, it is worth mentioning that there is a rapid spread of digital technologies in both south and north Mediterranean countries. The new wave of digital technologies is referred to as Industry 4.0 technologies, referring to a new phase of the industrial revolution linked to the development of interconnectivity, automation, machine learning and real-time data processing. However, with the acceleration of the digitization of several sectors of the economy, we are starting to talk about a fifth industrial revolution (Industry 5.0) (Ben Youssef & Mejri, 2023). Industry 5.0 is built around three interconnected core values: people, sustainability and resilience.

The new digital technologies have the ability to foster green transition. While digitalization has the potential to foster the "green transition," twin transitions will depend on several economic, social and political factors, which should be carefully taken into consideration (European Commission, 2022). These factors are very important since they include the

costs, opportunities, investments and jobs of the twin transitions; behavioural change; regulatory frameworks, standards and geopolitical aspects. By leveraging digital technologies and solutions, countries can achieve sustainable development goals, mitigate environmental challenges, and promote a more resilient and inclusive economy.

It is important to note that digitalization alone is not a panacea for the green transition. It should be coupled with strong policy frameworks, capacity building and stakeholder engagement to ensure equitable access, privacy protection and cybersecurity. Collaboration among Mediterranean countries, international organizations, and private sector actors is also vital for sharing best practices, fostering innovation, and scaling up digital solutions for the region's green transition.

The green and digital transition have the ability to reinforce each other. Digital technologies with their functions and their potential can be a key driver for green transition

This short paper is organized as follows. The first section provides insights for the spread of industry 4.0 technologies and their pro-environment aspect. The second section shows the new trends in the digitalization of tourism. The third section explains the approaches toward smart agriculture. Section four discusses e-commerce and marketplaces through platforms. Section five gives some suggestions for new cooperation between south and north Mediterranean countries regarding twin transition.

A New Industrialization Path: The Spread of Industry 4.0 for Pro-Climate and Pro-Environment Industry

MED countries are facing several climate change impacts. Temperatures in the region have been rising faster than the world average, with a 5°C increase over pre-industrial levels being possible by 2100. Several Mediterranean countries are heavily dependent on food imports and their renewable water resources are increasingly stressed and could further decline by 20 percent by 2030. Faced with several different challenges, these countries are trying to find solutions. One of these solutions are industry 4.0 technologies, which have proved to be pro-climate and pro-environment.

Fourth Industrial technologies (4IR) have the potential to reduce the effects of climate change, as well as for natural disaster prediction (Ben Youssef, 2020). AI and big data analytics already play a key role in management and preparedness for natural disasters, and in mitigating climate change through the prediction of weather events, like cyclones. Robots and drones are already being developed for rescue operations on land and under water. These are key advancements since several MED countries are susceptible to earthquakes, floods and sandstorms.

The green and digital transition have the ability to reinforce each other. Digital technologies with their functions and their potential can be a key driver for green transition. The technologies' different attributes like monitoring, tracking, stimulation, forecasting etc. can increase the efficiency of the use of the resource and extend the life cycle of the product. Moreover, data and data analysis are key for green and digital transitions. The new advanced technologies of industry 4.0, have the ability to collect and disseminate data and provide advanced analyses. However, digital technologies should be directed in the right way in order to be environmentally friendly, circular and energy efficient. Their inappropriate use can lead to the increase of carbon emissions. For example, data centres using non-renewable energies can emit as much in the way of emissions as the aviation industry.

Digital technologies have the potential to foster the green transition in the energy sector. Simulation and forecasting using digital technologies can speed up research and development cycles for new materials, products, processes or business models in areas where zero-carbon and green technologies are not yet competitive. Digitalization is, today, one of the strong pillars of the energy transition. At the same time, the energy transition and the production of renewable energies is fundamental for the production of the energy necessary for digital technologies (UNIDO, 2017). Intelligent networks (smart grid) have

emerged and now help to manage the variability of renewable energy production. With the increasing development of individuals' production of their own energy through solar power, coordination has become fundamental to the point that some speak of the internet of energy.

A New Path for Tourism: Tourism 4.0 as a Way of Shifting towards Sustainable Tourism in the Region

The Mediterranean region is an increasingly popular holiday destination because of its extensive cultural history, breathtaking scenery and unspoiled coastline (Ben Youssef; Zeqiri and Belaid, 2020). In 2019, the Mediterranean region registered more than 400 million International Tourists Arrivals (ITAs), making it one of the most popular destinations in the world. The tourism sector accounted for up to 15% of regional GDP, with a 75% growth since 1995, expected to reach 626 million ITAs by 2025 according to the UN World Tourism Organization (WTO) (Fosse, 2021).

However, worries about the industry's socioeconomic and environmental effects have been highlighted by the tourism industry's recent rapid rise. Globally, it is estimated that carbon emissions from tourism make up around 8% of all emissions, with an annual increase primarily attributable to air travel (Lenzen et al., 2018). The largest emitting sector in the European Union was transportation, including foreign travel, which accounted for between 15 and 40% of national carbon emissions and roughly 30% of all EU emissions. More than 4% of these are accounted for by maritime transportation. Industry 4.0 technology integration offers creative solutions to address these issues and advance sustainable tourism.

Industry 4.0 technologies offer effective instruments to track and manage environmental effects on the Mediterranean tourism industry (Ben Youssef & Zeqiri, 2022). For instance, the Internet of Things (IoT) can be used to gather data in real time about the use of water, electricity and waste in hotels, resorts and other tourist facilities. A stakeholder's ecological footprint can be reduced and resource allocation can be optimized with the use of this data. Additionally, drones with cutting-edge imaging systems can help with the monitoring and defence of delicate ecosystems, enabling more successful conservation initiatives.

Industry 4.0 innovations can improve the visitor experience while advancing environmental education and awareness. Applications for augmented reality (AR) and virtual reality (VR) can provide immersive experiences, allowing tourists to virtually explore historical locations and obviating the need for physical travel. While supporting sustainable practices, smart tourism platforms can offer tailored recommendations depending on visitors' tastes. Additionally, interactive exhibits and educational apps can inform visitors about the biodiversity of the area, conservation initiatives and regional customs, promoting a deeper appreciation for the natural and cultural legacy of the Mediterranean.

Community empowerment and participation should be given top priority in sustainable tourism in the Mediterranean

Community empowerment and participation should be given top priority in sustainable tourism in the Mediterranean. Industry 4.0 technologies can make it easier for local stakeholders to participate in decision-making processes by connecting them. Regional goods, services and cultural events can be promoted through social media platforms and mobile applications to help small companies and maintain regional customs. Digital platforms can also let tourists and local populations communicate directly, promoting cross-cultural understanding and exchange.

Boosting Agriculture by Shifting towards Agriculture 4.0 (Less Use of Water, Optimization of Fertilizers, Optimization of Land Use, Vertical Agriculture…)

The agricultural sector in Mediterranean countries is one of the sectors most threatened by climate change. The Mediterranean agricultural industry is heavily dependent on water, using an astounding 75% of its water resources (IUCN, 2023). In com-

bination with climate change, which is leading to increased water shortages and droughts, this unsustainable exploitation of water is very concerning and is having severe consequences on the region's biodiversity. The leakage of agricultural fertilizers and the use of pesticides is also accelerating this biodiversity loss.

Long associated with intensive practices and a productivist model, the agricultural sector is changing under the effect of digital technologies. Indeed, the potential of technologies can enable better use of resources and greater adaptation to climate change. Technologies help farmers make better use of natural resources like water and land, but also to rationalize the use of fertilizers and many other inputs. This modification has the effect of reducing pollution, better adapting to climate change and limiting GHG emissions. Today, the uses of water for plots are calculated by intelligent systems, and take into account climate conditions, air humidity, soil humidity and the needs of the crop. These systems are essential nowadays under the paradigm of precision agriculture.

Then, these technologies allow farmers to improve their business models by linking supply and demand locally. One of the consequences concerns the shortening of distribution chains. This development was one of the most important responses to the Covid-19 crisis. Local agriculture adapted to the needs of consumers makes it possible to limit transport over long distances and therefore GHGs. Digitalization through Big Data plays an important role in this area. The emergence of marketplaces and local and regional platforms for agricultural products has improved outlets for agricultural products and their marketing. In some cases, this improves the export of local agricultural products and their integration into structured value chains (Chebbi, 2022).

Digital platforms can also play an important role in the technological dissemination of innovative and sustainable practices. New generation agricultural machines are expensive and their pooling allows farmers to use them without necessarily buying them. These new practices are spreading and there is a rationalization of the use of devices and instruments thanks to agricultural platforms. Similarly, specific applications and platforms are specialized in advising farmers to provide solutions, thanks to digital technologies, to the problems encountered. Drone monitoring makes it possible to see if diseases are present in plots, and then assistance is provided to determine the diseases and the appropriate treatments in real time, avoiding late responses.

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Boosting Trade and Commerce through Marketplaces and Platforms

While some of the south Mediterranean countries have already highly embraced e-commerce, other countries and those of the north Mediterranean are on their way to shift to online trade. Home delivery and e-commerce services are becoming key for the rationalization of transport. The development of these platforms in Mediterranean countries has an impact on road traffic. Cities like Cairo, Tunis or Casablanca have seen an explosion in the number of delivery companies. This activity is practised formally (through organized companies) and informally through the use of social networks. The organization of a new form of mobility to limit environmental and ecological impacts is at the centre of the world's green transition. This makes it possible to optimize existing systems, but can in no way replace the need to make significant investments in clean transport and soft mobility for trade.

In the current digital era, promoting trade and commerce through platforms and marketplaces has taken on more significance. These platforms offer a wide range of advantages to consumers, business owners and entrepreneurs. Through the use of marketplaces and platforms, companies can present their goods and services to a global clientele. By connecting with customers outside of their typical geographic borders, firms can access new markets and possibly increase their sales.

To assist users in finding new products and businesses, marketplaces and platforms make use of advanced search engines and recommendation systems. Small and medium-sized businesses (SMEs),

which may ordinarily find it difficult to compete with better-known, established brands, may benefit greatly from this enhanced visibility. Marketplaces and platforms give businesses access to dashboards and tools for managing inventory, tracking sales and analysing consumer behaviour. Businesses may optimize their supply chains, make educated decisions and increase overall operational efficiency by using this data-driven strategy.

Marketplaces and platforms play a crucial role in boosting trade and commerce by providing a digital ecosystem that connects buyers and sellers, streamlines transactions, enhances visibility and facilitates collaboration. As digitalization continues to transform the business landscape, leveraging these platforms becomes increasingly vital for businesses to thrive in the global marketplace.

Towards a New Deal between North and South around Digitalization and Green Transition?

A new deal between north and south Mediterranean countries can foster a more inclusive and sustainable global digitalization and green transition. There is a chance of working together to address shared difficulties and take advantage of the possibilities offered by the twin transition on both Mediterranean shores. Between the two sides, there are still a number of disparities, particularly in terms of political principles and geopolitical stances. However, addressing these differences – and even valorizing them on the basis of mutual respect – could offer a workable solution to the numerous shared issues plaguing the Mediterranean region, as well as a means of institutionalizing and putting into practice cutting-edge forms of regional cooperation in a variety of other policy areas. Collaboration, cooperation and a shared commitment to addressing the needs and aspirations of all nations will be essential to its success.

When promoting a geopolitical framework for the digital transformation in the Southern Neighbourhood and concentrating solely on security requirements, the northern institutions should exercise more caution. This calls for more cautious export regulations for electronic surveillance technology, as well as an improved framework for the promotion of decentralized and generative technologies that will empower individuals as well as governments. It is encouraging and significant that south Mediterranean countries are paying attention to cybersecurity challenges. However, there is a risk associated with the securitization of digital networks in the region, which is made increasingly clearer when you take into account the absence of references to the preservation of fundamental rights in the national digital policies of the south Mediterranean.

The North should actively support technology transfer and capacity-building initiatives in the South. This can involve sharing knowledge, expertise and best practices in areas such as renewable energy, sustainable agriculture and eco-friendly manufacturing processes. It is crucial to ensure that the South has the necessary skills and resources to effectively adopt and adapt digital technologies for sustainable development.

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The North and the South should promote knowledge sharing and research collaboration to drive innovation and address common challenges in digitalization and the green transition. This can involve establishing research partnerships, funding joint projects and facilitating exchanges of experts and scholars.

To achieve the ultimate goal of a fair EU-Southern Neighbourhood collaboration with regard to the digital and green transition, institutions in the North should boost innovation ecosystems and digital capabilities and skills in the Southern Neighbourhood, which will require significantly longer-term investments. In this manner, the nations of the Southern Neighbourhood will be able to benefit from the innovative prospects presented by the twin green and digital transformations that the New Agenda for the Mediterranean draws upon.

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