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Report of the Task Force on

The Green Economy and Innovation

Eastern Mediterranean and Middle East Climate Change Initiative

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Abbreviations

ADNOC	Abu Dhabi National Oil Company
AED	United Arab Emirates Dirham
CEDARE	Centre for Environment and Development for the Arab Region and Europe
CO2	Carbon Dioxide
CCUS	Carbon Capture, Utilisation and Storage
DEWA	Dubai Electricity and Water Authority
EMME	Eastern Mediterranean and Middle East
EIT	European Institute of Innovation & Technology
EU	European Union
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GEI	Green Economy and Innovation
GGGI	Global Green Growth Institute
GORD	Gulf Organisation for Research & Development
GSCM	Green Supply Chain Management
HDI	Human Development Index
ICT	information and communications technology
IIA	Israel Innovation Authority
KIC	Knowledge and Innovation Community
KOSGEB	Small and Medium Enterprises Development Organisation of Turkey
MENA	Middle East and North Africa
NDC	Nationally Determined Contribution
NGO	Non Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
PPP	Public-Private Partnership
R&D	Research and Development
R&I	Research and Innovation

SCP	Sustainable Consumption and Production
SDG	Sustainable Development Goal
SME	Mmall and Medium-size Enterprise
SV2030	Saudi Vision 2030
TÜBİTAK	Scientific and Technological Research Council of Turkey
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Education, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
USAID	US Agency for International Development
VC	Venture Capital
WRI	World Resources Institute

Abstract

The exponential growth of global production and consumption patterns has brought the planet near catastrophic climate changes and the collapse of biodiversity. The impact of such a crisis is particularly relevant in the Eastern Mediterranean and Middle East (EMME). It could be mitigated by the adoption of virtuous economic models that take into account environmental externalities and the need to preserve natural capital through circular and regenerative practices. Such models should be designed to maximise social benefits, increase local prosperity and promote an inclusive job market. Specific policies are required in a multi-level and systemic perspective, to leverage and orient innovation capacity towards the green transition.

This report explores the situation in the EMME region and highlights practices and constraints that characterise each of the 17 economies in the area. Taking into account global trends and the regional context, it proposes four transitional missions, targeting the urban transition, the water-energy-food nexus, industrial symbiosis and the economy of natural ecosystems. The report makes four recommendations for implementing mechanisms that could support the development of the green economy in the region: 1) creating consistent data, economic models and policy assessment at the regional level, 2) promoting green skills, 3) establishing a distributed platform to accelerate green innovations, and 4) creating a regional green research and innovation partnership to expand the place-based generation of knowledge.

Executive Summary

> We are not living in a linear, Newtonian world where actions cause predictable reactions. We are in fact part of a complex system of environmental, socio-political and economic systems that we are constantly reconfiguring and that is constantly affecting us.
>
> —*New Approaches to Economic Challenges*, OECD 2020

> If I only had an hour to chop down a tree, I would spend the first 45 minutes sharpening my axe.
>
> —*Abraham Lincoln*

The exponential growth in human impact on the Earth's resources is threatening the integrity of the biosphere and bio-geochemical flows. Acceleration of climate change could dramatically compromise the planet's equilibrium, with unpredictable consequences for life and societies. A deep and rapid transformation of the current economic model is needed to incorporate externalities, stop the loss of natural environments and biodiversity, and regenerate the global commons, which has been overexploited. Systematically addressing these issues requires a new emphasis on economic *effectiveness* rather than economic *efficiency* and multi-level policies that will determine the economic focus, investments and public-private partnerships (PPPs) needed to generate ecologically sustainable value.

By adopting a regionally diversified agenda, the new green economy model can overcome the fear of sacrificing growth in employment and incomes in order to achieve environmental objectives – fear that has generated tension between the economic and environmental pillars of sustainable development. In developed regions, the transition should bring more prosperity, even in the absence of GDP growth. In developing countries, the linear development model should be re-engineered into a green growth model, in order to simultaneously achieve strong economic and environmental performance. A portfolio of transformative actions should contextually address 1) economic and policy context and regulations; 2) physical and digital infrastructures; 3) social and cultural dimensions; and 4) science, education and skills to produce systemic innovation in economic, regulatory and social frameworks alongside industrial and service value chains.

For most communities in the EMME region, green prosperity is a practical pathway to fuse sustainable economic and environmental development into a single policy framework.

For the wealthiest countries, new approaches should target prosperity instead of growth. If classified in terms of the Human Development Index (HDI) versus the environmental footprint, the EMME countries are positioned in an "arch" spanning low to high HDI, where socioeconomic performance is clearly detrimental in terms of impact on natural resources. Unemployment reached unsustainable values in Greece, Palestine and Iraq, with high values also registered in large countries such as Egypt, Turkey and Iran. Therefore, unemployment, especially among youth and women, should be a focal aspect of regional green economy policies.

The Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Qatar, Oman, Saudi Arabia and the United Arab Emirates) have very high per capita carbon dioxide (CO_2) emissions and low penetration of renewable energy. Fossil fuels are still highly subsidised in many countries, and only three countries in the region (Greece, Israel and Turkey) have introduced environmental taxation schemes.

The region's economy is highly diversified, adding a level of complexity to establishing a common regional trajectory towards the green economy model. Countries have different levels of specialisation, compositions of their economic systems, roles for small- and medium-size enterprises (SMEs) and publicly controlled organisations, and socioeconomic challenges. The correlation between innovation and GDP per capita gives some hints about the country's trajectories. Israel, Cyprus and the United Arab Emirates have diversified their economies in ways that other wealthy countries in the region could emulate. Their experience suggests that innovative capacity and related investments could leverage the green transition if framed in a robust greening strategy and consistent regional frameworks.

Every country in the region except Egypt and Syria is significantly more urbanised than the average country in the world; Kuwait and Qatar are almost totally urban. Therefore, the transition of urban metabolism - i.e. the combined flows of energy and matter in cities - towards a green and circular model emerges as a priority and offers a testing ground for the development of place-based green business models and innovation.

Transformation of the food chain in the EMME region is particularly challenging, for two reasons. First, the growing separation of urban and rural communities is driving an increasingly industrialised model of food production, which dramatically rises the amount of externalities in open cycles, boosting the use of packaging and imported materials, as well as fuel for transportation over longer distances between production and consumption. Second, the GCC countries are highly urbanised and their harsh climatic conditions make it almost impossible to establish conventional agriculture. As a result, the food chain in these

countries is very fragile, relying on long-distance supply chains and leaving a heavy ecologic footprint. Innovations are needed to close the cycles and optimise exchanges along the value chain. Novel farming practices should be embedded into the urban metabolism, water management and food production should be holistically connected, short-distance food trading should be incentivised by taking into account the environmental footprint in pricing, and regional food chains should be consolidated by specific incentives and infrastructures. Circular models should be promoted by integrating waste-to-product practices into food chains and using food waste as fertiliser.

The economic transition should be supported by an appropriate financial system, which could leverage some pioneering experiences that have already been established in the region. A deeper understanding of the interaction of economic processes with the regional stocks of natural capital should pave the way to the implementation of nature-based economy strategies, able to preserve and even regenerate ecosystem services.

Emerging technologies will play a crucial role in driving the transition towards the green economy paradigm, although technologies alone will not suffice. Providing support to technology transfer, start-up and scale-up processes and access to finance should be an integral part of green economy frameworks. Measures already adopted by the European Union (EU) and national policies should be interconnected within a regional ecosystem to offer a single EMME space for eco-innovation. A comprehensive policy approach is needed in order to create green jobs. National employment policies and programmes should accelerate investment in green sectors and prepare workers by enhancing their skills.

Despite the pressing urgency and the large potential for development, the green economy and eco-innovation still lack a comprehensive design and coherence in the EMME region, where cross-border innovation policy frameworks and actions are missing, with the exception of collaborations promoted by some international donors. National strategies need strengthening and melding into a regional model.

EU members Greece and Cyprus are now linked to the European Green Deal policy. Israel adopted its green economy policy in 2014, which it revamped during the COVID-19 pandemic. In 2020, Jordan established the Jordan Environmental Fund, supported by the US Agency for International Development (USAID), and adopted a green growth strategy. The United Arab Emirates adopted its green growth strategy in 2012; in 2015, it implemented the Green Agenda 2030. GCC countries have adopted strategies that envisage transitional paths towards a diversified and greener economy that are already backing explorative initiatives.

At the same time, the region provides strong incentives for fossil fuels and energy-intensive activities, and it continues to exploit oil and gas. Turkey and Egypt explicitly adopted the United Nations' Sustainable Development Goals (SDGs) as the reference framework for their country strategies, but their growth models are still based on heavy infrastructural investments and the expansion of resource-depleting markets. Iran appears to be delayed, as a result of international economic sanctions that are affecting its economy. Syria and Iraq are facing enormous problems due to war disruptions. Lebanon and Palestine have set ambitious goals and created dynamic environments, but they face adverse geopolitical factors and multiple crises.

The EMME region should adopt a portfolio of measures that translate global approaches into local but broad and interconnected economics of change. Implementation of a regional policy for accelerating clean innovation should merge local and autonomous innovation actions into a systemic vision built at the regional level. This is the appropriate level from which to account for the complex interactions that underpin techno-social pathways, grounding innovation policies in geopolitical and socioeconomic reality.

The Task Force suggests implementing regional green transitional missions in four areas: urban transition, industrial symbiosis, the water-energy-food nexus and the economy of natural systems. Governance of these missions should enable open and inclusive processes of innovation, experimentation, action and learning. Policies, legal arrangements and governance models that can hinder the implementation of the transitional pacts (conflicting regulations on biodiversity, resource exploitation, land management, etc.) should be holistically reconsidered. Co-creation/collaboration, learning and communication are key to achieving the broadest consensus on what needs to be done. Exploitable results and knowledge gained from previous schemes and projects – such as good practices, open software and hardware, available capacities and skills, and existing infrastructure at piloting sites – should be leveraged at the regional level.

In addition to the region's geopolitical fragmentation and economic diversity, the lack of a systemic process for data collection and analysis is hindering development of a regional green economy strategy in the EMME area. Systemic frameworks for regional policy design and evaluation are missing as well.

To overcome this gap, the Task Force recommends establishing an EMME Green Economy and Innovation (GEI) Observatory, which should facilitate the monitoring of information and data on the green economy and innovation in EMME countries and help to design policies, policy measures and innovative schemes (including technologies, know-how and jobs) at the regional level.

Another recommended mechanism, inspired by the EU Erasmus+ programme, would establish an international mobility programme that would train and retrain people in the region to meet the demand arising from the growth of green economy sectors and facilitate the development of joint transformation agendas in education and vocational training.

The Task Force also recommends adoption of an integrated regional model for green innovation through a distributed system of green innovation hubs for knowledge creation and dissemination, entrepreneurial experimentation, infrastructural support and mobilisation of appropriate resources towards the green economy framework. The proposed EMME Green Accelerator platform would orient, integrate and empower existing facilitation tools (incubators, accelerators, innovation hubs, science and technology parks) and local open innovation ecosystems to promote the scale-up of transitional businesses in a regional perspective.

Enhancing co-ordination between EMME countries and between EMME countries and international agencies and organisations could increase the sharing of data, best practices, emerging technologies and methodologies. The Task Force recommends establishing an intergovernmental regional research and innovation partnership – the EMME Green Research and Innovation (GRI) Partnership – to promote and finance transnational research and innovation activities, including the collection and distribution of scientific data, and the identification and sharing of good practices and innovative solutions, both in climate change adaptation and environmental footprint mitigation. This partnership would strongly support the implementation of the four green transitional missions.

1. Scope

Modern society is highly fragile in the face of systemic threats, as the COVID-19 crisis has revealed [1]. The pandemic is likely to be one of many interlinked emergencies caused by the progressive destabilisation of the planet's fundamental cycles and ecosystems as a result of the last 70 years of exponential socioeconomic development – the "Great Acceleration" – combined with the exponential growth in the population and climate change [2].

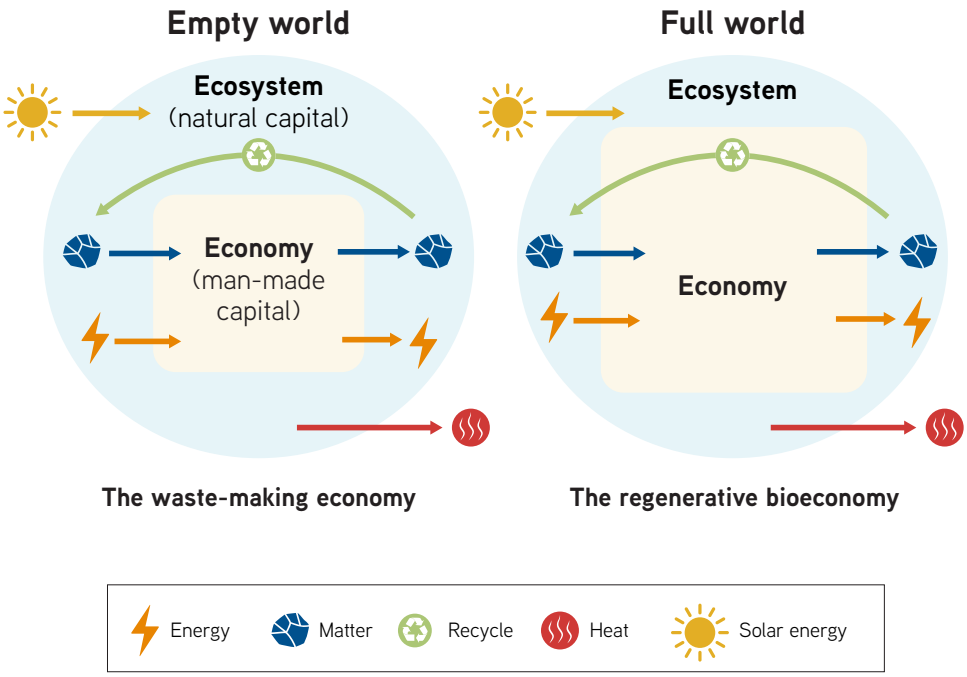
The unsustainability of a model based on the unlimited growth paradigm has been noted for almost 50 years [3], but no substantial changes in the world's economic systems have been introduced. A modest reduction of the footprint of the OECD most advanced economies[1] has been offset by the delocalization of production in the not-OECD countries and by the introduction of billions of people into the consumer market, with an exponential expansion in the demand for goods, the exploitation of resources, emissions and pollution.

With the landmark Paris Agreement in 2015, global leaders set a goal of keeping the global temperature rise to well below 2°C above pre-industrial levels in order to avoid "dangerous climate change". Severe effects will start to occur at an increase of 1.5°C, within a very short time. The goal is to radically reduce global greenhouse gas (GHG) emissions by 2030. Yet carbon dioxide concentrations in the atmosphere are still growing[2], natural environments and biodiversity are being lost at an unprecedented rate[3], the global commons are being overexploited[4], wealth and income inequality are steadily rising[5].

Nothing less than a deep revision of the foundational principles of the economy is urgently needed to take into account physical externalities – i.e. the contribution of each single economic activity to the overall increase of entropy on our planet. As the Earth system, with the exception of inbound solar energy, is finite and closed, the economy should be reconciled with physics in ways that avoid the entropic degradation of the environment [4]. Economist Herman Daly proposed a progressive achievement of a socioeconomic steady state in which material wealth and population stabilise at a sustainable level [5]. Nobel laureate Elinor Ostrom suggested the rediscovery of virtuous and stable interactions of humans and ecosystems that have been implemented by indigenous communities through wise governance of the commons and the *ante litteram* practice of circular economy [6], the radical "cradle back to cradle" approach, which was introduced in 1981 by Stael and Reday [7].

1. See data from the Global Carbon Project, https://cicero.oslo.no/no/posts/klima/global-environmental-footprints.
2. https://public.wmo.int/en/media/press-release/greenhouse-gas-bulletin-another-year-another-record.
3. https://www.iucnredlist.org/resources/summary-statistics.
4. See J. Rockström speech about Global Commons in the Anthropocene, https://youtu.be/R0oX4uZcPNg.
5. See A. Shorrocks, J. Davies, and R. Lluberas, "The Global wealth report 2020," Res. Inst., 2020.

FIGURE 1.1. The shift from a waste-making to a resource-aware economy



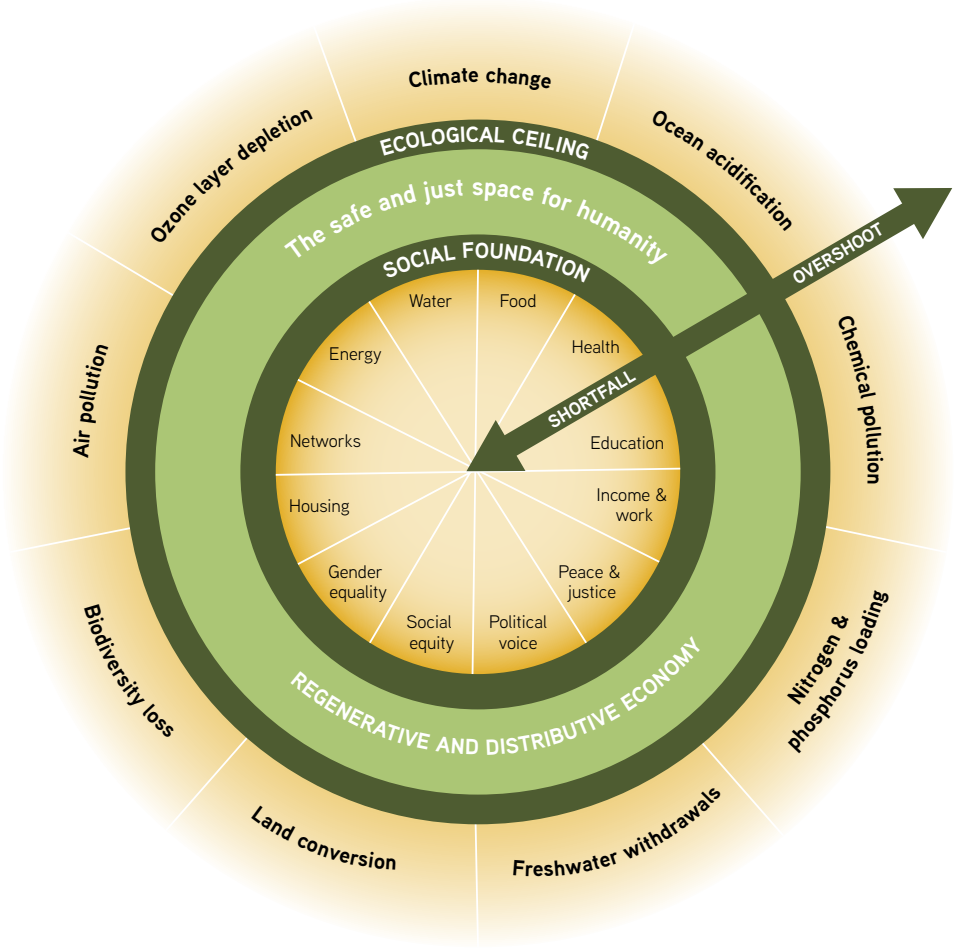
Source: [5].

In line with the United Nations Environment Programme (UNEP) definition, the transformation towards a green economy envisaged in this report should result "in improved human well-being and social equity while significantly reducing environmental risks and ecological scarcities"[6] through an appropriate valuation and preservation of natural capital and ecosystem services. This transformation requires a portfolio of co-ordinated actions and an orchestration model that is represented by the "doughnut" model introduced by economist Kate Raworth [8]. Her model targets a convergence, of wealthy societies, which should reduce their footprints without compromising their social achievements, and poor societies, which should increase their social prosperity without putting stress on their natural capital and cycles. Both should remain below the so-called planetary boundaries, i.e. nine critical biophysical constraints imposed by the planet Earth, if we want to preserve its stability. The planetary boundaries will be extensively discussed in section 3.

Figure 1.2 describes this model. The "safe space" is under the ecological ceiling, the external limit of the doughnut corresponding to the planetary boundaries. The "just space" stays above the threshold of social foundation, which is structured in 12 pillars. The green area represents the desired area, in which social prosperity and ecological stability coexist.

6. https://www.unep.org/pt-br/node/23750.

FIGURE 1.2. The doughnut economic model



Source: [8].

Through a regionally diversified agenda, the model can allay the fear that growth in employment and income will need to be sacrificed to achieve environmental objectives. Such fears have generated a constant tension between the economic and environmental pillars of sustainable development, and must be overcome through diversified but harmonised approaches: in developed regions the transition should bring more equality and prosperity, even in the absence of GDP growth; in developing countries, the linear development model should be reengineered into green growth, in order to simultaneously produce strong economic and environmental performance [9], as represented in Figure 1.3.

FIGURE 1.3. Key factors affecting and benefits of green growth

Source: [9].

The sustainability concept includes people, the planet and the economy. The other paradigm, of circularity, focuses on resource cycles within planetary boundaries, by applying three principles: 1) preserve and improve natural capital, 2) optimise resource performance, and 3)enhance effectiveness[10]. Moving towards a sustainable and circular economy could generate socioeconomic benefits and reduce the depletion of the environment by decoupling resource consumption from prosperity. It will enhance the security of the supply of raw materials, increase competitiveness and innovation, improve social wealth and create high-quality jobs.

For most Eastern Mediterranean and Middle East (EMME) communities, green prosperity is a practical pathway to "fuse sustainable development's economic and environmental pillars into a single intellectual and policy planning process" [11]. It offers a roadmap for strengthening the rate and resilience of economic growth. Many challenges should be addressed in a systemic way. They include the establishment of an appropriate financial system, the implementation of key enablers and accelerators, the reorientation of skills and consumer behaviour, the validation of new business models and the adoption of multi-level governance frameworks.[7]

In the last decade, analysis by academics and international organisations pointed to the need for comprehensive reforms and co-ordinated actions [12] [13] [14] [15] [16] [17], particularly as part of recovery following the end of the pandemic [18] [19]. This report identifies tendencies and suggests directions towards a new economic architecture for the region that should include a bottom-up set of tools, mechanisms and institutions that aim to remove some of the risks, uncertainties and market barriers holding back the green model. It highlights the need to generate sustainable innovation and new green business models; fine-tune their social impact, ensuring fair access to new opportunities; and monitor their environmental effectiveness, avoiding "green washing" or the offshoring of externalities. The report envisions the smooth phasing out of some industries and the scaling up of new sectors.

At the global level, a comprehensive transitional process is already evident in some critical industries, such as mobility and energy. It suggests that exponential changes are possible and could be replicated at the regional level. For example, breakthrough innovations have recently made electric vehicles fully marketable. As a result, sales rose by a factor of above 40 between 2011 and 2020, reaching a total of 3 million vehicles, and an estimated 66 million are expected to be sold by 2040, representing two thirds of the market[8]. Photovoltaic technology has followed a similar trajectory, with solar installations growing by 58% a year on average since 2010, thanks to a combination of supporting actions that triggered both market uptake and innovations that have steadily reduced technology costs by an average of 10% a year since 1980 [20].

The electric vehicle and solar power examples are being emulated in many other clean innovation domains, such as energy storage, CO_2 emissions mitigation and capture, renewable plastics, chemicals and fuels, water treatment, decontamination and waste treatment, and agri-food sustainable supply chains. Other approaches, aimed to behavioural changes,

7. European Commission (2020): Green growth and circular economy. Retrieved from: https://ec.europa.eu/environment/green-growth/index_en.htm.
8. https://www.bloomberg.com/news/articles/2021-08-09/at-least-two-thirds-of-global-car-sales-will-be-electric-by-2040.

i.e. smoothing consumption, developing economies of share, boosting the value of use instead of the value of ownership, could be promoted through multi-sided transitional policies, which would create new markets with large, forecasted growth for the years ahead. Such a dramatic transformation would have substantial impacts on the job market [21].

Because the job market of the EMME region, especially in some of its traditional industries, will be highly affected by climate change, while it has untapped potential in some emerging green value chains, the creation of green jobs represent a focus of this report and a core component of the suggested policies and actions.

2. Geographical setting[9]

Correlation of human development and environmental exploitation

We introduced the concept of safe and just space in the previous section, as the condition of achieving social goals while avoiding the transgression of planetary biophysical boundaries. A comprehensive study analysed the relationships between 7 indicators of national environmental pressure (relative to biophysical boundaries) and 11 indicators of achievement of social thresholds for over 150 countries [22]. According with the results, no country is even approaching the safe and just space, with the exception of Vietnam, yet: all of them are distributed within an arch from poor social achievements and low-impact, to greater wealth and unsustainable footprint, as shown in Figure 2.1 (the EMME countries have been highlighted). It results evident that, in order to approach a sustainable combination of environmental and social performance, each country should follow a different path, which depends from its present situation and especially the level of correlation between wealth and exploitation of the environment.

The Human Development Index (HDI) is another measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and having a decent standard of living. It also results correlated with the environmental footprint, as shown in Figure 2.2, which is based upon datasets offered by the Global Footprint Network. HDI is correlated to global hectares per capita, i.e. the equivalent surface needed to sustain the consumption of one person in that country, taking into account production, consumption and trade. The countries in the EMME region are distributed along an arch, from Syria, which shows the lowest HDI and footprint, through Israel, which achieves the highest HDI at a cost of about 5 global hectares per capita, to Qatar, which has the largest environmental footprint of about 15 global hectares per capita.

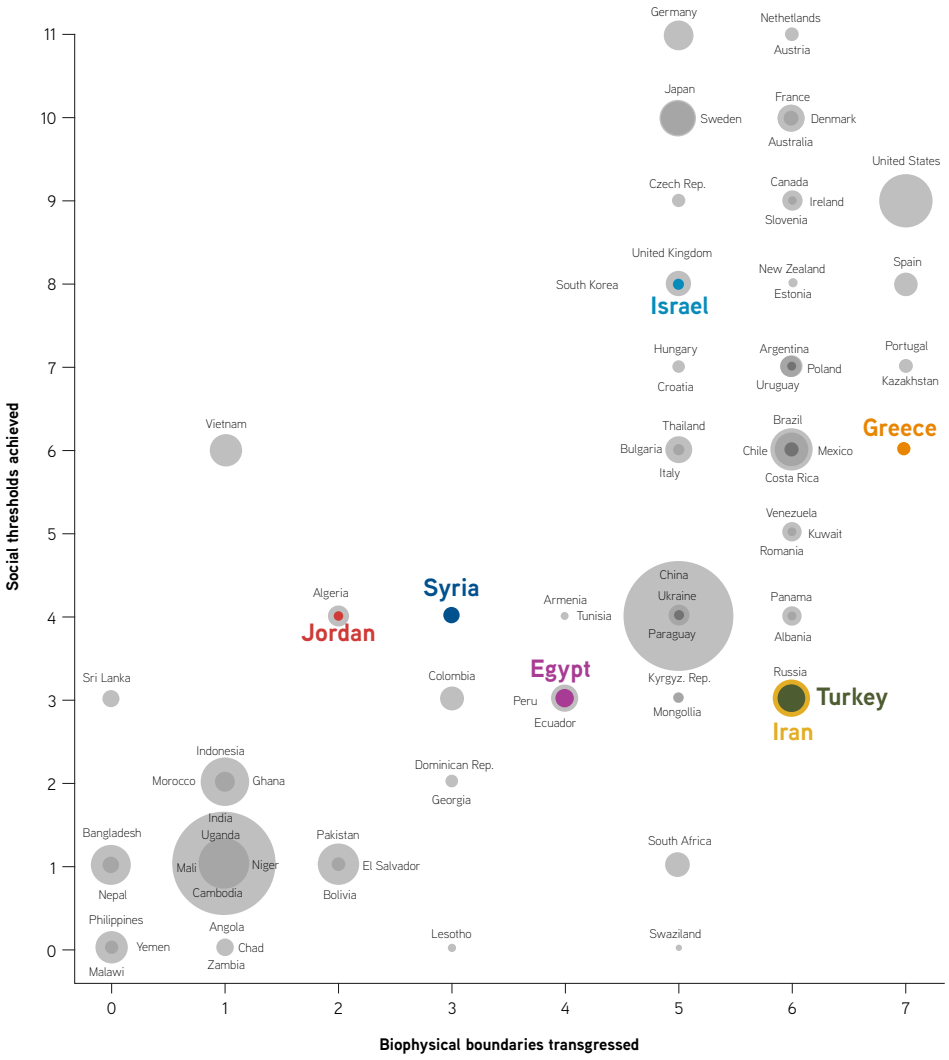
Highlights of the EMME countries

Five important observations emerge from analysis of the Global Footprint Network data on the 16 EMME economies (complete datasets for Palestine were not available):

1. Egypt, Turkey and Iran – the most populated countries in the region, with about half of the population of the whole region – show steady demographic growth. This fact should be taken into account in terms of impact of any green economy policy framework.

9. Data have been collected till September 2021.

FIGURE 2.1. Number of social thresholds achieved versus number of biophysical boundaries transgressed for different countries

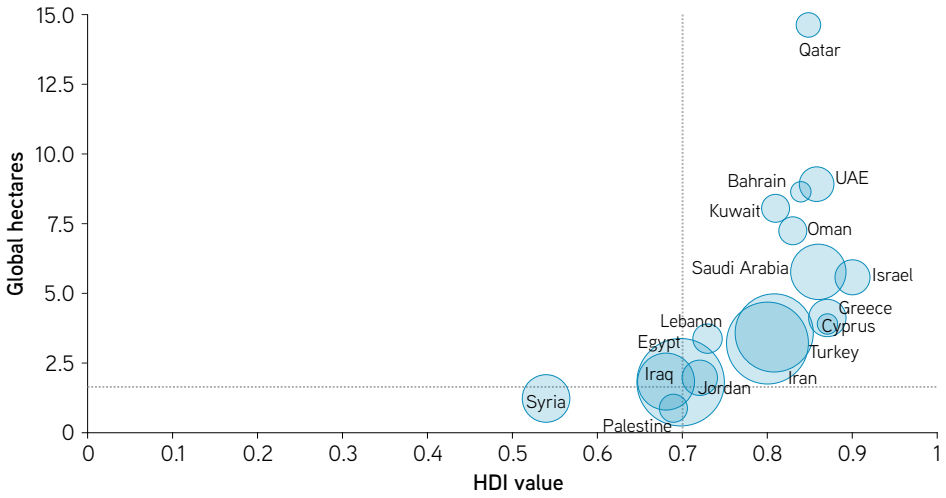


Source: Adapted from [22].

Note: Circles representing countries are scaled by population. EMME countries are shown in red. The just and safe space is on the left-top.

2. Population is densest in Bahrain, followed by Lebanon and Israel. Density is high in Kuwait and Qatar, too.
3. GDP per capita is exceptionally high in Qatar. The other countries fall into three groups: low income (Egypt, Jordan, Iran, Iraq, Lebanon, Syria, Turkey); middle income (Bahrain, Cyprus, Greece, Oman, Saudi Arabia) and high income (Israel, Kuwait, United Arab Emirates).

FIGURE 2.2. Correlation between the Human Development Index and the environmental footprint in the EMME economies



Source: Global Footprint Network. Datasets are offered by the Footprint Data Foundation (https://data.footprintnetwork.org/?_ga=2.159842941.1386211738.1629126283-1483958886.1629126283#/abouttheData).

4. Unemployment ranges from 0 to 5% in the high-income countries. It reached unsustainable values in Greece (above 25% during the peak of the financial crisis) and Iraq (up to 30% as a result of the second Gulf war), with values ranging around 10% in the largest countries of the region (Egypt, Iran, and Turkey). Employment, especially among youth and women, should be a focus of green economy policies.

5. Oil- and gas-based economies (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates) have very high per capita CO_2 emissions and low penetration of renewable energy. Fossil fuels are still highly subsidised in many countries (Bahrain, Egypt, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates). Only three countries (Greece, Israel, Turkey) have introduced environmental taxation schemes.

The economy of the region is highly diversified, adding a level of complexity to establishing a common regional trajectory towards the green economy model. Countries show different levels of specialisation, compositions of their economic systems, roles for small- and medium-size enterprises (SMEs) and publicly controlled organisations, and socioeconomic challenges.

Both Greece and Cyprus are driven towards the green model by EU policies, which continued to be enforced during the pandemic crisis. Cyprus, which is still a partially occupied country, is characterised by a service-based economy (finance, tourism, information and

communications technology), a central role of the real estate sector and efforts to consolidate leadership in the maritime industry. Greece has developed agriculture, tourism and the maritime industry, and SMEs play an important role. Its economy is still affected by the long tail of the financial crisis.

Many EMME countries are heavily affected by systemic instabilities that are limiting their orientation towards and capacities for the green transition. Palestine, due to the Israeli occupation, suffers major structural problems, including a resource gap, labour market distortions and dependence on external sources of income. Jordan is the world's largest host country of refugees (2.8 million of the country's 10.2 million people are registered refugees, mostly from Palestine and Syria). This influx has placed pressures on Jordan's natural resources and infrastructure, particularly as it imports 93% of its energy needs and ranks fifth in the world in terms of water stress according to the World Resource Institute[10]. Lebanon, with a population of 6.8 million is hosting about 1.5 million refugees. It has suffered major economic, political and financial crises since October 2019 (with signs of recession beginning in late 2018). The economies of Iraq and Syria are exhausted by war and instability, which are slowing plans to achieve more sustainable economies. US sanctions have hurt Iran's economy, reversing the process of internationalisation of the Iranian business environment, and the adoption of sustainable economy principles in national five-year development plans.

The Gulf Cooperation Council (GCC) countries are moving on a path towards more sustainable economies. Kuwait has started developing wind and solar resources. Bahrain introduced its Economic Vision 2030 in October 2008, addressing the United Nations Sustainable Development Goals (UN SDGs), after four years of discussions with public and private stakeholders. Oman also has taken the initiative to reduce the risks of an economy that is dominated by the export of hydrocarbons with a growing public as well as external debt. Under Saudi Vision 2030 (SV2030), Saudi Arabia has declared its goal of diversifying its economy to reduce its substantial dependency on oil. The recent reform of energy prices and efficiency standards has triggered reductions in CO_2 emissions, while GDP has continued to grow. The United Arab Emirates is pursuing a policy of economic diversification, investing heavily in construction and services and emerging as a hub for travel and tourism; manufacturing (aluminium, iron and steel, cement, etc.) and trade and logistics. The development of a green economy is integral to its agenda of economic and energy diversification, which is pursuing a progressive independence from the oil and gas sector.

The Egyptian economy seems to have been stabilised by several enormous infrastructure development, including the second Suez Canal channel and the construction of a new

10. https://resourcewatch.org/data/explore/wat036rw1-Water-Stress-Country-Ranking

administrative capital. Diaspora financing and remittances are also critical parts of the economy, representing about 10% of the GDP[11].

Turkey is affected by very rapid urbanisation, which rose from 25% in 1950 to 75% in 2015 [12]. This trend is driving demand for energy and increasing the environmental impacts of waste disposal. Turkey is addressing these challenges by using the SDGs as the reference targets of its national development plans.

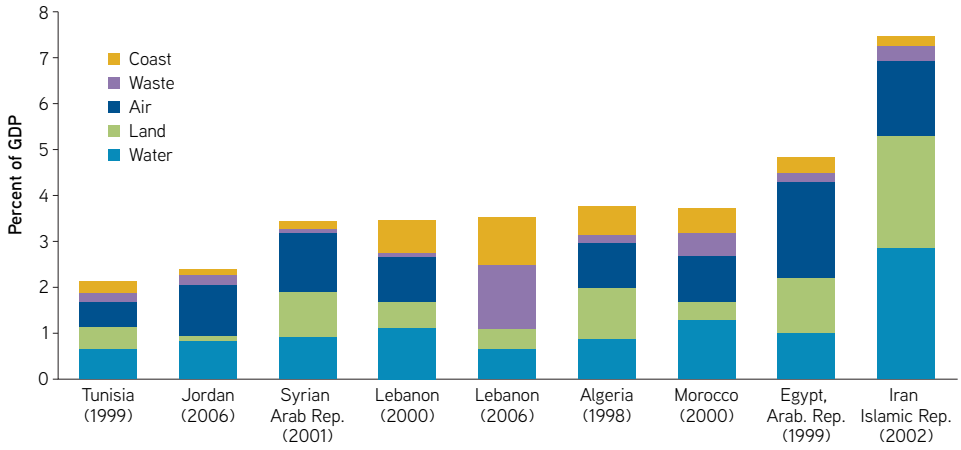
Cost of environmental degradation

Despite the extreme pressure on the environmental systems, cost of environmental degradation hasn't been sufficiently analysed in the region. A relatively old but still relevant study conducted by the World Bank has been showing a total impact ranging from about 2.5% of GDP in Jordan to more than 7.0% of GDP in Iran (Figure 2.3) [23], highlighting a clear opportunity for establishing a virtuous regenerative economic loop that would finance green activities with savings in terms of environmental costs.

Innovation trajectories

The correlation between innovation and economic development in terms of GDP per capita gives some hints about countries' trajectories [24]. Figure 2.4 identifies countries in the EMME region that were more innovative than expected given their per capita GDP

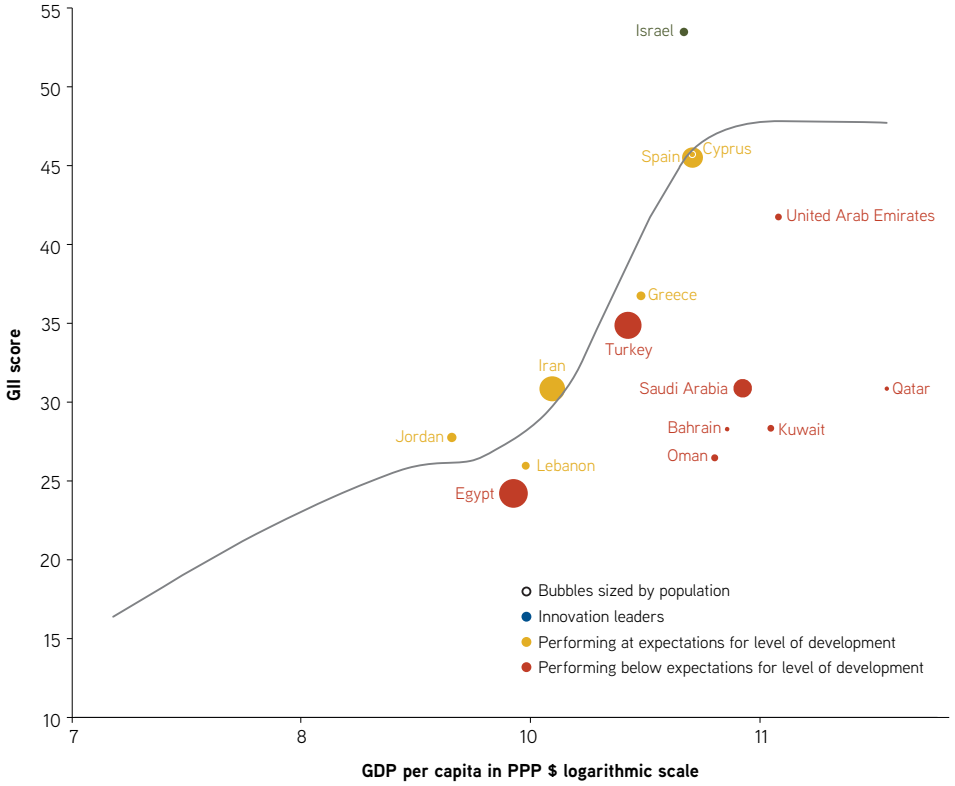
FIGURE 2.3. Cost of environmental degradation in selected countries in the Middle East and North Africa



Source: [23].

11. https://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS?locations=EG
12. Rise of the Anatolian Tigers: Turkey Urbanization Review, Main Report. World Bank, 2015

FIGURE 2.4. Correlation between Global Innovation Index (GII) and GDP per capita, 2020



Source: [24].

Note: PPP = Purchasing power parity. The curve represents the ideal GII performance against GDP.

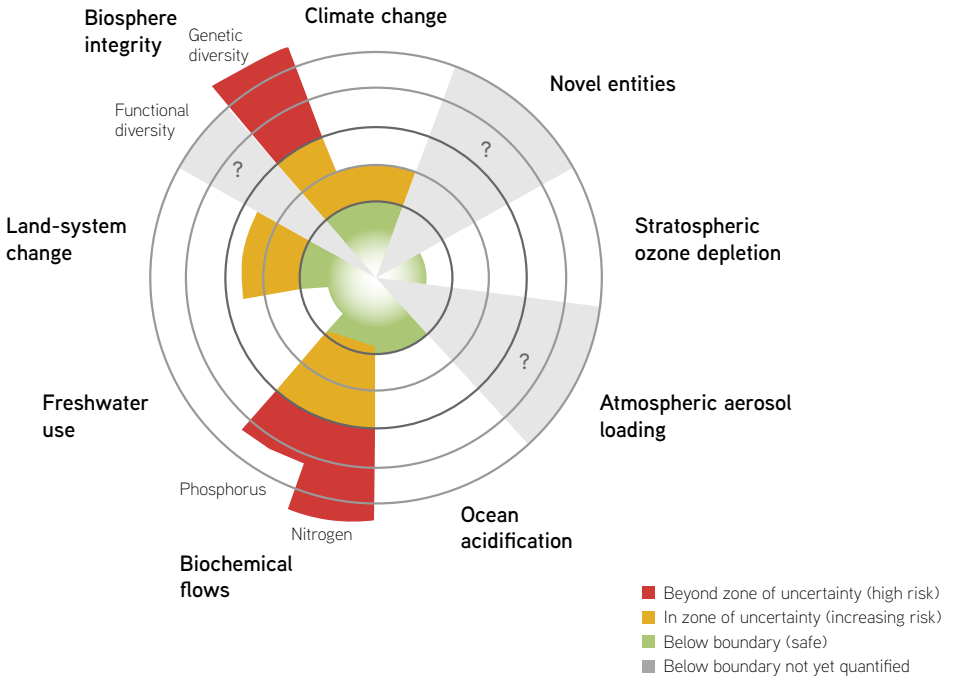
(Israel); as expected (Cyprus, Greece, Iran, Jordan and Lebanon) and worse than expected (GCC members). Turkey and Egypt are just below the level expected given their per capita GDP; both investing in innovation to spur economic growth. Among the GCC countries, the United Arab Emirates results the most innovative and relatively close to its potential performance. Regional collaboration in innovation - such as the multi-level frameworks launched by the European Union - could integrate national efforts to address climate and ecologic challenges, with benefits for both leaders and followers.

3. Key elements for the development of Green Economy and Innovation

Green Economy and Innovation policies should be part of the systemic and deep change, which is needed to restore a safe global environment. Scientists have identified nine mutually interconnected processes that are regulating the stability and resilience of the Earth's ecosystems, which have been under pressure due to human activities since the Industrial Revolution (Figure 3.1) [25]. As transgressing these boundaries makes large-scale irreversible environmental changes possible, potentially threatening human civilisation, economy should be transformed in a way that respects these limits.

Climate change, while critically important, is just one of the problems that needs to be addressed by restructuring the economic model. Any alteration of the processes regulating the stability and resilience of the Earth system has negative effects on the integrity of the biosphere, which drives biodiversity loss and moves the planet towards a new mass extinction. These combined factors of instability of the biosphere have reached quite high

FIGURE 3.1. The nine planetary boundaries



Source: https://www.stockholmresilience.org.

levels of risk (in red in Figure 3.1) and therefore, their neutralization should be targeted by transformative policies in combination with climate change mitigation. Tackling climate change requires eliminating or reducing GHG emissions through a major reorganisation of the energy and other industrial sectors. Preventing the loss of biodiversity and equilibrating biogeochemical flows results far more complex and difficult, as the preservation and restoration of biocapacity depends from all levels of the human activities in the planet. Their embodiment into economic practices requires a true shift of paradigm.

The role of agriculture

A striking message that emerges from the planetary limits approach is that agriculture is one of the principal factors destabilising the planetary equilibrium [26]. Stresses induced by agricultural practices have led to the transgression of the limits on biosphere integrity and bio-geochemical flows. Agriculture is also the major driver of changes in land systems and freshwater use and a significant contributor to climate change. It is a major contributor to progress towards the planetary boundaries of the processes that are still in the safe zone. The areas in which it may be possible to reverse global warming and resource depletion are control of GHG emissions and changes in the food production model. The design and implementation of integrated actions addressing the water-energy-food nexus should thus be a priority in any transitional plan towards the green economy.

From efficiency to effectiveness

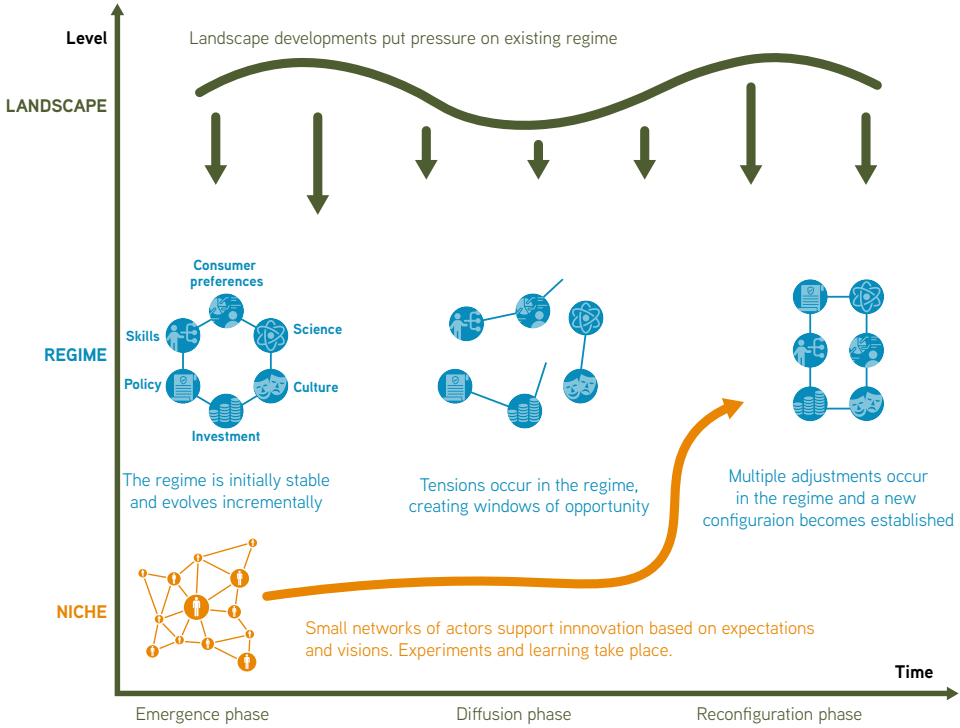
Addressing these issues requires a move from the current paradigm of economic efficiency to one of economic effectiveness, starting from the preservation and regeneration of natural capital. Purpose-driven policies must shape the economic focus, guide investments and ensure PPPs that generate value [27]. Understanding and addressing negative externalities must become a priority in economy and industrial planning, in order to account and offset impact on the planetary boundaries. According to the *Natural Capital at Risk: Top 100 Externalities of Business* study, "primary production sectors (agriculture, forestry, fisheries, mining, oil and gas exploration, utilities) and primary processing sectors (cement, steel, pulp and paper, petrochemicals) generate externality costs of US$7.3 trillion, or 13% of 2009 global economic output. The majority of environmental externality costs are from GHG emissions (38%), water use (25%), land use (24%), air pollution (7%), land and water pollution (5%) and waste (1%)" [28].

Without taking externalities into consideration, the unlimited growth paradigm resulted in highly efficient but fragile supply chains [29]. The system retains insufficient buffer

capacity and flexibility to absorb disruptive events like climate change or even the pandemic crisis without massive public interventions. In many countries, including much of the EMME region, the environmental crisis has already developed into a "triple crisis", in which environmental stress is creating economic difficulties and social instability. Structural reorientation measures are urgently needed to support affected workers, communities and SMEs. Governments are therefore being asked to orient investments, procurement strategies and the management of massive crisis bailouts and social interventions towards meaningful and long-term transformation. A portfolio of deep transformative actions should be assembled to trigger concurrent innovation in economic, regulatory and social frameworks, alongside industrial and service value chains [30] [31]. These actions should address 1) economic and policy context and regulations; 2) physical and digital infrastructure; 3) social and cultural dimensions and 4) science, education and skills (see Figure 3.2).

To trigger transitions in socio-technical systems, transformative innovation policies must apply practice-based knowledge and an analytical approach to the understanding of system properties. The new paradigm means that economies pursue a broader and multi-dimensional objective – i.e. prosperity – rather than growth as measured by GDP, in order to

FIGURE 3.2. Deep transformation of techno-socioeconomic frameworks



Source: [30].

make development sustainable and increase human well-being. Pursuing economic resilience instead of simple economic growth would require some fundamental modifications in macroeconomic approaches, in order "to account more systematically for changes in the asset base; to incorporate welfare losses from inequality in the distribution of incomes; to adjust for the depletion of material resources and other forms of natural capital; to account for the social costs of carbon emissions and other external environmental and social costs; and to correct for positional consumption and defensive expenditures" [32]. Shifting from the economy of quantity to the economy of quality would drive economies away from expansive investments in competition with nature towards harmonious investments that respect the Earth's ecological equilibrium [33].

This approach is well embedded in the UN strategy for implementing the SDGs [34]. Prosperity is one of the "5 P's" (the others are people, planet, peace and partnership). The components for achieving prosperity include the following:

- Creating enabling conditions for inclusive growth to help bridge economic, social and environmental gaps for sustainable development.
- Framing three broad policy priorities tailored to the development needs of countries: 1) integrating planning; 2) supporting employment creation, decent work and redistributive programmes to address poverty, inequality and exclusion; 3) mobilising innovative financing mechanisms for enabling the transition to inclusive and sustainable growth.
- Working on recovery solutions and human mobility, with a focus on livelihoods and economic recovery, migration and displacement, as well as development.

Rich and poor countries will take different trajectories. For low-income countries, environmental sustainability should be taken as a compass, directing the actions aimed to increase production and consumption. As in high-income countries the concept of prosperity should replace the concept of growth, governments must discourage excessive consumption, by overcoming any structural impediment to doing so, and offering adequate incentives.

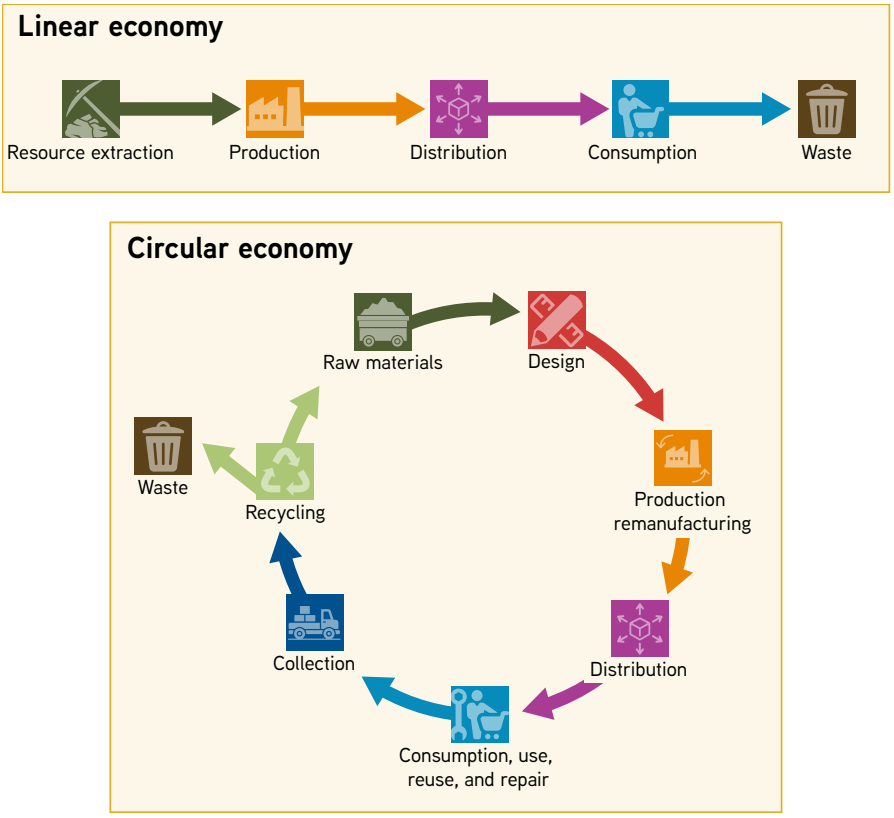
Shifting to this new paradigm is at the core of the European Green Deal, the most comprehensive set of policies and measures for the green transition that is available at the global level. It sets out a new vision that seeks to unify the EU countries by simultaneously addressing their economic, environmental and social challenges in a mutually supporting way. It confirms the need for a profound transformation of the nature of growth in Europe, providing the best framework for the pathway towards recovery and to "building back better" to strengthen resilience against future shocks.

This systemic revolution sees a minor, albeit still relevant, role of supply-side technologies, although the focus is transforming end-use socio-technical systems. The European Green Deal is extremely relevant for the EMME Climate Change Initiative, as it binds two countries in the region (Cyprus and Greece), and informs many other opportunities of co-operation within existing and future frameworks (including the ENI CBC MED [13], Horizon Europe, EuropeAid, and bilateral actions) that connect the European Union with most of the countries in the region.

The circular economy

The circular economy paradigm is emerging as an alternative to the linear, growth-based approach (see Figure 3.3). It replaces the open, nature-to-waste model with a restorative economic loop, the goal of which is to extend the life cycle of products, components and materials. The circular economy is "restorative by intention and by design" [35].

FIGURE 3.3. The linear economy and the circular economy models



13. http://www.enicbcmed.eu/sites/default/files/Reference%20documents/jop_eni_cbc_med_2014-2020_adopted.pdf.

The focus on durable goods differentiates the holistic circular approach from many other environmental agendas (such as the recycling-based model). In the circular model, production and consumption should create "the smallest possible amount of loss and waste" [16]. It combines sustainability goals with economic wealth, job creation and social inclusion. The European Commission's Circular Economy Package for 2015–19 generated almost EUR 147 billion of turnover and employed 4 million people in circular economy related jobs [36]. It was followed by an organic action plan, unveiled in 2020 as part of the European Green Deal [37]. This new Circular Economy Action Plan (CEAP 2020) provides "a future-oriented agenda for achieving a cleaner and more competitive Europe in co-creation with economic actors, consumers, citizens and civil society organisations". It includes legislative and non-legislative measures that take the entire life cycle of products into account in order to keep resources circulating in the economy for as long as possible. It aims to achieve the sustainability of seven value chains: electronics and ICT; batteries and vehicles; packaging; plastics; textiles; construction and buildings; food, water and nutrients. Appropriate policies can create the ideal conditions for the development of circular business models, which do not always require technological disruption or large upfront investment, while delivering substantial societal benefits. At the same time, new skillsets are required that can leverage digitalisation opportunities, both in reorganising material flows and in supporting new behaviours by different actors.

The circular economy has a strong relationship with the SDGs, in particular with SDG 12 (responsible consumption and production), SDG 6 (clean water), SDG 7 (affordable and clean energy), SDG 8 (work and economic growth) and SDGs 11 (sustainable cities and communities). Its "design out waste" (DoW) approach includes innovation throughout the value chain, inspiring the transformative actions of existing businesses and the creation of new ones, supported by specific policies and incentives. The concepts of durability, repairability, reusability and upgradability are at the core of the circular economy. Implementation of these concepts leads to a significant reduction in the flow of goods and thus a reduction in industrial production and emissions. For example, the best way to reduce the use of cement and steel, which have very high embodied emissions, is to reuse materials from buildings that are demolished instead of sending them to landfills.

Another way to reduce the emissions embodied in goods is to shorten the chain connecting production and consumption locations. Globalisation caused many productive sites to move to areas where labour costs are lower, environmental regulations looser and/or the tax systems more benign. This trend increased the emissions produced by ships, trucks, vans and airplanes. Shortening the distance between production and consumption sites would reduce the CO_2 emissions produced by international transportation.

Application of a circular model at the local, national and regional levels in the EMME region is strongly endorsed. The high level of industrialisation of some countries, together with the high concentration of the population in urban sites, requires the introduction of circular and integrated supply chain models (industrial symbiosis) and zero waste targets in the cities (circular urban metabolism). It's worth to mention that data on the flows of raw materials and goods within and between countries, which would support the implementation of models aimed at the optimisation of the exchanges in terms of environmental impact, are lacking.

The crucial role of settlements

How can a deep transformation of the economic system be implemented? Where should policy makers begin?

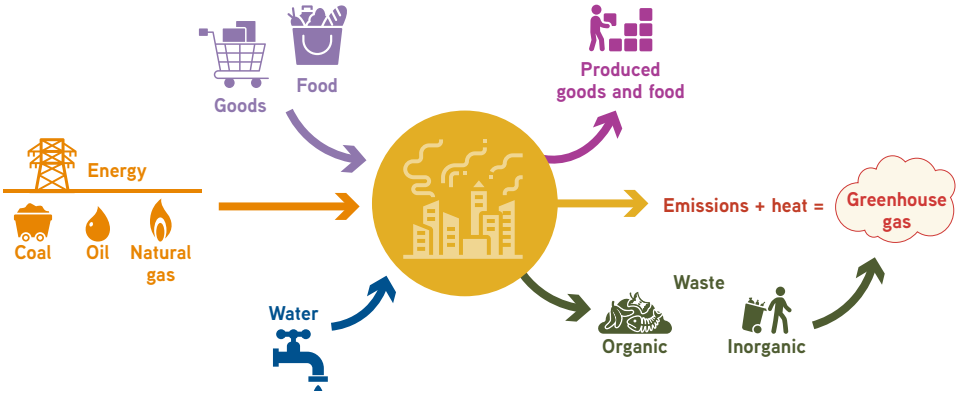
One place should be cities. "Cities are aggregators of materials and nutrients, accounting for 75% of natural resource consumption, 50% of global waste production, and 60-80% of greenhouse gas emissions" [38]. The urbanised share of the population, which stood at around 56% globally in 2020, is projected to reach 68% by 2050 [34].

Cities are the places where new and more efficient ways to use energy in buildings can be found, the places where new transport approaches can be developed and new ways of reducing industry emissions can be developed and implemented. Cities also strongly affect the food chain, as they are the places where two-thirds of the world's food is consumed [39], a figure that will reach 80% by mid-century. As settlements are the main source of global environmental disruption, it is reasonable to start by changing their economies [40]. If the model of consumption of natural resources of cities changed, it would pull with it the production model of rural areas, moving them towards environmental sustainability. Why do settlements cause such a disproportionate burden on the environment? The answer lies in the concept of "urban metabolism".

The notion of urban metabolism is loosely based on an analogy with the metabolism of organisms, although in other respects parallels can also be made between cities and ecosystems. Cities are similar to organisms in that they consume resources from their surroundings and excrete wastes. Thus, the notion that cities are like ecosystems is also appropriate. Indeed, the model of a natural ecosystem is in some respects the objective for developing sustainable cities. Natural ecosystems are generally energy self-sufficient, or are subsidised by sustainable inputs, and often conserve mass, through recycling by detritivores. Were cities to have such traits, they would be far more sustainable [41].

The metabolism of settlements is typically linear, moving from "take" to "make" to "dispose" (Figure 3.4). The growth of settlements triggers an expansion of inputs and, therefore,

FIGURE 3.4. The linear urban metabolism



waste, which cannot be disposed of without adversely affecting the environment. A new model of metabolism is needed to reduce both resource consumption and waste – a framework in which GHG emissions are minimised or even eliminated, food is supplied by a sustainable production system and food nutrients are returned to the soil. To include the full climate impact of cities, a consumption-based accounting framework should be used together with incentives for circular models.

This framework takes into account all GHG emissions associated with the flow of goods and services. From the consumption-based approach, the set of transformative actions, taxation and regulation policies, and new business models can be derived for minimising or eliminating a settlement's GHG emissions, starting from the evidence that there are two emission sources to consider, the produced ones and the ones embodied in the goods, services and food imported.[14]

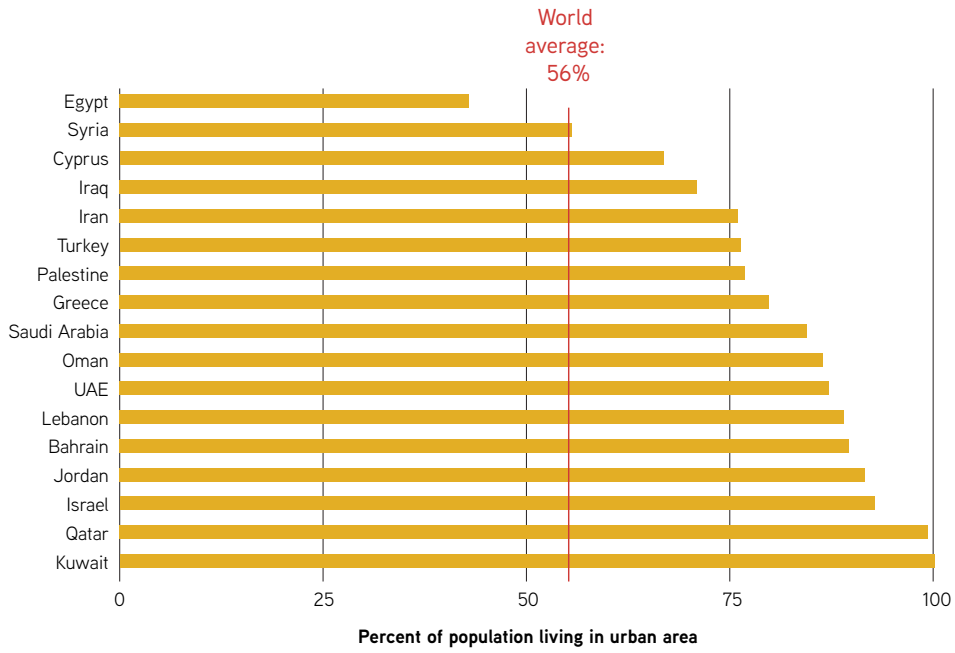
The role of urban metabolism is particularly important in the EMME region, because of its very high level of urbanisation. Every country in the region except Egypt and Syria is significantly more urbanised than the global average. Some countries, such as Kuwait and Qatar, are almost completely urban (Figure 3.5).

The food chain

The main challenges to tackle are climate change and biodiversity loss. As the main driver of biodiversity loss is agriculture, it is useful to analyse the role of the food chain and the best ways to restructure it in a sustainable way.

14. https://www.c40knowledgehub.org/s/article/The-Global-Protocol-for-Community-Scale-Greenhouse-Gas-Emission-Inventories-GPC.

FIGURE 3.5. Level of urbanisation of EMME economies, 2020

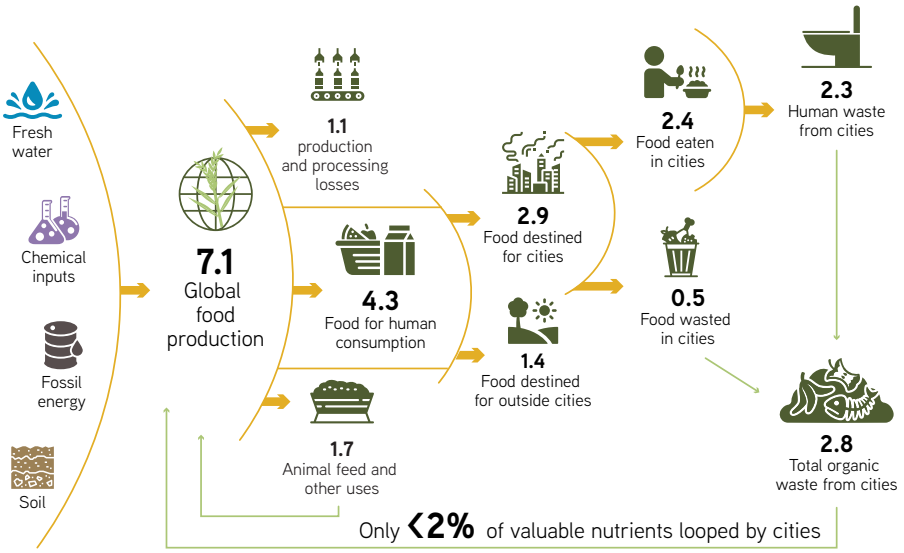


Source: Statista.

The largest contribution of food production to GHG emissions is livestock, which produce about 14.5% of global emissions, of which cattle produce 61% [42]. About a third of cropland is used to produce animal feed [43] (80% if pasture land is included [44]). Animal breeding also has indirect and direct effects on nitrogen and phosphorus flows to the biosphere and oceans, on freshwater consumption and the global hydrological cycle, and on chemical pollution. Reducing meat and dairy production is therefore critical to fighting climate change and biodiversity loss.

Life on earth depends on the cycle of nutrients, in which plants absorb nitrogen, phosphorus and potassium from the soil and are then eaten by animals (including humans) and excreted and returned to the soil, where the cycle restarts. Human activity has interrupted this natural loop, as almost none of the nutrients available in food is returned to the biosphere. Rural soils are progressively degraded and then artificially fertilised, a practice that generates an imbalance of nutrients. About half of the 1.3 billion tonnes of solid waste produced annually by settlements is organic and it should be returned to soil instead of being landfilled or burned. Urban wastewater is largely unrecovered, and less than 2% of the nutrients in food are recycled as shown in Figure 3.6 [39].

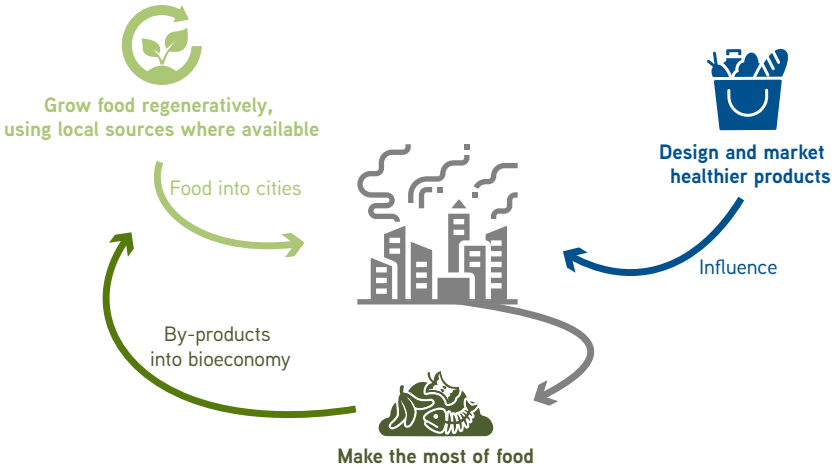
FIGURE 3.6. Flow of materials in the global food system



Source: [39].

In the circular economy framework, biological nutrients go through a series of cascading stages that yield valuable products. Food products are designed in ways that maximise locally available and seasonal ingredients, produced by traceable regenerative practices. Compost and fertilisers are derived from food waste and made available to peri-urban farmers (Figure 3.7).

FIGURE 3.7. Three ambitions for cities to build a circular economy for food



Source: [39].

Transformation of the food chain in the EMME region is particularly challenging, for two reasons. First, the gradual separation of urban and rural communities in agricultural countries has led to an increasingly industrialised model of food production that dramatically increases open cycles, overuse of packaging, distances between production and consumption, and adoption of globalised materials. Second, the very high level of urbanisation of GCC countries and their harsh climatic conditions prevent almost any conventional agriculture, making the food chain very fragile and heavily affecting its ecologic footprint.

Innovations are needed to close the loops and optimise exchanges along the value chain. Novel farming practices should be an integral part of the urban metabolism, water management and food production should be holistically connected, short-distance food trading should be incentivised by taking into account the environmental footprint in pricing and regional food chains should be consolidated by specific incentives and infrastructures. Circular models should be promoted by integrating waste-to-product practices into food chains and using food waste to fertilise the soil.

Finance

Development of a green economy requires the availability of aligned investment tools and the mobilisation of capital. Private financing has been playing a central role in renewable energy projects, which have attracted equity investors, such as pension funds, and used financial tools such as project bonds. Therefore, banks should be incentivized to make available complementary financing at different levels of the capital market for green initiatives. Increased co-operation among banks, utilities, development finance institutions and institutional investors should be pursued. The lack of capital markets in some countries, which is preventing private investment, especially in weak and emerging economies, should be addressed by policies that offset risks and improve attractiveness. Guarantees, credit enhancements, currency hedging, blended finance and other de-risking tools can help mitigate and distribute risk across actors. New venture capital finance is needed, with the long-term approach that is appropriate for green innovation. Bottlenecks could be removed by improving public-private co-operation and validating new business models. Green bonds can fund strategic infrastructural transitions, such as renewable energy networks, sustainable settlements, regeneration of ecosystems and capital stocks.

Development banks and development finance institutions play an important role by connecting private and public actors within sustainable development projects. Specific multilateral and bilateral development financial instruments have been designed for climate investment strategies. Multilateral development banks can leverage their public shareholders towards environment-aware projects, becoming the centres of transitional finance clusters.

The European Commission's High-Level Expert Group on Sustainable Finance [45] has created a list of recommendations that could be included as part of the foundational agenda of a green financial system in the EMME region, where pioneering experiences are already available [46]. Its recommendations include the following:

1. Introduce a common sustainable finance taxonomy to ensure market consistency and clarity. Establish clarity on what is "green" or "sustainable", in order to channel capital flows towards assets that contribute to sustainable development.
2. Clarify investor duties to extend time horizons and sharpen the focus on environmental, social and governance factors.
3. Make climate change risks and opportunities fully transparent within a framework of sustainability disclosure covering financial products, financial assets, financial institutions and financial authorities. Fully disclose and account for externalities and natural capital depletion and risks.
4. Empower and connect citizens with sustainable finance issues, improving access to information on sustainability performance, promoting financial literacy and easily accessible information on sustainable finance.
5. Establish a regional pipeline of sustainable assets, including natural capital projects, backed by green bonds.
6. Build sustainable finance competencies in corporations, aligning the culture of the financial sector with long-term perspectives, mitigating the influence of short-termism in value extraction strategies.
7. Support the growth of impact-oriented enterprises by providing incentives for ones that are having a positive impact but difficulty accessing finance or that face particularly difficult revenue challenges. Deploy a strategy for inclusive and sustainable banking, capitalising on the opportunities offered by new financial technologies.
8. Facilitate access to capital, and provide incentives for natural capital investments, in particular for projects that prioritise contributions to adaptation to and mitigation of climate change and sustainability and that de-risk investments, including green and blue infrastructure, nature-based solutions and nature restoration.
9. Reorient investments towards sustainable agricultural and fishing practices, by enhancing disclosures on sustainability indicators to investors and consumers, including externalities in food pricing and facilitating access to capital for sustainable operators.

Green finance mechanisms should be linked to the paradigm shift towards a nature-based economy, a new approach that values natural capital and incorporates it into the economic

system. The Nature-Based Economy Working Group of the European Commission's Task Force III on Nature-Based Solutions [17] has provoked discussions of cross-sectoral policies bridging climate change and biodiversity challenges with sustainable economic growth. The goal is to arrest the rapid depletion of natural capital stocks. The notion of the nature-based economy implies an economic model that "encompasses all production, exchange and consumption processes related to activities concerned with the protection, conservation, restoration and sustainable use of natural resources by consumers, industry and society at large." Its proposal is in line with the challenge outlined in the Dasgupta review of the *Economics of Biodiversity* [47] to focus on "increasing the efficiency with which the biosphere's supply of goods and services are converted into global output and returned to the biosphere as waste".

Innovation and entrepreneurship

In 2009, 34 countries – including 2 in the EMME region (Greece and Israel) – signed the Green Growth Declaration [48]. It encouraged for the first time the adoption of eco-innovation strategies as a source of new economic opportunities and markets arising from the need to improve the management of natural capital. Eco-innovation can shift economies towards a resource-aware techno-economic model while fostering the social objectives of inclusive employment and poverty reduction. Eco-innovation is a potential trigger of "leapfrog" shifts to more sustainable economic structures through the capitalisation of accumulated knowledge and technologies. It promotes specialised innovation, such as "the implementation of new, or significantly improved, products (goods and services), processes, marketing methods, organisational structures and institutional arrangements" [49] to reduce negative externalities and generate positive spill overs [50]. It stimulates structural changes in social and institutional structures [51]. Eco-innovation usually includes radical or disruptive innovations, in order to accelerate the paradigm shift, which cannot be achieved through the simple adoption of eco-efficiency and eco-design approaches in techno-economic systems. Countries should develop portfolios of sophisticated combinations of different types of innovation, together with new organisational and managerial arrangements, in order to achieve systemic transformative innovations [52, 53].

New scientific and technical principles should be deployed together with new organisational and business models, rendering traditional practices obsolete. Emerging technologies will play a crucial role in driving the transition towards the green economy paradigm. PricewaterhouseCoopers and the World Economic Forum (WEF) have mapped Fourth Industrial Revolution (4IR) technologies across the SDGs [54]. They found that leveraging technology towards decarbonisation and the restoration of biocapacity can be justified

from a historical perspective. According to scholar Carlotta Peres, game-changing innovations – like steamships, railways and computers, the cost of which fell as their influence on growth and society rose – are needed [55]. Eco-innovation entails changes in social and institutional structures, including value patterns, behavioural models, social structures and interactions. The environmental benefits of eco-innovation go well beyond the private sector, as the transition can produce society-wide improvements in social norms, cultural values and institutional structures [29].

Four interdependent and mutually reinforcing elements are critical to the emergence of new regimes [56]:

- enabling technology
- innovative business model
- careful market-adoption strategy
- favourable government policy, which amends regulations that inhibit the development of the new technology and business model.

Soft factors – such as cultural barriers and traditional practices, attitudes and ownership – are also critical.

Large-scale and complex eco-innovation arenas are emerging as industrial symbiosis networks and eco-cities and regions. The shift from linear to circular systems of production and consumption can trigger eco-innovative actors and practices, which will play a role in reorganising value chains and building new interdependent and mutually beneficial collaborative networks around innovation, which policy makers should address [57].

Innovative business models can involve both large, established firms and small start-ups, with the latter seeking to exploit technological or commercial opportunities not yet approached by incumbent actors. New companies tend to engage in more radical innovations than existing ones. The establishment of a favourable ecosystem could help scale up new business models built on the reduction of environmental impacts [58]. The emergence of new business actors and their related innovation should find the support of appropriate policies to overcome incumbent forces.

A new generation of companies is already providing new types of services in the fields of energy and material efficiency.[15] Sustainable business models, leveraging resource-sharing and eco-innovations are offering functionalities instead of products, with much smaller ecological footprints (i.e car sharing instead of car ownership, home-working platforms instead of office premises, etc.). Urban circularity and industrial symbiosis offer new pos-

15. See https://impact.dealroom.co/intro.

sibilities in resource efficiency and recovery (i.e. reuse of materials in deconstruction and reconstruction of buildings, urban mining and micro-manufacturing, integrated zero-waste industrial platforms, etc). National and local authorities can help sustain these projects by creating market conditions and sound frameworks that smooth short-term transition costs, introducing pricing instruments regulations and subsidies, and setting indicators to properly value and reward their positive impact.

Green innovation in SMEs should be targeted, as these firms can address inclusive and green growth, especially in the manufacturing sector, which accounts for a large share of global environmental impact. Green SMEs may play a leading role in incremental as well as disruptive innovations, as smaller and innovative firms are more likely to exploit opportunities that larger firms do not consider [59]. SMEs are also relevant in combining green and inclusive growth. Green and socially inclusive models effectively pursue a "triple bottom line", in which ecological and social values are embedded into a financially viable business model [ibid]. Green niches can develop into larger markets, in which eco-entrepreneurs reinvest the initial profits and gradually capture shares in previously monopolistic industries. If there is greening pressure along the supply chain, green practices will improve the competitiveness of SMEs [60]. As a matter of fact, SMEs are already experiencing greening-related cost reductions from several sources [61]:

- process efficiency
- improved product design
- use of waste
- recycling of raw materials
- infrastructure efficiency
- introduction of environmental management systems to reduce environmental impacts and increase operating efficiency
- reduced packaging and transport.

Promoting the implementation of green supply chain management (GSCM) in the EMME region [62] could induce firms to switch to sustainable supply chain models, creating space for eco-innovators and eco-entrepreneurs. GSCM can give firms a competitive advantage, allowing them to both generate value and reduce their environmental footprint.

Finance should be an integral part of green economy frameworks, providing support to technology transfer, start-up and scale-up processes. Some EU measures and national policies are already in place. They should be interconnected within a regional ecosystem to create a single EMME space for eco-innovation.

Green jobs

Model-based estimates show a limited effect of climate change policies on the employment rate. They also show a noticeable transformation in the sectoral composition of employment, which will shift from carbon-based to carbon-neutral activities. Good policies could support the transition in a way that increases employment potential in the new emerging sectors and activities while assisting workers affected by the paradigm change.

Skills bottlenecks could emerge as a serious impediment for green investments and growth. Organisation for Economic Co-operation and Development (OECD) modelling shows that the impact of GHG mitigation on GDP growth can be absorbed if the labour market is appropriately adapted [63]. In contrast, a rigid labour market could mean that decarbonisation has negative effects on the overall economy, prompting more and more resistance to change. Therefore, it is suggested that environmental policies be combined with measures that help workers take advantage of the new framework. For example, revenues from environmental taxes can be used to reduce taxes on labour income, as done in European Nordic countries, generating a "double dividend" in terms of both lower GHG emissions and higher employment. Notwithstanding the geopolitical uncertainty in certain parts of the Middle East, larger global trends have relevance for the region's long-term competitiveness. The development paradigm of the GCC economies is still strongly entangled with GHG–intensive industries. Even in EMME countries that are not fossil fuel producers (such as Turkey), tax revenues, financial markets, pension funds and jobs are connected at different levels to GHG–emitting activities. This dependency poses a barrier to adopting the green economy approach.

Employment is a thorny issue in most EMME countries [64]. The region has the world's highest rate of youth unemployment and the lowest engagement of women in the labour force, leaving vast human resources untapped. High-paying and formal jobs are limited in number, and most private employment has low value added. The region's labour markets are still substantially "inefficient, inequitable, and locked in a low-productivity equilibrium", according to a report by the World Economic Forum [65], with marked differences in terms of economies shares of high-, medium- and low-skilled jobs; reliance on foreign workers; and the prevalence of informal work.

Circular strategies to reduce waste and pollution would introduce new production methods and workplace habits. In the search for extended product life, industries would look for better performance of the embodied resources, improving their quality instead of expanding their quantity. Such a tendency would have implications for employment across the economy, in extractive industries, manufacturing, transportation and services, as the UNEP Green Jobs Report, issued by the Worldwatch Institute, notes [66].

Increased opportunities and incentives to maintain, repair, upgrade, recycle, reuse and remanufacture products generate job opportunities across the life cycle, including in stages that will be more labour intensive and far less energy intensive than in traditional value chains. In 2019, *Material Economics* (with support from the European Climate Foundation) published an in-depth study on steel, plastics, aluminium and cement in the European Union, as well as two supply chains (passenger cars and buildings). It found that a more circular economy could cut emissions from heavy industry by 56% by 2050, without the loss of any jobs [67]. Promoting the 3Rs – reuse, repair, recycle, especially repair and reuse – is the most effective way to reduce environmental impacts and create green jobs, remarkably for socially excluded and less-educated people.

The International Labour Organization describes green jobs as "work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contributes substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonise the economy; and minimise or altogether avoid the generation of all forms of waste and pollution" [68]. Jobs in organic agriculture, waste recycling and green buildings fall into the first category; cleaner production processes in industry and the reduction of water and electricity consumption in hotels generate green jobs of the second category. Decent work – defined as "productive work for women and men in conditions of freedom, equity, security and human dignity" [69] – should become a characteristic feature of green jobs, in order to leverage the quantitative and qualitative effects of the green transition on employment. These changes should be anticipated, understood and taken advantage of by job seekers and youth who are still studying or undergoing training. Promoting green jobs requires comprehensive employment policies and programmes that stimulate green investments and simultaneously enhance workers' skill levels and employability.

Several strategic issues need to be addressed:

- Which sectors have the greatest potential to create new jobs?
- How can governments and social partners boost green investments in sectors that benefit job seekers?
- What kinds of development strategies should be implemented to prepare young people for green jobs?
- How can green entrepreneurship programmes support the creation of a significant number of jobs?
- How will partnership programmes between the region's countries increase the impact of policies?

Doing so requires data on skills development measures and programmes for the green economy. They should be collected by:

- Identifying green job categories and classifying jobs in existing national/regional employment databases into them.
- Integrating quantitative and qualitative information from relevant sectors (existing data sets, opinions of stakeholders and experts, position papers of sector bodies, definitions of the national qualification frameworks).
- Identifying environmental goods and services and green national accounts to provide a comprehensive definition and overview of the green economy.

A shared standard system for identifying and developing green skills is therefore needed to create comparable sets of data across countries and a system for monitoring the creation of green jobs. A first step is to build a mechanism, such as a dedicated observatory, to project the jobs and skills required by the green economy and consider how their emergence affects local labour market dynamics. Green economy opportunities that are net positive at the international level could still cause job losses at the country level and particularly the local level. Each community is in the best position to monitor its own situation in a regional and global perspective.

A key factor in ensuring jobs is mobility: Workers should be able to move easily across sectors and countries, away from dwindling polluting industries in pursuit of green job opportunities. To support and harmonise this process at the national and regional levels, clear policies; identification and distribution of responsibilities; the engagement of representative organisations, such as trade unions or employer associations; and international agreements and frameworks, are needed.

Many countries are committed to forecasting green activities that could be pursued by traditional sectors. Table 3.1 describes these activities in Spain.

TABLE 3.1. Green activities of traditional sectors in Spain

Sector	Green activity
Agriculture	Biomass activities
Auxiliary automotive industry	Components for wind turbines
Chemical and electronic industries	Photovoltaics
Civil public works	Construction of thermoelectric generators
Electronic components and electricians	Components for wind turbines
Plumbing	Solar thermal energy
Shipyards	Offshore wind farms

Source: [70].

Other countries, such as Denmark, Germany and France, have enhanced their capacity to monitor the implementation of green activities with detailed data monitoring. Table 3.2 summarises these data to conduct a breakdown analysis.

An excellent example of a permanent mechanism for forecasting green job trends is the French National Observatory for Jobs and Occupations of the Green Economy (Onemev). Created in 2010 by the Ministry of Environment, it analyses employment shifts during the green transition. It could be a model for similar efforts in the EMME.

It's worth to mention that in Oman and the United Arab Emirates, the World Economic Forum is co-operating to leverage the Closing the Skills Gap Accelerators project, which is expected to contribute to the "reskilling revolution" challenge of upskilling and reskilling 1 billion people by 2030. The United Arab Emirates are pioneering this process through their Green Job Program, launched by the Ministry of Climate Change and Environment, which is expected to increase the number of green jobs from about 49,500 in 2018 to 83,000 in 2030 [72].

TABLE 3.2. Selected green activities in three European countries

Country (year)	Percentage of
Denmark (2015)	**Total green production [a]**
Renewable resources	49
Saving of energy and heat	14
Wastewater handling	10
Other waste handling	10
France (2015)	**Jobs in eco-activities [b]**
Environmental protection	58.7
Resource management	24.0
Cross-cutting activities (e.g. research and development, engineering)	17.3
Germany (2016)	**Environmental occupations [c]**
Water supply and waste management	27.5
Environmental technology and energy use	22.2
Renewable energies	17.9
Environmental administration and consulting	13.6
Conservation of nature and landscape	12.1
Biology, geology and meteorology	6.7

Source: [71]

a. In Denmark, green production accounts for areas in which the major activities of the green economy occur (Danmarks Statistik). The reported sectors do not sum to 100%.

b. In France, eco-activities refer to activities involved in the production of goods or services for the purpose of protecting the environment or the sustainable management of resources (Onemev).

c. In Germany, environmental occupations are occupations that contribute to environmental protection, resource conservation, the sustainable use of nature, recycling or similar purposes (Bundesagentur für Arbeit). Excluded are jobs such as marketing, trade or information technology, which are not substantially concerned with environmental regulation.

4. The policy landscape in the region's economies

Despite its tremendous potential, the green economy and eco-innovation lack a coherent design in the EMME region. Cross-border innovation policy frameworks and actions are missing, with the exception of collaboration projects promoted by international donors and funding programs. Green national policies have achieved a moderate level of maturity in the region, but efforts are still needed to improve national strategies and fuse into a regional model (Figure 4.1).

EU countries such as Greece and Cyprus are linked to the overarching European Green Deal policy; Israel adopted a green economy policy in 2014 (which was revamped during the COVID-19 crisis); and Jordan established the Jordan Environmental Fund, supported by the US Agency for International Development (USAID), and a Green Growth Strategy in 2020. The United Arab Emirates adopted its Green Growth Strategy in 2012; it adopted

FIGURE 4.1. Level of maturity of national green economy policy frameworks

Sources: Annual studies of the EU Eco-Innovation Observatory (https://ec.europa.eu/environment/ecoap/about-eco-innovation/policies-matters/new-eco-innovation-observatory-monitoring-member-states_en), the UN Economic and Social Commission for Western Asia [73] and the MAVA Foundation [74], expanded and updated by the Climate Change Initiative (CCI) Task Force.

Note: The four shades of green, from lighter to darker, represent: 1) debated, 2) established within a broader country strategy, 3) expanded by specific measures, 4) consolidated into a framework.

an implementation mechanism setting the Green Agenda 2030 in 2015. Other GCC countries have launched strategies that envisage transitional paths towards a diversified and greener economy and are backing explorative initiatives.

These efforts notwithstanding, strong incentives for fossil fuels and energy-intensive activities remain in place. Although Turkey and Egypt have explicitly adopted the UN SDGs as the reference framework for their respective country strategies, their growth model is still backed by investments in heavy infrastructure and the expansion of resource-depleting markets. Iran appears to lag the rest of the region, because international economic sanctions are affecting its overall economy. Syria and Iraq are facing enormous problems from war disruptions. Lebanon and Palestine have set ambitious and dynamic plans, but they face adverse geopolitical factors and multiple crises.

Direct EU funds, EU regional funds, ENI CBC MED and EuropeAid are playing prominent roles in the region. The European Union has direct partnerships with Egypt, Iraq, Israel, Jordan, Lebanon, Palestine, and Turkey and a joint collaboration agreement with Iran. ENI CBC MED, which focuses on the emerging green economy framework, is associated with Cyprus and Greece, as EU countries, as well as Egypt, Israel, Jordan, Lebanon and Palestine, which are recognized as Mediterranean Partner Countries (MPC). Egypt, Iran, Iraq, Jordan, Lebanon, Palestine, Syria and Turkey are middle-income eligible countries for research and innovation partnerships, under Horizon Europe[16]. The PRIMA Foundation[17], funded by Horizon Europe, associates Cyprus, Egypt, Greece, Israel, Jordan, Lebanon, and Turkey, together with other EU and partner countries, in a programme of research and innovation for Mediterranean agri-food system. Israel is fully associated to Horizon Europe, and a hub of the European Institute of Innovation and Technology (EIT) has been established in Israel, focusing, among other sectors, on green innovation. The European Green Deal policy framework will promote and support further cross-border collaboration in the EMME region. The European Union is also conducting dialogue with GCC countries on the transformation of the energy system, among other issues.[18] National co-operation agencies in the region (the British Council, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH [GIZ] and USAID), and UN agencies and programs (United Nations Industrial Development Organization - UNIDO, UNEP and UNDP) are orienting their action towards the just and green transition as well.

The EU–funded SwitchMed initiative is fostering sustainable consumption and production patterns in the Southern Mediterranean.[19] The initiative stimulates "the creation of new

16. https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/common/guidance/list-3rd-country-participation_horizon-euratom_en.pdf
17. https://prima-med.org/wp-content/uploads/2018/02/PRIMA-SRIA_Strategic-Research-and-Innovation-Agenda.pdf.
18. https://www.iai.it/sites/default/files/iairp_14.pdf.
19. https://switchmed.eu/.

greener business opportunities and decent employment while reducing the environmental footprint of consumption and production activities". It involves Egypt, Israel, Jordan, Lebanon and Palestine from the EMME area, together with Algeria, Morocco and Tunisia, providing direct support to the private sector, creates an enabling policy environment and facilitates sharing of practices among stakeholders. UNIDO, the UNEP/Mediterranean Action Plan, the Regional Activity Centre for Sustainable Consumption and Production, and the Union for the Mediterranean are co-operating with the European Union in its implementation. Sustainable Consumption and Production National Action Plans (SCP-NAPs) have been drafted under the first phase (2013–18) together with a variety of demonstration projects in Egypt, Israel, Jordan and Palestine. Under SwitchMed II (2019–23), further actions have been implemented and progress in sustainable consumption and production is being monitored.

The following sections provide country highlights that have been identified by national members of the Task Force as relevant to the work of consolidating regional policies and actions in support of the green economy and innovation. Those notes, put together from diverse materials, may not reflect the official stance of the countries and should be viewed as complementary to other sources.

Bahrain

The Kingdom of Bahrain has been engaged in systemic efforts towards achieving sustainable development,[20] as reflected in the principles of the country's constitution. They include provisions to ensure protection of the environment and address dimensions of sustainable development. An Environmental Impact Assessment policy has been established to address problems of pollution and degradation. More generally, the country's policies follow the precautionary principle, the "polluter-pays" principle, the sustainability concept and the concept of shared responsibility. To expand the co-operation of government offices with citizens and residents, Bahrain is promoting education and awareness on the concept of shared responsibility.

The Joint National Committee on Climate Change was established in 2007 to oversee climate issues in the country and ensure balance between and integration of climate change commitments and economic and social needs. Chaired by the Supreme Council for the Environment, it includes members from the National Oil and Gas Authority, the Ministry of Industry and Commerce, the Ministry of Electricity and Water, the Ministry of Transportation – Civil Aviation Affairs, the Ministry of Foreign Affairs and the Economic Development

20. https://www.bahrain.bh.

Board. "Economic Vision 2030" [21], launched in October 2008, provides guidelines for development of the kingdom's economy and targeting prosperity for every Bahraini around three guiding principles – sustainability, fairness and competitiveness - in the overarching vision of the achievement of the UN Sustainable Development Goals. Launched after four years of debate in the public and private sectors, it focuses on shaping the vision of the government, society and the economy. Following its launch, the Economic Development Board promoted a programme of economic and institutional reform and co-ordinated with the government to draft the first National Economic Strategy, an implementation roadmap for Economic Vision 2030.

The kingdom established a Green Climate Fund, under the Financial Mechanism of the UN Framework Convention on Climate Change, in order to support projects, programmes and policies in developing countries. The Supreme Council for Environment serves as the country's National Designated Authority for the Green Climate Fund.

Other initiatives are in place under the Ministry of Finance. They include the Green Policy Commission (which identifies areas for optimisation of energy and rational use of natural resources) and the Government Initiative Committee for the optimal use of natural wealth and resources (which includes representatives of relevant ministries and departments involved in implementation). The government is promoting the use of clean alternative energies, especially solar and wind, as well as the adoption of energy-saving practices. Improvements to the water system have been achieved through the implementation of systems that prevent water leakage in buildings, preserve aquatic resources and stimulate a wider use of treated wastewater in the agricultural sector. Information campaigns have been launched to promote water-saving awareness. Reforestation projects are progressing in various regions of the country to improve the urban interface with the expansion of green areas.

Protection of marine resources and the environment has given a boost to fish farming and to the establishment of artificial coral reefs. The strategic structural plan for Bahrain in 2030 includes the concept of integrated management of both the coastal and marine environments in urban planning. The Pearling Path project is as an integrated sustainable economy initiative in this domain located on a UNESCO World Heritage site, the marine natural reserve of AlHairat.[22] It preserves oyster habitats and the local pearl fishery economy.

The Recycle IT project was initiated to address the lack of appropriate channels for disposing of e-waste. It promotes the repair and refurbishment of obsolete information

21. https://www.evisa.gov.bh/Vision2030Englishlowresolution.pdf.
22. https://pearlingpath.bh/en/.

technology equipment, which is collected and donated to nongovernmental organisations (NGOs) and underprivileged families. Usable sections of non-functioning units are used as spare parts; residual components are recycled. After the launch of the project, which is paving the way towards the development of local e-waste recycling industries, Bahrain's rating in the e-Waste Recycling Technology assigned by the Centre for Environment and Development for the Arab Region and Europe (CEDARE) rose from 1 to 3, with a maximum of 5.[23]

Large Bahraini companies are actively pursuing environmental goals. BAPCO, the state-owned exporter of crude oil and refined products, has launched an environmental, health and safety policy. Its refinery gas desulphurisation project received first place in an environmental award scheme organised as part of the Offshore Arabia Conference and Exhibition 2011 in Dubai. Aluminium Bahrain, one of the largest and most advanced aluminium smelters in the world, has been awarded the International Millennium Business Award for Environmental Achievement by the United Nations. It promotes awareness campaigns on the environment, as well as projects and programmes for environmental improvement, including the creation of an internal green oasis with a garden, a vegetable farm and the largest artificial lake in the kingdom. The Gulf Petrochemical Industries Company – a GCC joint venture based in Bahrain using natural gas as a feedstock for the production of ammonia, urea and methanol – established its first CO_2 recovery plant in 2010. It also launched other environmental projects, such as the Princess Sabeeka Garden, a fish farm and bird sanctuary.

Bahrain is also investing in innovation in the building sector. The Bahrain World Trade Centre, a 50-story skyscraper located in Manama,[24] integrates three large-scale wind turbines of 1.2 MW each, which supply 15% of its electricity needs. The building received the 2006 LEAF Award for the Best Use of Technology within a Large Scheme and the Arab Construction World award for Sustainable Design.

Cyprus

Despite significant progress, Cyprus remains below the EU average in terms of resource-efficiency outcomes; it is slightly above the EU average in eco-innovation outputs.[25] Individual actors from academia and industry are making strides, but no eco-innovation sectors have yet developed. In 2018, eco-industry exports declined, falling to 0.02% of exports, down from 0.03% in 2016. Employment in the green sector increased, from 0.6% of the total

23. https://www.zawya.com/mena/en/business/story/Plan_to_set_up_recycling_unit_in_Bahrain_for_electronics_and_electrical_appliances-SNG_196529885/.
24. https://www.designbuild-network.com/projects/bahrain-world-trade-centre/.
25. https://ec.europa.eu/environment/ecoap/cyprus_en.

workforce in 2017 to 1.34% in 2018. Public investments have been directed towards the development of renewable energy (especially photovoltaic), as well as the improvement of resource efficiency in the building sector. New environmental regulations that seek to mitigate waste, air pollution, and water and energy shortages are sustaining the growth of the green economy and innovation in the country by boosting demand for greener products and services. Consumers' requests for organic and eco-labelled products are growing, and new green markets are offering opportunities to a variety of SMEs.

The Ministry of Energy, Commerce and Industry has embraced the concept of the circular economy; the government has approved regulatory proposals on municipal waste management by local authorities; and the Ministry of Agriculture, Rural Development and Environment has incorporated circular economy principles into its strategy for achieving energy and climate objectives. Because of its geopolitical position (the only EU country in the Middle East), small scale and socioeconomic characteristics (good research and educational system, dynamic private sector), Cyprus has been proposed as a regional hub for climate change research [75]. Its national Restart 2016–2020 Programme for the promotion of research, technological development and innovation is part of the Smart Specialisation Strategy drafted under the EU regional development policies, and it takes into account the need for green innovation [76]. The Business4Climate initiative – initiated by the Cyprus Employers & Industrialists Federation (OEB), in collaboration with the Cyprus University of Technology and the Department of Environment of Cyprus – has contributed to the establishment of a positive environment for the green transition by engaging non-Emissions Trading System businesses in GHG emissions reduction. The follow-up support scheme will aim to reduce GHG emissions from both commercial and industrial activities, targeting approaches that are proven to contribute to decarbonisation. Business executives surveyed by the OEB suggest modernising the vocational training system to address the growing demand for green professionals.[26]

The goal of the EU Recovery and Resilience Facility, from which Cyprus can draw down EUR 968 million of funds (a mix of grants and loans), is to ensure a sustainable recovery from the COVID-19 crisis, address the socioeconomic impacts of the pandemic and shield EU economies in the long term [77]. Cyprus's proposals are distributed across five priority areas: public health and civil protection, lessons derived from the pandemic, fast-tracking the transition to a green economy, enhancing competitiveness and economic resilience, and progress towards a digital era. It should establish a blueprint for sustainable development policies in Cyprus for the coming years, through a balanced combination of investments and reforms. The economic and social impact of the crisis will be mitigated and the

26. https://www.oeb.org.cy/en/drasis/business4climate/.

resilience and competitiveness of the economy sustained by the introduction of new green and digital capacity-building actions.

A study by the EIT Climate KIC in 2017 [78] identified Cyprus' potential to become an innovation and entrepreneurship regional hub for the validation and testing of clean technologies. Based on international experiences and best practices, it recommended advancing Cyprus's entrepreneurship ecosystem through a 15 to 20-year roadmap.

Egypt

A survey has recently examined the main barriers and challenges that prevent industrial firms from introducing process or product innovations [79]: 55% of firms identified the competition policy, which is not supportive of innovation, as the major barrier to innovation; 23% cited the lack of specific government support; and 18% cited the weakness of the intellectual property regime. The survey also highlighted a lack of technology transfer and knowledge management.

Various stakeholders have promoted technology transfer initiatives in Egypt, but a specific process was not institutionalised until 2008, through EU–funded projects [80, 81, 82]. In 2010 the Ministry of Communications and Information Technology launched the Technology Innovation and Entrepreneurship Centre, which is responsible for sustaining innovation and entrepreneurship in the ICT sector. It is now one of the major enablers of innovation in Egypt's ICT ecosystem. The Industrial Council for Technology and Innovation, under the Ministry of Foreign Trade and Industry, aggregates 13 technology transfer and innovation centres for industrial sectors such as textile development, engineering industries, and food and agricultural industries. In 2017, the Egyptian Centre for Innovation & Technology Development was established as the first private centre specialising in innovation policies, technology transfer systems and the promotion of technology development across key sectors and pre-identified priorities. The Academy of Science Research and Technology (ASRT) in 2013 launched an initiative to establish the Technology Innovation Commercialisation Office, to ensure the sustainability of the few existing offices and scale up projects. Thereafter, in 2016, ASRT established INTILAC, a network of incubators based on models developed by the NETKITE project [27], funded by the ENI CBC MED programme, which now consists of more than 20 nodes with diverse scope and locations.

At the regional level, Egypt has been witnessing progressive improvement in venture capital (VC) investment and numbers of deals. In 2018, Egypt received 22% of all deals in the Middle East and North Africa (MENA), an increase in value of 7% from 2017, the fastest

27. Cross-border network to foster Knowledge-intensive business: http://netkite.eu.

growth in the region. Egypt was also the fastest-growing country in the region in 2020, with a 31% increase in investment. In 2000, Egyptian start-ups and SMEs accounted for 17% of VC investment in MENA countries. In 2019 and 2020, Egypt ranked second to the United Arab Emirates among MENA countries, ahead of Saudi Arabia [83].

Egypt Vision 2030, adopted in 2015 [84], has set ambitious green economy and innovation goals based on the principles of inclusive sustainable development and balanced regional development. Egypt's National Strategy for Green Economy, adopted in 2016, paves the way towards an economic development model that addresses environmental conservation and ecological scarcity while pursuing the achievement of an equitable and resilient society.[28] Drafted in collaboration with UNEP and CEDARE, it contains actions for a gradual transition to a green economy, which are based on four strategic pillars: water, agriculture, waste and energy. They envisage the implementation of 28 projects across 13 governmental facilities. Some of these projects were implemented with the support of the Ministry of industry and UNEP.

In order to balance major plans for the development of infrastructure against significant environmental vulnerabilities, worsened by climate change, Egypt requires green finance capacity. In 2021, the government announced a plan to launch the country's first green bonds, which is seen as an important start in providing financial incentives for sustainable development.[29]

Greece

Greece ranks seven positions lower than the EU average for eco-innovation, lagging on eco-innovation inputs, resource efficiency and socioeconomic outputs. It performs at the EU average on eco-innovation activities and exceeds the EU average on eco-innovation outputs, however.

Moves towards green innovation are recent, with the government's first call for a public dialogue on circular business models and innovation taking place only in April 2019.[30] Innovation stakeholders and ecosystems in Greece are firmly integrated into clusters at the regional level. They have established partnership deals as part of larger European networks while striving to integrate with global networks.

The country lacks an integrated co-ordination of actions and resources towards cohesive policy targets [85]. According to a report published in 2016 [86], industry's adoption of

28. https://www.un-page.org/may-egypt-launches-national-strategy-green-economy-amcen.
29. https://www.reuters.com/article/egypt-bonds-int-idUSKBN26K1MJ.
30. https://ec.europa.eu/environment/ecoap/greece_en.

circular models had not yet borne results in Greece. Of eight sectors examined, five were in a transitional phase and had made progress in waste management, and three had yet to make progress.

Significant changes need to be made at the design stage. At the end of the 2014–20 EU programming period, several initiatives were launched to support environmental entrepreneurship.[31] Individuals were invited to establish environment-friendly companies, and established SMEs were encouraged to adopt low-impact tools and techniques. These programmes are mobilising the agri-food, construction and shipping sectors to adopt more eco-friendly solutions.

Iran

Iran's environmental policy is outlined in various legal documents, including Article 50 of the Iranian constitution. Reducing pollution and preserving the country's natural and cultural resources are important priorities in the country's development plans. Pollution from motor vehicles, factories, power plants and the residential sector are affecting the health of the population; the marine environment is affected by oil pollution, with about 1.2 million barrels (roughly 160 000 metric tonnes) of oil being spilled into the Persian Gulf area annually, from tanker transport accidents (49.5%), offshore production facilities (19.4%), urban run-off (14.8%), and almost 10% from natural sources (oil seeping out from natural deposits) [87]. The National Greenhouse Gases Inventory for 2017 (data of 2010) showed that 81% of total CO_2 emissions result from the energy sector (fuel combustion and "hot flaring").[32]

Energy efficiency in cities and decarbonisation of industrial systems are priorities for the country, together with mitigation of the environmental impacts of the oil and gas industry. Measures in line with a green economy strategy have been proposed, although many of them are still at the conceptual stage, with only a few elaborated and implemented. Among those, we can mention: (i) in the built environment, the improvement of energy efficiency of central heating systems and their switching to natural gas to decrease the level of liquid and heavy fuels consumption in household sector; (ii) in industry, the renewal of obsolete processing equipment and machinery, switching to natural gas, introducing efficient energy conversion technologies and Combined Heat and Power (CHP) and Waste Heat Recovery (WHR) technologies; (iii) in agriculture, a program to replace diesel engines with electric submersible pumps in agricultural wells; (iv) in the transport sector, a 10 years-plan to double passenger-kilometers per year to 34.2 billion in 2024 and expand freight

31. https://www.sustainablegreece2020.com/home.
32. https://unfccc.int/sites/default/files/resource/Third%20National%20communication%20IRAN.pdf

rail capacity from 21.7 ton-kilometer per year to 75.8 ton-kilometer per year in 2024, the renewal of city bus, taxi fleets and private vehicles, supporting the adoption of natural gas powered engines instead of diesel ones; (v) in power generation, the installation of 6 000 MW wind and 18 700 MW hydro power plants by 2025, on top of 2013 capacities that were 98 MW and 10266 MW, respectively; (vi) in oil&gas, the recovery of flared gases in offshore and onshore oil extraction facilities, reduction of flare gas in gas treatment facilities and methane leakage reduction in transport and distribution of natural gas, adoption of Carbon Capture and Storage.[33]

The Science, Technology and Innovation Policy review carried out by the United Nations Conference on Trade and Development (UNCTAD) in 2016 underlined the importance of strengthening policy co-ordination to counter institutional rigidity and facilitate implementation of key reforms [88]. Energy costs are as low as 30% of world market prices for some energy carriers, which leads to wasteful use of energy. Eliminating energy subsidies would be the best way to reduce energy consumption and emissions. The effects of phasing out subsidies have been estimated and sectoral measures been proposed to convert losses from the deterioration of the environment and subsidies to polluting activities into investments in green economy initiatives.

Along with support from the UNESCO Green Citizens Project, the government has envisaged a package of green policies and launched multiple training programmes to encourage industries to develop eco-friendly processes and products [89]. Piloting initiatives of industrial symbiosis in the mining and metal-processing sectors have been envisaged [90].

Iraq

Since the conclusion of the Second Gulf War, Iraq has been facing immense difficulties in its reconstruction process, slowing any attempt to introduce green economy principles. The Iraqi government tried with limited success to attract investors in the renewable energy field, through incentives such as tax breaks, favourable tariffs, land rights and support to apply for permits.

Iraq launched its Renewable Energy Offset Program in 2018 to promote investments in renewable energy projects for generation of power by oil-producing companies.[34,35,36] Even in this sector, however, stable developments have been impeded by the lack of coherent policy frameworks and the lack of national security and economic stability.

33. ibidem
34. https://www.eia.gov/international/overview/country/IRQ.
35. http://www.tradearabia.com/news/OGN_348629.html.
36. https://iraqenergy.org/2018/10/18/solar-energy-in-iraq-from-outset-to-offset/.

Problems in Iraq are many and wicked. The weakness of the financial sector makes it difficult to forge relationships with foreign investors. The electricity infrastructure is obsolete, losing more than 30% of its electricity in its distribution. Until it is fully renovated, clean energy generation will not be able to efficiently feed the grid and will remain a viable solution only for off-grid installations and remote villages. Appropriate training and capacity building are needed to enable the local workforce to install, operate and maintain renewable energy infrastructure.

Green economy strategies leveraging Iraq's strong solar energy potential have been suggested for the development of the Kurdistan region, enjoyed remarkable economic growth until mid-2014 but has since been facing an economic crisis. The growing gap between demand and supply is a serious problem for this area [91].

Israel

Israel has a well-developed innovation ecosystem (ranked 6th on the Bloomberg Innovation Index [92] and 13th on the Global Innovation Index [24]). It is the world leader in gross domestic spending on R&D (4.9% of GDP) [93] and the number of start-ups per capita [94]. The business sector in Israel is the main source of R&D expenditure (at 85%); the government and higher education institutions contribute only 12%, much less than many other OECD countries.

In 2011, a year after Israel joined the OECD, the Israeli government passed a resolution to promote green growth in the country. Following the resolution, the Ministry of Environmental Protection and the Ministry of Economy and Industry identified six leverage points for green growth in Israel:

- A green licensing law: Integrated licensing with a longer planning horizon, providing more certainty to businesses.
- Green growth and green production centres: Serving industrial plants and businesses subject to environmental licensing.
- Sustainable consumption: Policy tools to influence purchasing decisions and use patterns.
- Green procurement: Incentives for sustainable consumption that would give the government a leading role, serving as an example by integrating green public procurement in its agencies.
- Green track to innovation: Removal of obstacles to the establishment of beta sites by creating enabling regulations for these facilities, developing an accreditation

system for locally appropriate techniques and providing economic incentives for their implementation.

- Green employment: Incorporation of new knowledge in both academic and professional training systems on the basis of projected demand in the labour market.

The Israel Innovation Authority (IIA) – an independent, objective public agency responsible for Israel's innovation policy – is paying attention to green innovation and to collaboration with EU countries under the European Green Deal. It promotes industrial innovation, with an emphasis on the high-tech sector, including manufacturing. The Authority's roles are to initiate state-funded R&D and to award funding to entrepreneurs and industrialists.[37] The IIA is a hub for private, public and international entities in the innovation ecosystem, which promotes technological infrastructure and R&D through various private consortiums and programmes of knowledge transfer. It also fosters an attractive, competitive and advanced financing environment by removing regulatory and financial obstacles to growth. The IIA develops human capital by facilitating coding bootcamps; high-tech specialisation programmes; advanced technology studies workshops; and early-stage companies of the ultra-Orthodox, minorities and women. Its programmes include multiple channels for green initiatives in the fields of climate change, waste and pollution reduction, alternative fuels, and agri-tech initiatives.

SME and entrepreneurship policies in Israel are designed primarily by the Ministry of Economy and Industry and implemented by the IIA (which focuses on leading technology-based start-ups) and the Small and Medium Business Agency. While enjoying a well-developed innovation ecosystem and skilled workforce, Israel suffers a low rate of basic technological adoption, persistent security concerns, burdensome regulation, low commitment to sustainability and low market efficiency due to lack of domestic competition and barriers to entry [95].

Disparities across sectors reduce the overall productivity of the Israeli economy. Productivity levels in high-tech sectors, scientific R&D, and computer and electronics manufacturing are higher than the OECD average. But productivity in traditional sectors – such as wholesale trade, construction, transportation, accommodation and food – are lower than the OECD average and could benefit from the green transition.

To promote green growth, Israel has launched several initiatives. They include the Israeli Green Building Council (a forum dedicated to promoting green buildings through the Green Building Standard and certification process, together with the Standards Institution of Israel)[38] and the Indicators for Well-being, Sustainability and Resilience (a complement

37. https://innovationisrael.org.il/en/sites/default/files/Israel%20Innovation%20Authority%202020.pdf.
38. https://ilgbc.org/about/about-ilgbc/.

to the system of national accounting this set of indicators promotes the consideration of health, jobs, education and sustainability in policy making).[39]

Jordan

Key innovation and entrepreneurship ecosystem stakeholders in Jordan have recently mapped, with over 80 entities, categorised into five categories: investment and finance, R&D, innovation hubs, governance and support projects.[40] Key players include iPark (with start-up incubators in Amman, Aqaba and Irbid and an intellectual property commercialisation office); CEWAS Middle East (which incubates start-ups focused on water, sanitation and waste solutions in Jordan and the region); and Hassad (an agri-tech incubator), among many others. Jordan's Ministry of Digital Economy and Entrepreneurship leads relevant national efforts, such as the National Incubation Programme, the Access to Market Plan, Enhancing the Legislative Framework for Social Entrepreneurial Companies and the Facilitating Entrepreneurial and Start-Up Businesses initiative.[41]

Jordan's Nationally Determined Contributions (NDCs), submitted under the Paris Agreement, commit it to mitigating climate change through decarbonisation actions in the energy, transport, waste management, industry, water, and agriculture and food security sectors. Jordan aims to reduce GHG emissions by 14% reduction by 2030, 1.5% through its own means and an additional 12.5% conditional upon international assistance. Jordan's NDCs also include strategic adaptation measures, such as measures for combatting desertification, improving biodiversity and ecosystem services, reducing poverty, and funding education and skills programmes to expand the opportunities and productivity of the workforce. Sectors for targeted adaptation projects include water, health, agriculture and urban development [97].

The Government of Jordan's Priorities Plan for 2020–21 was designed to enhance resource security in key sectors, including energy, water and agriculture, among others. In the wake of socioeconomic shocks from COVID-19, the Government has also promoted increased self-reliance through investment in national resources, encouraging sustainable practices and increasing the share of natural gas and renewable energy in the energy mix in order to improve its stability and prevent shocks [98].

The Ministry of Energy and Mineral Resources issued the Jordan Energy Strategy for 2020–30 with a focus on increased dependence on national resources. It includes a more ambitious target for renewable energy's share of the energy mix, which should reach 14%

39. https://www.cbs.gov.il/en/mediarelease/Pages/2016/Israeli-Indicators-Of-Well-Being-Sustainability-And-Resilience-2013-2014.aspx.
40. https://tti-jo.org/2020/07/02/tti-publishes-the-first-version-of-the-innovation-ecosystem-map-of-jordan/July 2020.
41. https://modee.gov.jo/EN/Pages/Entrepreneurship.

by 2030, a 31% increase in the contribution of renewable energy to electricity production by 2030, improved energy efficiency with a 9% increase between 2018 and 2030. It also supports wider adoption of electric mobility, which helps with Jordan's decarbonisation targets, as transport is the second-highest GHG–emitting sector in Jordan [99].

In line with Jordan's efforts to achieve Agenda 2030 and the SDGs, the Ministry of Environment (MoEnv) developed the Sustainable Consumption and Production National Action Plan (2016–2025)[42] to mainstream sustainability in the agriculture and food production, transport and waste management sectors. The action plan proposed developing the policy and legal framework for each sector, as well as specific actions that promote innovation in the low-carbon/zero-emission transition in these three priority sectors [100].

In 2017, the MoEnv issued a National Green Growth Plan, which was approved by the Council of Ministers and cited by the League of Arab States as a best practice example to be replicated in the region [101]. The plan "charts out a plan for Jordan to achieve an expanding yet sustainable and resilient economy that ensures the creation of green jobs for its citizens and increased investment in green projects". To achieve this strategic vision, the MoEnv worked with national stakeholders to develop the Green Growth National Action Plan 2021–2025[43], identifying key policy and project interventions in the water, waste, energy, agriculture, tourism and transport sectors. This plan is the follow-up of the collaboration with the Global Green Growth Institute, which highlights the "significant potential to benefit from a green growth policy and implementation framework, due to the fact that its growth is highly vulnerable to external influences (energy, food and commodity prices) and to environmental constraints such as water scarcity". Green growth is presented as an opportunity for the country to address environmental challenges while pursuing social and economic development. The Green Growth National Action Plan includes capacity-building actions designed for public sector employees and public awareness-raising activities. It aims to create a stable and attractive framework for investments by the private and the public sectors. It includes detailed plans and business cases for investment in PPP projects, helping drive policies and plans, including the Third National Communication to the UN Framework Convention on Climate Change, Jordan's Water Strategy (Water for Life 2008–2022), the National Agenda, the Executive Development Plan, the Renewable Energy and Energy Efficiency Law No. 18 (April 2012), the UNEP Green Economy Scoping Paper and the National Climate Change Policy of the Hashemite Kingdom of Jordan 2013–2020.

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42. https://www.greengrowthknowledge.org/research/national-strategy-and-action-plan-sustainable-consumption-and-production-jordan-2016-2025.
43. https://gggi.org/launch-of-the-green-growth-national-action-plan-2021-2025/.

Kuwait

Oil products are the primary source of revenue for Kuwait, making up about 95% of the total value of its exports. The abundance of hydrocarbons has discouraged the diversification of investments and meant that little policy attention has been paid to the long-term impacts of environmental degradation, including health problems, the decline of water resources and loss of farmable land, and the increased vulnerability of coastal and marine resources [102]. Kuwait, together with Russia, Saudi Arabia and the United States, is among the few countries to have declined to endorse the landmark report on global warming at the Katowice Climate Change Conference in 2018.

Since then, Kuwait has begun to establish governmental bodies and implement policies towards a sustainable development model. As global warming may render much of the Gulf uninhabitable by 2090 [44], Kuwait has strong motivations to finance renewable energy and climate change mitigation actions. Vision 2035 "New Kuwait" states the goal to become a regional financial and trade hub through the implementation of a coherent and balanced social, economic and environmental policies [103].

Environmental policy in Kuwait rests on investments in the renewable energy industry and improvements in the use of oil reserves. Kuwait annually produces about 4 million barrels of oil and is home to about 8% of the world's oil reserves. It consumes 450 000 barrels a day (900 000 by 2030). The country plans to lower this number by increasing renewable energy's share to 15% of its electricity mix by 2030.[45, 46]

The Shagaya Renewable Energy Park is a PPP that represents a pilot of Kuwait's energy strategy. Its partners are the Kuwait Institute for Scientific Research, the Kuwait National Petroleum Company, the Kuwait Authority for Partnership Projects and the Kuwaiti Ministry of Electricity and Water, which share their expertise in renewable energy. In addition to solar power, Kuwait is also investigating the potential for wind power. It has invited Spanish companies Elecnor and Siemens Gamesa Renewable Energy to build and oversee wind farms. The Kuwait Fund for Arab Economic Development financed a project to exploit hydropower in Pakistan by building a dam as part of a strategy to support the Arab and Muslim worlds in accessing renewable energy and sustainable development.

Kuwait's subsidies to water have promoted the extensive use of water in agriculture and manufacturing, depleting the country's aquifers. An appropriate price policy, combined with the adoption of sustainable technologies for water desalination, purification and

44. http://www.naharnet.com/stories/193409-persian-gulf-may-be-too-hot-for-human-survival-by-2090-here-s-what-this-means-for-your-city/.
45. https://www.kw.undp.org/content/kuwait/en/home/operations/projects/environment_and_energy/kuwait-environmental-governance-initiative--kegi-.html.
46. https://oxfordbusinessgroup.com/analysis/winds-change-new-solar-and-wind-capacity-will-move-country-closer-its-2030-renewable-generation.

management, could support the artificial recharging of groundwater resources, with long-term positive impacts for the country and economy. The Kuwait Institute for Scientific Research is conducting research in aquaculture and oceanography to identify species of significant economic value, study and monitor their stocks and develop alternative aqua-farming techniques. Allowing fish stocks to recover would revive the traditional fishing industry in Kuwait, which could contribute to the development of sustainable tourism, by proving the producibility of local and sustainable food.

Lebanon

Lebanon economy is driven primarily by SMEs, which are responsible for 95% of the private sector's contribution to GDP and account for 50% of the workforce.[47] Several factors prevent micro, small and medium enterprises (MSMEs) from scaling up. Most of these enterprises are family run, lack professional managerial skills and have limited access to finance. Despite these disadvantages, some companies show a capacity for innovation, especially the agri-food processing and tourism sectors are dynamic and reach international markets.

Until the COVID-19 crisis, the support ecosystem for entrepreneurs was growing rapidly. It included innovative mechanisms, fiscal incentives, financing options - including risk capital-, and incubation and acceleration programmes. The framework deteriorated during the pandemic, when many activities, facilities and support mechanisms were put on hold or closed.

Lebanon has one of the lowest tax rates in the world. The Investment Development Authority offers tax breaks for up to 10 years, together with other incentives, to both national and international businesses in the ICT industry, provided specific conditions are met.[48]

Green innovation is now the target of high-level policies and pilot initiatives that deal with environmental issues related to climate change, population growth and urbanisation. UNDP and the International Labour Organization paved the way in 2011, by developing a joint analysis about the potential to generate jobs from the green transition in Lebanon, and concluding that "there is considerable potential for green jobs in the energy, construction, agriculture/forestry and waste management sectors fostering economic growth, social development and wellbeing due to improved environmental health".[49] Thereafter, to promote and achieve sustainable public procurement, in 2012 Lebanon developed an action plan under the direction of the Institut des Finances Basil Fuleihan, with the support of the

47. http://www.economy.gov.lb/media/11222/smes-in-lebanon-180412-19-website.pdf.
48. https://investinlebanon.gov.lb/.
49. https://www.greengrowthknowledge.org/sites/default/files/downloads/resource/Green_Jobs_Assessment_in_Lebanon_ILO.pdf.

UNDP and UNEP.[50] In 2015, it issued the Sustainable Consumption and Production Action Plan for the Industrial Sector in Lebanon[51] under the SwitchMed initiative, as a national response to SDG 12 (responsible consumption and production). It identified three operational objectives: 1) to adopt best available techniques to promote sustainable consumption and production (SCP) in the industrial sector, 2) to introduce SCP approaches in industrial sector in policy and institutional frameworks and 3) to educate and raise awareness of consumers about SCP in the industrial sector.

Lebanon represents one of the most active VC markets in the Arab world: eleven VC firms founded in 2018 the Lebanese Venture Capital and Private Equity Association (LVCPEA), representing funds under management in excess of $360 million. [52] Foundation Diane and IM Capital result among the most active VCs in the green economy field, and support green entrepreneurs together with a good number of incubators and accelerators that provide assistance to businesses across the country; among them, Flat6Labs, Speed Lebanon, Berytech and the Tripoli Entrepreneurship Club are among the most specialised. [53] Venture philanthropy represents another relevant dimension of the national ecosystem. Together with banks and other financial institutions – such as the European Bank for Reconstruction and Development, Bank Audi and Kafalat – they are offering dedicated funding and loans to the green sector. Several angel investments and microfinance programmes are oriented to enhance green industry.[54]

Berytech, the leading actor in the national innovation ecosystem, is pursuing an open innovation model to boost local capacity in sustainable development.[55] In an effort to generate a first wave of Lebanese eco-innovators, it is operating two pioneering programs, one focused on agri-tech (Agrytech[56]) and the other on cleantech (Cleanergy[57]).

Oman

Oman has worked to build capacity in innovation along with constructive linkages between complementary actors and competencies [104, 105]. EJAAD, established with the support of The Research Council (TRC) and Petroleum Development Oman, connects industrial expertise and academic research to meet industry needs, enabling increased technology transfers, innovation and the development of new industries. It serves as a platform for companies to post inquiries, with academics and researchers submitting requests to work.

50. https://www.greengrowthknowledge.org/sites/default/files/downloads/policy-database/national_action_plan_lebanon.pdf.
51. https://www.greengrowthknowledge.org/research/sustainable-consumption-and-production-action-plan-industrial-sector-lebanon-2015.
52. https://www.wamda.com/2018/01/lebanese-venture-capital-private-equity-association-launched
53. https://berytech.org/gimed-project-maps-25-potential-investors-in-lebanon/
54. ibidem
55. https://berytech.org/berytech-engagement-to-the-un-sustainable-development-goals/.
56. https://berytech.org/programs/agrytech/.
57. https://berytech.org/programs/cleanergy/.

The organisation aspires to strengthen technical and industrially driven research through links to international academic institutions. More than 60 industrial challenges have been presented through EJAAD, and some 20 joint research projects have been implemented. The associated network comprises some 60 affiliated members.

Oman has been investing in enhanced oil recovery, making the country one of the leading experimental laboratories for technical progress and field tests in this area [106]. The costs of exploration keep increasing, however, together with the environmental challenges. Oil production results in ever-increasing volumes of wastewater, salt and chemical pollutants. Meanwhile, Oman's groundwater reserves are dwindling rapidly as well as becoming polluted, and rising ocean water is penetrating coastal areas, causing damage to agriculture and vegetation. Desalinised sea water is the dominant source of drinking water. Heavy public subsidies of water and energy have severely impeded and delayed investment in increased efficiency and renewal. Deteriorating public finances and declining oil production mean that these subsidies are now unviable. Fuel subsidies have been reduced in recent years, energy subsidies are cut for large users, and water subsidies are also on their way out.[58]

In anticipation of these changes, renewable energy and investment in enhanced efficiency have seen upticks and are expected to grow in importance. Manufacturing has grown in recent years, but the sector is the second smallest in the GCC and has the lowest productivity.

The circular economy is severely undeveloped. Waste management is poorly implemented, with total reliance on landfills, prospects for sustainably expanding domestic production are compromised by land and water scarcity. Agriculture is highly inefficient and responsible for 80% of Oman's water consumption, and increasing threats from salinisation on the coastal plains has strangled many farms, leading them to close.

Experimental initiatives in support of sustainable agriculture include plantations featuring water-saving technologies, decentralised desalination systems and innovations in land use [107]. Specific examples include hydroponic and greenhouse farming powered by solar power, traditional crops adapted to local climate, seawater greenhouses that turn seawater into fresh water for crops, rainwater harvesting to recharge aquifers, investments in biosalinity research, pink light–emitting diode technology to grow food using less water and land, and desert aquaculture. Native species have been underused. A revitalisation of niche products with potential high added-value is under way. Demand for eco-food is underdeveloped, however.

58. https://www.omanobserver.om/article/6326/Front%20Stories/oman-to-gradually-phase-out-water-electricity-subsidies

Opportunities are at hand for new initiatives, connecting sustainable practices with social change, such as bridging farms and schools. Studies have been conducted on industrial symbiosis in Omani industries, and some examples of environmentally friendly entrepreneurial projects – such as the eco-house competition launched by TRC and Al Mouj Muscat, Oman's lifestyle and leisure destination – aim to boost competitiveness by stimulating innovation and reducing damage to the environment.[59] The Community Innovation Assistance Program,[60] aims to fuse support of culture with science and technology. It is directed towards museums, scientific clubs and women's associations, among others, and showcases inventions, establishes cross-border links and breeds new innovators and entrepreneurs.

Entrepreneurship and private sector development have become high priorities for public policy,[61] but rigidities, including stifling government bureaucracy, present many hurdles. The private sector employs a very small share of the Omani work force [108]. Teachers' training and attitudes, along with the absence of professional training and practical skills, reduce the effectiveness of the educational systems in covering the needs of the job market. Academic degrees are in high demand, but the attitude towards skills is ambivalent, with cultural factors (such as the importance of personal connections) playing a role in the hiring processes.

Oman has a young population that is fully literate and technology savvy. Skills development and education are promoted at all life stages, but there is a mismatch between skills and the job market. Many youths still look for public sector jobs, and unemployment among them is very high. The OCCI Innovation Award, organised by TRC, with the support of the Oman Chamber of Commerce and Industry, aims to motivate Omani youth to innovate in science and technology as a basis for new products and useful services.

After the long-term reign of Sultan Qaboos bin Said Al Said, in January 2019 Haitham bin Tariq Al Said became the sultan of Oman. Since then, the government has been preparing for extensive policy reforms. The agenda has progressed under the umbrella of Vision 2040,[62] which involves all major stakeholders. The need for reshaping the roles of and relations between the government, the private sector and civil society is embedded in the work as a prerequisite for diversifying the economy and achieving sustainability. Attaining a share of 30% energy consumption from renewable sources by 2030 is among the agenda's concrete objectives.

59. https://ecohouse.trc.gov.om/ecohouse/
60. https://www.trc.gov.om/trcweb/topics/innovation/programs/71.
61. https://timesofoman.com/article/1826198/business/al-mouj-muscat-proves-eco-friendly-strategies-can-be-good-for-both-environment-and-business.
62. https://www.2040.om/Oman2040-En.pdf.

Palestine

There is a general consensus that sustainable development in Palestine should be linked to a viable institutional framework enabling development planning and the rule of law. Amid recent political and economic crises (increasing unemployment, a humanitarian crisis in Gaza, the growing financing gap in the Palestinian Authority, declining living standards), the Palestinian Authority has struggled to remove barriers for the private sector to grow and support a sounder business environment. According to the World Bank "the Israeli constraints on movement, access and trade continue to be the main impediment to economic growth in the Palestinian territories" [109]. The occupied Palestinian territory is forced into asymmetrical economic ties with Israel by a one-sided customs union in which Israeli products get free access to Palestine while Palestinian goods are subject to a wide range of restrictions in Israel. The result is a major structural deformation of the Palestinian economy, which is characterised by resource and labour market imbalances, an unhealthy dependence on external income, sectoral disarticulation and underdeveloped infrastructure [ibid].

There is substantial evidence of environmental degradation in Palestine. Surface and underground water resources are affected by the discharge of untreated wastewater, the percolation of solid waste and leakages from unregulated industries. The population has soared, both in expanded urban areas and in new Israeli settlements, forcing changes in land use and driving an unsustainable impact on the natural ecosystem. These tendency, which climate change will exacerbate, should be challenged by the development of green innovation and entrepreneurship activities.

The Palestinian Authority identified three main sectors – agri-food, tourism and construction – as priorities in shifting to a more circular and sustainable economic model. Climate change adaptation and mitigation measures are included in Palestine's NDCs and National Adaptation Plans.[63, 64]

As agriculture is the sector most sensitive to climate change, specific interventions are required in the management of water for irrigation and smart adaptation to climate change. The introduction of new technologies in water harvesting, grazing and rotation management, as well as the enhanced use of agroforestry, are envisaged in the adopted plans. The Palestinian National Voluntary Review on the Implementation of the 2030 Agenda offers a repository of the main SCP challenges: unsustainable water usage, soil degradation and desertification, energy infrastructure degradation, unsustainable farming practices, and lack of waste treatment and disposal infrastructure [110].

63. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/State%20of%20Palestine%20First/State%20of%20Palestine%20First%20NDC.pdf
64. https://unfccc.int/files/national_reports/non-annex_i_parties/application/pdf/national_adaptation_plan__state_of_palestine.pdf

Several factors have slowed environmental progress. The innovation ecosystem in Palestine suffers from critical weaknesses, especially in terms of public policy leadership, and is not yet open to the international innovation and research environment. Public support for scientific research is still very limited and substantially fragmented. It has very limited impact in terms of industrial and economic development. This limitation might also be an effect of economic depression, political instability, and the traditional focus of donors on low-knowledge-intensive projects. Another problem is that entrepreneurship is still considered a high-risk activity in Palestine. According to reports by the Global Entrepreneurship Monitor, it has one of the lowest early-stage entrepreneurial activity rates in the region.[65] Palestine, despite possessing a larger pool of better-educated entrepreneurs compared with other countries in the region, also suffers from a huge gender gap in the private sector.

Finally, the fact that most of the common goods needed for the green economy, including most of Palestinian agricultural and grazing land, are located in Area "C"[66], which is not within the Palestinian Authority's control, and general restrictions that limit movement and the use of modern technologies, are major impediments to sustainable development. Resolving environmental governance challenges requires enhanced co-operation between the Palestinian and Israeli authorities.

Due to these limitations, just few green entrepreneurs in Palestine have turned environmental challenges into business opportunities. They may count on external aid provided through specific projects or larger social economy support programmes. A sustainable growth path driven by the private sector would require a reduction of structural constraints and the identification of leverage strategies enabling the green business ecosystem, including financial players and investors.

Qatar

The latest strategic planning document of Qatar, the Qatar National Vision 2030,[67] establishes a balanced approach to sustainable development that includes community development, economic development and environmental sustainability. This vision, presented at the UN Summit in September 2019, commits the emirate to address climate change through its sovereign wealth fund. Under the Vision 2030, green investment will be encouraged within a low-carbon economic growth, in line with the achievement of the climate objec-

65. https://www.gemconsortium.org/economy-profiles/palestine.
66. Area C was committed in 1995 under Oslo II agreement to be "gradually transferred to Palestinian jurisdiction", but such transfer never happened. See https://www.un.org/unispal/west-bank-area-c-ocha-map/.
67. https://www.gco.gov.qa/en/about-qatar/national-vision2030/.

tives of the Paris Agreement. The government is also committed to implementing green buildings standards in governmental buildings and promoting the adoption of such standards by the private sector. Stadiums built for the 2022 World Cup have been highlighted as global icons of sustainable building; the organisers are touting the championship as the first "carbon-neutral" one. Stadiums will use solar power and energy- and water-saving cooling and lighting technology.

The Gulf Organisation for Research & Development (GORD) is a focal point of this process.[68] Its Global Sustainability Academy delivers annual capacity-building programmes, which serve professionals and practitioners in both the public and private sectors through sustainability-related activities. GORD is working with the Supreme Committee for Delivery & Legacy, UNESCO and Doha Bank on standards to limit GHG emissions, investments in decarbonisation projects and the introduction of carbon credits through the voluntary carbon offsetting platform Global Carbon Trust.

UNESCO and GORD are working to increase awareness about climate change, reduce unsustainable consumption practices and enhance the role of educational institutions. Doha Bank has partnered with GORD to address sustainability and carbon neutrality, and they awarded project that are leading sustainability within the MENA region, including the Hamad Port and Qatar Rail.

The International Chamber of Commerce Qatar (ICC Qatar) launched the ICC Green Economy Roadmap and the ICC Qatar Energy and Environment Commission as part of the development and implementation of specific policies for the green economy. Launched during Rio+20, the ICC Green Economy Roadmap outlines 10 conditions and related policy recommendations that form a participatory framework. They include social, environmental and economic innovation; collaboration across all sectors; integrated governance; the balancing of short- and long-term strategies; and multilateralism.

The Qatar Green Building Council (QGBC)[69] was launched in 2009 by the Qatar Foundation for Education, Science and Community Development, to promote a sustainable building industry for Qatar. It connects academics, innovators, researchers, activists and the public in efforts to implement the Qatar National Vision 2030 in the sector. Through QGBC, Qatar has joined a network of 80 countries in which national green building councils are active under the umbrella of the World Green Building Council.

68. https://www.gord.qa/.
69. https://qatargbc.org/.

Saudi Arabia

Saudi Arabia's Strategic Vision 2030 (SV2030) envisages a large number of initiatives.[70] Many of them could feature in a co-ordinated transformation strategy for Saudi industrial sectors. In a general perspective, Saudi Arabia is likely to remain an oil and gas country until global changes occur or it depletes its resources. It is nevertheless moving toward a more knowledge-based model of growth [111].

Saudi Arabia practices some of the lowest carbon-intensive oil extraction in the world. An even wider implementation of carbon capture, utilisation and storage (CCUS) strategies would recycle carbon by-products into useful chemicals, building elements, paper and other "durable carbon" products. Industrial symbiosis – in which CO_2 is removed from industrial waste streams and converted into petrochemical feedstock – offers opportunities to reduce the country's ecological footprint while maintaining its level of industrial competitiveness. Other strategies to move towards the circular economy include Emissions to Value, natural sinks, bio-energy production, methane reforming from CO_2 and direct air capture of CO_2. The leading national company, SABIC, has already started operating one of the world's largest carbon capture and purification plants in the industrial city of Jubail. It converts up to 500 000 tonnes of CO_2 a year for use in fertilisers, carbonated drinks and methanol. Other downstream industries could benefit from the availability of low-carbon raw materials emerging from the transition to circular carbon models, especially in higher-value specialty chemicals and materials.

The need of a skilled workforce for implementing a green and knowledge-based economy poses a challenge to the educational system, and especially re-skilling should be a priority. In line with the SV2030, citizens are envisaged to share in the benefits of the green transition, instead of being affected in terms of personal wealth and benefits. Relevant measures include compensation cash payments for the loss of fuel subsidies, improvements to urban infrastructure and incentives for high-efficiency air-conditioning units.

The Ministry of Economy and Planning (MEP) carried out the Kingdom's First Voluntary National Review on the Progress of SDGs. The ministry has linked the SDGs to the G20's 15 Sustainable Development Sectors Action Plan, which is regularly updated at the G20 summits. Saudi Arabia has also actively contributed to the United Nations' High-Level Policy Forum on Sustainable Development. It published the Second Voluntary National Report on the SDGs during the Kingdom's presidency of the G20 in 2020.

The country's Intended Nationally Determined Contribution (INDC) describes its strategic approach to energy efficiency, renewable energy, CCUS, utilisation of gas and flare

70. https://www.vision2030.gov.sa/.

minimisation. A number of initiatives address the need for adaptation to higher temperatures. They include efforts touching on urban planning, water and wastewater management, integrated coastal zone management and reduced desertification. The INDC sets a target of 130 000 million fewer tonnes of CO_2 emissions a year by 2030, which would be supported by economic diversification and the introduction of lower-carbon alternatives to oil and gas.

As part of SV2030, the National Industrial Development and Logistics Program (NIDLP) targets the use of digital technologies that can improve trade and local content in industry, mining, energy and logistics. It is introducing policies and regulations promoting financial enablement and special economic zones and identifying needs for infrastructure, industrial land, and research and innovation. The programme provided energy refund payments amid the progressive reduction of fuel subsidies, preventing popular backlash. The reform process is far from complete, however, with energy prices still lower than in most other countries.

Energy efficiency represents another element of the transformation; it can increase public acceptance of higher energy prices. A number of initiatives have been launched to promote the adoption of high-efficiency air-conditioning units and smart home applications. SV2030 is promoting a green growth model through the implementation of large-scale urban megaprojects that include two USD 500 billion megacities (Neom on the Red Sea and Al-Qiddiya Entertainment City outside Riyadh); new business and industrial cities, such as the USD 100 billion King Abdullah Economic City; USD 21.9 billion in housing developments for the Dahiyat Al Fursan New City and the Avenues in Riyadh; the USD 22.5 billion Riyadh Metro and bus network; the USD 7.8 billion King Abdullah Financial District; Jeddah Tower (the world's first 1-kilometre tall building); and the Green Riyadh Project, which will increase the amount of green space in the city. Such urban infrastructure projects should mitigate the trend of urban sprawl, which has increased the carbon footprint of cities, and promote energy efficiency, renewable energy and net-zero carbon emissions through transit-oriented development, district-level cooling and zoning policies, reflective and green roofs, cooling corridors and temperature-reducing ecological and biophysical elements.

The government of Saudi Arabia is also considering plans for the installation of a solar photovoltaic and wind power field with a capacity of 60 gigawatts by 2030,[71] which has the potential to create 100 000 new jobs, although - as in the construction sector - most of these workers are likely to be non-Saudis. More in general, the development of the green economy offers a good opportunity to increase the participation of women in the labour force, and specific policies encouraging Saudi women to pursue university degrees in

71. https://english.aawsat.com//home/article/1545441/saudi-arabia-plans-generate-60gw-renewable-energy-2030.

science, technology, engineering and mathematics (STEM) could facilitate their entry into this new and fast-growing field.

In April 2021, Crown Prince Mohammed bin Salman announced the Green Saudi Initiative[72] and the Green Middle East Initiative,[73] which aim to reduce carbon emissions by 60% in the region and plant 50 billion trees across the Arab world, in the world's largest afforestation project, doubling the size of the so called Great Green Wall[74] in the Sahel region. A regional event gathering the international partners of the Middle East Green Initiative was set to launch in the second quarter of 2022.

Syria

Since 1967, Syria's geopolitical constraints have hampered its access to the technologies, financial support and strategic alliances needed for development projects and schemes, including the Clean Development Mechanism.

Regulated and environmentally sustainable development has been a focal point of Syria's five-year plans since 2006. In 2012, Syria created a Higher Council of Environment Protection to increase the role of the Ministry of State for Environment Affairs in a multisectoral approach to environmental issues, including green investments and green economy. The ministry hosts the National Centre for Cleaner Production, the Fund for Supporting and Protecting the Environment, and the National Observatory for Environmental Information.

The new constitution, approved in 2012, introduces the concept of "comprehensive, balanced and sustainable development" (Art.13.2) and "the protection of environment" as a "responsibility of the State and society" and "a duty of every citizen" (Article 27).[75] The new environmental law, approved the same year, gave more mandates and responsibilities to the Ministry of State for Environment Affairs and introduced environmental policies and incentives, such as cancelling some taxes and reducing by 50% custom taxes on eco-friendly materials and technologies. The Law of Regional Planning, approved in 2010, stated the preparation of regional plans to support sustainable development. Thereafter, the Local Administration Law, approved in 2011, shifted local authorities to fully empowered administrations with wider powers in promoting integrated and sustainable development. Other relevant laws and regulations include the Water Law (2005); the Decree to Protect, Manage and Exploit Forestry (2007); the Law Protecting the Marine Environment (2006); the Energy Conservation Law (2009); and the Decree of Organic Agricul-

72. https://www.saudigreeninitiative.org/.
73. https://www.saudigreeninitiative.org/about-middle-east-green-initiative/.
74. https://www.greatgreenwall.org/about-great-green-wall.
75. National report of the Syrian Arab Republic to the UN Conference on Sustainable Development (Rio+20), June 2012.

ture in Syria (2012). The Ministry of State for Environment Affairs and the Syrian Arab Organization for Standardization and Metrology have issued a number of specifications, guidelines and principles to support the economy and society though the environmental transition. Environmental impact assessments touch on waste management, water and air quality, and energy efficiency in the built environment.

In 2012, civil war erupted between governmental and rebel forces in Damascus and Aleppo. Large parts of the territory were out of government control until 2018. The costs of the war have been estimated at USD 400 billion,[76] which corresponds to a recession of 30 years. The systemic disruption also generated about 6 million internal displacements and 6 million international migrants. The challenge for the country is to now choose a green economy paradigm in the reconstruction process, which will include the built environment, all infrastructure and the industrial system.

Turkey

Turkey has made some progress in implementing a green economy, and sustainable development has been included in country planning, especially in the development of its energy system [112]. Its approach is raising some concerns about conflicts in the use of land and natural resources, however, because of the impact of energy infrastructure (especially hydroelectric) on agriculture, biodiversity and cultural heritage [113].

Polices are still required to unlock the large potential in developing environmental goods and service markets. In the face of growing challenges such as water scarcity and quality, air pollution, coastal erosion and temperature extremes, more attention must be devoted to the need for frameworks for green innovation. Meeting the SDGs would improve environmental performance and country resilience. The 10th National Development Plan (NDP) 2014–18 cites sustainable development as a principle [114, 115]. It places importance on sustainable urbanisation through increased efficiency and underlines the importance of environmental issues, identifying water, climate change and ecological preservation among its priorities. Fostering innovation through transformation of the competitive manufacturing industry, as well as by promoting R&D and environmentally conscious growth, are also among the goals of the plan. The SDGs remain central to the 11th NDP.

The Renewable Energy Resources Support Mechanism (YEKDEM), is a feed-in-tariff mechanism that encourages investment in the renewable energy sector if the generation of power does not contribute to the depletion of natural resources [116]. Despite the mechanism, large and energy-intensive industries are still driving GDP growth, with still heavily

76. https://archive.siasat.com/news/cost-syria-war-destruction-388bn-1390948/.

subsidised fossil fuels dominating the country energy mix. The industrial development has been based upon transportation on roads, which required massive infrastructural investments, i.e. about 25% of the giant investment plan targeting the centenary of the Turkish Republic in 2023, which amounts to USD 325 billion in a decade [117]. Efforts to reduce the impact of infrastructure prompted the launch of a green certificate programme for airports in 2009, which was extended to ports in 2014 under the Green Port / Eco Port Project.[77]

Revenues from environmentally related taxes decreased from 4.0% to 2.0% of GDP between 2005 and 2018, although they still remained higher than the average OECD value of about 1.6%. Two-thirds of these tax revenues comes from energy products, leaving many possibilities for improving the Emissions Trading System scheme. At the same time, fossil fuel subsidies were raised nine times between 2008 and 2016, through the expansion of tax exemptions for industries and coal aid to poor families. In 2010, the Renewable Energy Law introduced a feed-in-scheme that set a target renewable energy share of 23% by 2023. Additional bonus payments have been introduced for hardware components manufactured in Turkey, to support domestic industries and unlock domestic investments [118]. The gas distribution has improved, reaching all provinces in 2018, and solar and geothermal energy use has been promoted in households and greenhouses, with more than 120 000 installations in 2019. A scheme for the adoption of ISO 50001 energy management standard has been promoted within a UNDP/UNIDO scheme, in order to reduce energy intensity by 10% in three years and the relative subsidised costs.

A rural development action plan, approved in 2016, included "environmental improvement and continuity of natural resources" as one of five strategies. As agriculture is strongly subsidised (with subsidies costing more than 2% of GDP), there is plenty of room to promote eco-innovation in this sector [119].

Public expenditure on the environment fell in real terms between 2006 and 2015, with a dramatic drop in expenditure on biodiversity and landscape preservation. At the same time, EU funds on climate-related actions have become largely available with EUR 1.1 billion allotted in the 2014-20 planning period for EU Pre-Accession Assistance, prioritizing water, waste and environmental management [120]. Few private investments have been made in the green economy outside the water and energy sectors. PPPs, which have been promoted in many sectors (almost half of transport, energy and hospital projects include a PPP) could strongly support the deployment of a green economy strategy, especially in urban areas.

Also, the financial sector is active: in 2014, the Banks' Association of Turkey issued voluntary sustainability guidelines, and further regulations have been issued by the government;

77. https://en.tse.org.tr/IcerikDetay?ID=848.

in May 2016, the Industrial Development Bank of Turkey issued the first-ever Turkish Green Sustainable Bond, worth USD 3 000 million. The World Bank has supported Turkey with funds for sustainable cities projects and loans for leveraging local banks' schemes for greening SMEs.[78] The Clean Technology Fund has provided USD 300 million through multilateral development banks.

Relevant public policies are promoting green R&D and innovation. Vision 2023 [121], put forth by the government in 2003, aims to elevate Turkey's economy to one of the top 10 world economies and to boost R&D spending to 3% of GDP, increase business R&D spending to 2% of GDP and increase the number of full-time equivalent (FTE) researchers to 300 000, of which 180 000 would be employed in the private sector. Although Vision 2023 identifies the environmental goals of "protecting the environment, advocating for clean technologies, managing all types of domestic and industrial wastes within the scope of environmental protection principles and protecting biological diversity", R&D investments to date have been essentially driven by space and defence. The Council of Higher Education provides PhD scholarships for research on renewable energy, energy storage, sustainable and smart cities, and sustainable agriculture. The International Accelerator Support Programme of the Small and Medium Enterprises Development Organisation of Turkey (KOSGEB) provides grants for technology transfer offices within universities.[79]

These efforts notwithstanding, the transformative potential of eco-innovative activities has not yet been tapped, and relevant educational attainment remains modest.

Turkey has supported business incubation schemes and provided funding for innovation by companies and their clusters in the last decade. In 2017 it approved a new intellectual property management law that greatly improved and modernised the framework [122]. Although eco-innovation indicators remain low, new schemes, such as public procurement policies, are promoting energy-efficient products. The EU Ecolabel regulation was introduced in 2018 to promote the expansion of environmentally conscious businesses. KOSGEB has been supporting SMEs in eco-innovative activities through several governmental funding programmes. The Scientific and Technological Research Council of Turkey (TÜBİTAK) has been providing grants for both SMEs and early-stage start-ups to encourage them to work on eco-innovation, as well as value-added technologies. Its multistage funding programmes are concerned with capacity building, R&D and commercialisation. Capacity-building programmes to support university technology transfer offices have similar initiatives to create and innovate in an environmentally sensitive technology ecosystem.

78. https://www.worldbank.org/en/news/press-release/2016/12/20/turkeys-cities-to-become-socially-environmentally-and-financially-sustainable-with-world-bank-support.
79. https://en.kosgeb.gov.tr/.

In 2018, TÜBİTAK and the Global Environment Facility introduced a new fund targeting green SMEs and start-ups. Although the fund is still small (USD 3 million), it represents a clear signal of the growing interest in eco-innovation.

The Sustainable Development Working Group within the influential Turkish Industry and Business Association (TÜSİAD) supports the implementation of environmental policies as well as the development of regulations that spur economic growth while sustaining natural resources. An important goal is to transform the automotive sector, the fifth-largest auto sector in Europe. A consortium is working to launch an electric car. The sectoral strategy is broadly addressing the transition to electric, hybrid, hydrogen and natural gas vehicles.[80]

The Ministry of Energy and Natural Resources, has been updating regulations on renewable energy and energy efficiency. It provides subsidies and incentives for promoting investment in renewable energy facilities. It promotes renewable energy investments and capacity building of innovation centres for wind and solar power technologies.

Turkey hosts 2 of the top 12 flat thermal solar panel manufacturers (Solimpeks and Eraslanlar), and it has the second-largest solar thermal market in the world, after China. Exports of eco-products have been growing, although performance is still lower than the OECD average.

Many factors should sustain the development of a green economy in Turkey. New stricter legislation about pollution, water quality and waste management will help promote the domestic market. The relevance of environmental issues for trading with the European Union (Turkey's main international partner) and China will drive export-oriented industrial sectors towards the transition. Corporate social responsibility policies, adopted by financial actors, such as Borsa Istanbul,[81] may induce the private sector to meet requirements and adopt new business models.

United Arab Emirates

Vision 2021[82] seeks to make the United Arab Emirates one of the most prosperous countries in the world. To fulfil this vision, it specifies a work programme based on six priorities: 1) a cohesive society and preserved identity; 2) a safe public and fair judiciary; 3) a competitive knowledge economy; 4) a first-rate education system; 5) world-class health care; and 6) a sustainable environment and infrastructure. The country has adopted a national green growth framework – the Green Agenda 2015–2030[83] – that defines prior-

80. TÜSİAD, Communication on Progress 2009/The Global Impact. URL tusiad.org/tr/yayinlar/raporlar/item/.../3512_437fbe6c049755ff8f88bae0d91d4c7a.
81. Borsa Istanbul (2017), BIST Sustainability Index website, www.borsaistanbul.com/en/indices/bist-stock-indeces/bist-sustainability-index.
82. https://www.vision2021.ae/en.
83. https://www.climate-laws.org/geographies/united-arab-emirates/policies/uae-green-agenda-2015-2030.

ity actions under green innovation and diversification, management of natural resources, green infrastructure, green jobs, clean energy, water resources management, waste management and sustainable transport.

In 2018, the United Arab Emirates ranked 38th out of 126 economies on the Global Innovation Index [24]. Innovation is a significant component and enabler of the country's policy priorities and programmes. The National Innovation Strategy,[84] launched in 2014 and updated in 2018, focuses on creating an enabling environment for innovation, building innovation champions and stimulating innovation in key sectors, including renewable energy, water, health and transportation. Initiatives include the Mohammed bin Rashid Centre for Government Innovation, launched in 2014; the Dubai Future Accelerators, launched in 2016 to enable accelerated deployment of cutting-edge technologies and solutions[85,86]; and Ghadan 21, a three-year initiative with a budget of USD 13.6 billion to "enhance the competitiveness of Abu Dhabi in driving economic development, innovation, and ease of doing business" [123]. The National Climate Change Plan and the National Energy Strategy adopted in 2017 have strengthened the country's commitment to climate action and sustainable energy by setting a target of increasing the share of clean energy to 50% of installed power capacity, reducing energy demand by 40% by 2050, and spurring innovation in technology, business models and regulation with regard to sustainable energy, particularly solar, and nuclear power plants.

In 2020, the Abu Dhabi National Oil Company (ADNOC) announced a target to decrease its GHG emissions intensity by 25% by 2030. ADNOC and Emirates Steel are implementing a CCUS project. Across energy-intensive industry sectors, efforts are being made to reduce energy use and emissions. Emirates Global Aluminium achieved a distinguished environmental record in 2019. Its carbon intensity (associated with smelting) was 38% lower than the global industry average, and its perfluorocarbon emissions were more than 91% below the global industry average.[87]

UAE entities are also taking a lead on hydrogen. In 2021, the Mubadala Investment Company, ADNOC and ADQ established the Abu Dhabi Hydrogen Alliance, which seeks to establish Abu Dhabi as a leader in the growing green and blue hydrogen sector and to build a green hydrogen economy in the United Arab Emirates. The Dubai Electricity and Water Authority (DEWA), Expo 2020 Dubai and Siemens are engaged in a joint project that will be the MENA region's first solar-based hydrogen electrolysis facility.

84. https://www.uaeinnovates.gov.ae/.
85. 'Dubai Future Accelerators,' Dubai Future Foundation, https://www.dubaifuture.ae/initiatives/future-design-and-acceleration/dubai-future-accelerators/.
86. The United Arab Emirates Government Portal, 'Innovation', https://u.ae/en/about-the-uae/the-uae-government/government-of-future/innovation-in-the-uae.
87. Emirates Global Aluminium, 'Our Economic Impact in the United Arab Emirates', https://www.ega.ae/en/impact/our-impact.

In transport, policies are being put in place to advance the adoption of electric and hybrid vehicles. DP World, the leading port operator in UAE, is a key investor in Virgin Hyperloop, a global new venture that is developing and testing technology to move pods at high speed through tubes in near-vacuum conditions, using electromagnetic propulsion and levitation.[88] In the aviation sector, the Sustainable Bioenergy Research Consortium (SBRC), a not-for-profit initiative established in Abu Dhabi in 2011, aims to advance sustainable practices, with a focus on clean fuel supply.[89] It includes universities, private companies and public entities. One of its flagship projects is the Seawater Energy and Agriculture System, which leverages aquaculture, halo-agriculture (a technique employing halophyte plants to absorb salt and produce food) and mangrove silviculture to produce sustainable biofuels and seafood.

In January 2021, the United Arab Emirates adopted the United Arab Emirates Circular Economy Policy 2021–31,[90] which targets the adoption of circular economy principles in four areas: green infrastructure, sustainable transportation, sustainable manufacturing, and sustainable food production and consumption. The country also established the United Arab Emirates Circular Economy Council, which will oversee implementation of the strategy.

The Circle Coalition – a partnership between government, private companies and civil society, established in 2019 – is working to develop a circular economy model to address plastic and packaging waste pollution. It has been involved in piloting a closed-loop recycling model for plastic bottles, cartons and other packaging in Abu Dhabi.[91] The United Arab Emirates is also a signatory to the Scale 360 initiative of the World Economic Forum, a partnership to promote the circular economy model through innovation-focused challenges.

Across the United Arab Emirates, a number of initiatives and projects have been implemented in agricultural technology and innovation. In 2019, Abu Dhabi passed a funding and tax incentive package of AED 1 billion for agri-tech companies to develop innovative solutions to traditional farming challenges, such as algae-based biofuels, indoor farming technology, precision agriculture and agri-robotics.[92] In 2018, Crop One Holdings, leading US based manufacturer of vertical farming systems, announced a USD 40 million joint venture agreement with Emirates Flight Catering, to build the world's largest vertical farming facility in Dubai. The facility plans to cover 130 000 square feet and produce 3 tonnes of leafy

88. Gulf News, 'United Arab Emirates Hyperloop gets a massive funding boost', https://gulfnews.com/uae/transport/uae-hyperloop-gets-a-massive-funding-boost-1.72821318.
89. Khalifa University, 'SBRC Project', https://www.ku.ac.ae/sbrc-project.
90. https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/federal-governments-strategies-and-plans/uae-circular-economy-policy.
91. Emirates News Agency, 'MOCCAE, Coalition Circle pledge to transform plastic recycling model in Abu Dhabi', http://wam.ae/en/details/1395302757294.
92. 'Welcome to Abu Dhabi's Global Tech Ecosystem,' Hub71, https://www.hub71.com/.

greens daily. CropOne Holding was awarded the Best Innovation in Indoor Farming Award at the 2019 Global Forum for Innovations in Agriculture conference in Abu Dhabi.[93]

The Ministry of Climate Change and Environment collaborated with food tech company Winnow to reduce food waste in the hospitality sector. The company created tool that facilitates the tracking of food waste by leveraging artificial intelligence to adjust purchase lists and menus, leading to financial and environmental savings.[94]

The United Arab Emirates is implementing measures across industrial sectors to accelerate the development of green products and services. The government's Green Business Toolkit provides businesses and entrepreneurs with entry-level guidelines on environmentally friendly operations, including sustainable office management and procurement. The United Arab Emirates has also launched a standards and labelling programme for appliances, including washing machines and dryers, household refrigerators, storage water heaters, air conditioners and lighting appliances. As part of the country's Green Agenda's Environmental Goods and Services Program, the United Arab Emirates is aiming to further develop eco-labels for products and services. In 2019, it introduced a Sustainable Agriculture Label, tagging food items that comply with standards of sustainable production and water efficiency.

Programmes have been launched to encourage and facilitate innovation and entrepreneurship. The United Arab Emirates' Climate Innovations Exchange (CLIX) is an ongoing initiative that aims to channel funds for climate change solutions and technologies.[95] The initiative, which is hosted by the Ministry of Climate Change and Environment, holds an annual sustainability and climate change start-up event.

In 2019, Dubai SME, an agency of the Department of Economic Development (DED) of Dubai, announced the launch of the business incubator Bedayat, in co-operation with The Sustainable City in Dubai. It will provide a range of services and training and networking opportunities to support entrepreneurship and innovation.[96]

Various public and private initiatives are promoting community engagement and awareness-raising on topics of relevance to sustainability, green growth and the climate. In 2018, the government launched the Emirates Youth Climate Strategy to build youth capacity on climate and environmental topics and promote youth participation in action to address environmental issues. Entities such as Masdar, the UAE global leader in renewable energy

93. CropOne, 'CropOne wins best innovation in indoor farming award for JV with Emirates Flight Catering', https://cropone.ag/news/2019/4/29/crop-one-wins-best-innovation-in-indoor-farming-award-for-jv-with-emirates-flight-catering.
94. 'Ministry of Climate Change and Environment collaborates with Winnow to accelerate fight against food waste,' United Arab Emirates Ministry of Climate Change and Environment, https://www.moccae.gov.ae/en/media-center/news/2/9/2019.
95. https://www.worldfutureenergysummit.com/en-gb/clix.html.
96. https://www.thesustainablecity.ae/2019/12/21/dubai-sme-announces-launch-of-bedayat-business-incubator-in-the-sustainable-city/.

and sustainable urban development, and DEWA have also launched programmes to engage youth in issues related to the climate and sustainable energy and mentor them to become environmental champions and leaders. Events and youth circles with a focus on sustainability, climate and conservation are conducted regularly. The Zayed Sustainability Prize, awarded annually during Abu Dhabi Sustainability Week, focuses on rewarding achievements in health, food, energy and water. It also recognises students' and teachers' efforts across the globe in pursuing impact-driven sustainability initiatives.

Sustainable finance is a critical part of the green economy ecosystem. The Dubai Green Fund is one of the pillars of the Dubai Clean Energy Strategy 2050, launched in 2015. The fund, also launched by DEWA, has about AED 100 billion (about EUR 40 billion). It mobilises public and private capital for green investments and facilitates easy, low-interest loans to clean energy businesses. In October 2017, DEWA and the National Bonds Corporation signed an agreement launching the fund with an initial AED 2.4 billion; they also set up a dedicated arm for Sharia-compliant investments.[97, 98, 99]

In 2020, a new Green Bond Accelerator initiative was announced in Abu Dhabi. The initiative – a joint effort by Abu Dhabi's Department of Energy, the Abu Dhabi Global Market and the Abu Dhabi Securities Exchange – aims to establish Abu Dhabi as a regional hub for the issuance of green bonds and Sharia-compliant *sukuks*.[100] With UAE companies issuing green bonds in the last few years, the sustainable finance domain in the country is showing increasing dynamism. Local banks have also been issuing green loans.

In 2019, the Ministry of Climate Change and Environment, conservatively estimated the number of green jobs in the country at about 49 500 (roughly 0.7% of the workforce).[101] These jobs are in the public sector, waste management and recycling, and tourism and transport. As sustainable products and services expand, the number of green jobs is projected to reach 86 000 in 2030.

97. https://www.dgf.ae/about-us.
98. https://thesustainabilist.ae/green-funding-for-reshaping-the-energy-sector/.
99. https://www.thenationalnews.com/business/dewa-invites-proposals-to-develop-dh100-billion-clean-energy-fund-1.217358.
100. https://wam.ae/en/details/1395302816528.
101. https://www.moccae.gov.ae/assets/download/a5663f73/United Arab Emirates%20Green%20Jobs%20Programs_Brochure.pdf.

5. Proposed policy and research initiatives

The EMME region's geopolitical uniqueness and fragility make it a "community of fate" according to Edgar Morin's definition.[102] It is thus recommended that the region pursue a portfolio of actions and economic cases towards the change regional actors hope to achieve, including an accelerated reduction of externalities and the regeneration of the commons. In particular, we suggest the implementation of EMME regional green transitional missions focused on the four critical topics of (i) urban sustainable development, (ii) industrial symbiosis, (iii) the water-energy-food nexus and (iv) the economy of natural systems. Economic cases should be built by considering the overall trade-offs between investment and cost savings, accounting for both direct monetary and indirect benefits and savings. Suitable transformative financial and accounting instruments should be developed and introduced.

The suggested approach can hardly be demonstrated by disaggregated and scattered actors. Actually, an orchestrated model is recommended, one that considers the synergies and trade-offs between different measures, sectors and countries. This could take inspiration from line with the emerging EU mission-led strategy, and especially from the Climate Resilient Europe Mission, which brings together both "easy" and "difficult" actions in a sum-positive, strategic aggregation of investments. A regional green innovation mission-led pact could also capitalise the well-tuned "deep demonstration" mechanism of EIT Climate KIC[103] and built around a portfolio of actions and open implementation platforms.

Suitable financing mechanisms must underpin the missions, to unlock and manage the investments needed. New integrated business models should be designed to drive transformative investments. Local financing mechanisms should bring together public, private and community capital investment partners. Innovations in the structural economic context should include shifting taxes and subsidies. Support for entrepreneurship skills, enterprise innovation and business growth should be oriented towards key green sectors. A virtuous cycle of more actions and more investments, leading to more returns, should arise from the – this time positive – non-linearity of the loop, resulting in more prosperity and environmental regeneration. From the financial point of view, public "catalytic capital" will be matched with green financial tools, private capital, and crowdfunding/community share offerings to achieve a true collective community engagement and feedback mechanism.

102. E. Morin, Seven complex lessons in education for the future, UNESCO, Paris, 1999.
103. https://www.climate-kic.org/programmes/deep-demonstrations/.

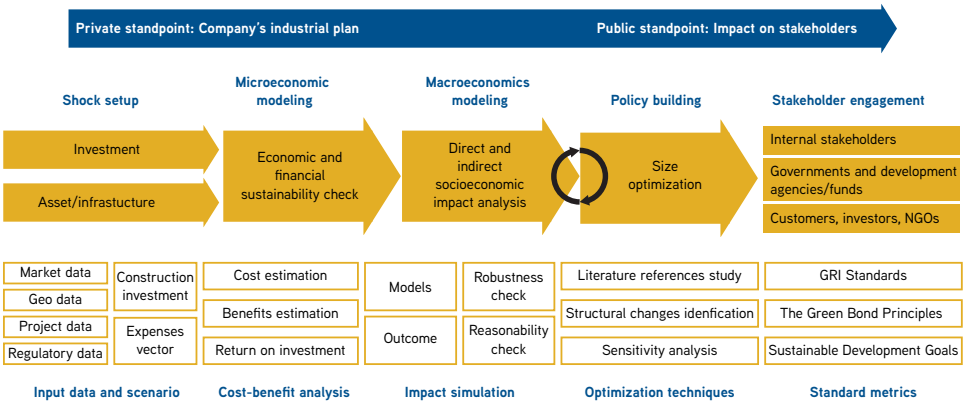
The business models to be explored within the transitional missions should deploy and manage investments to maximise climate adaptation and mitigation while ensuring equity and prosperity in the long run. Private and public standpoints could be matched through the implementation of real-world demonstrations wherein all processes, from "shock setup" (the stage when the transformative experiment is carefully planned) to policy making, would be tested using a data-driven approach. A possible framework is shown in Figure 5.1, which is depicting the transformational journey suggested by the OpenEconomics Foundation [124].

Redesigning or replacing old models and jobs requires the deployment of 1) reskilling strategies, at both the company and individual levels; 2) rectification of taxation and subsidy models, in order to achieve a fair and just pathway towards the transition; and 3) business and innovation support to help accelerate local sustainable enterprise growth.

Governance structures should enable open and inclusive processes of innovation, experimentation, action and learning. Policies, legal arrangements and governance models that can hinder the implementation of transitional pacts (conflicting regulations on biodiversity, resource exploitation, land management, etc.) should be reconsidered through a holistic lens. A major effort should therefore be invested in co-creation/collaboration, learning and communication, in order to achieve the widest consensus. In a portfolio-oriented approach, the application of a mission-based contextual open innovation management process should address specific objectives in different pilots, taking climatic zones and cultural and socioeconomic constraints into account.

Variables should be differentiated in each mission, to provide a comprehensive investigation of various strategies to be scaled up across the EMME region. Opportunities offered by

FIGURE 5.1. The transformational journey: From "shock set-up" to "policy building"



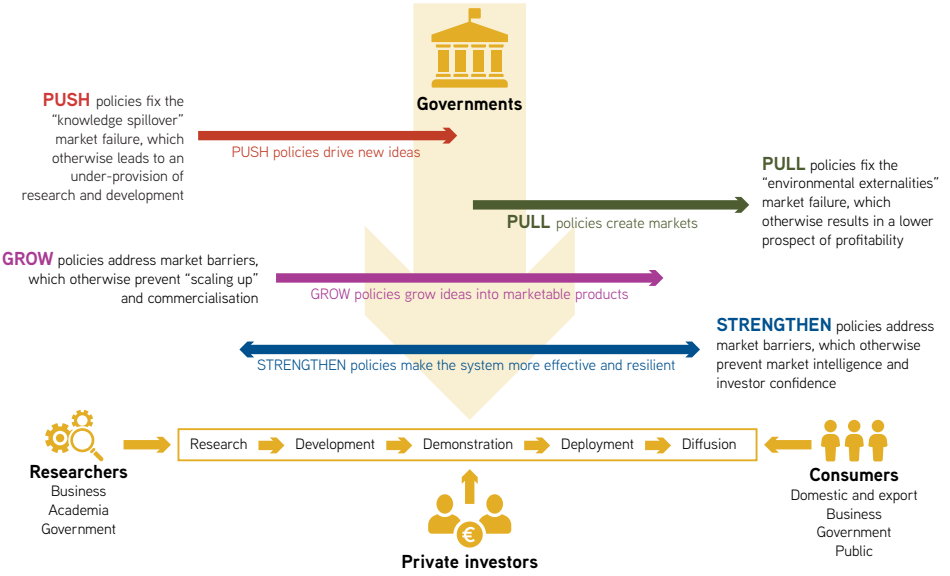
Source: [124].

renewable energy systems, digital technologies, and open science and knowledge should be capitalised through the participation of new and emerging players, not only incumbent actors. Exploitable results and knowledge gained from previous schemes and projects – such as good practices, open software and hardware, available capacities and skills, and existing infrastructure at piloting sites – should be leveraged. Providing case studies, technology transfer, training opportunities, policy advice and other guidance elements can help promote socioeconomic transformation and regulatory innovation.

In the overall picture, "push" policies will match the "pull" development of environmental externality markets, which give value to the commons (cleaner air and water, lower GHG emissions, biodiversity, waste reduction), boosting both the supply of and demand for green innovation. Finally, "grow" policies will help the innovative solutions to be brought into marketable products, while "strengthening" policies cut across the new green innovation system, improving its effectiveness and resilience. Along the journey from the lab to the market, the innovation pipeline will move from pushing research to pulling demand, decreasing the risk and shifting from public incentives to private investments. A comprehensive push-and-pull policy framework has been proposed by the Smart Prosperity Institute for the green transition in Canada. Figure 5.2 summarises the main features.

The four regional green transition missions are described below.

FIGURE 5.2. Innovation framework proposed by the Smart Prosperity Institute for the transition towards the green economy



Source: [125].

Mission 1: Urban sustainable development

The inclusion of green economy principles in urban polices in EMME region can spur the transition towards sustainable prosperity. Not all of the tools for managing the shift from a linear to a circular economy are always in the hands of municipal decision makers, depending on the level of decentralisation of both legislative and financial power. In the EMME area, two options have been observed:

1. The municipality has very limited, almost consultative power, as all decisions are taken at the central level. This is the case for the GCC countries, where the public expenditure system is highly centralised.
2. Municipalities have power over both public services (water and waste management, transport, street lighting, road and green maintenance, etc.) and social services (urban planning, building regulations, education, etc.). This category includes municipalities outside the GCC.

In both settings, five policy levers can help drive the transition of urban settlements towards a green economy:

- **Vision.** Joint strategic goals should underpin green economy city roadmaps and strategies, setting clear directions and informing other policy levels. The engagement of urban stakeholders in the implementation of a mid- to long-term roadmap will enhance its effectiveness and generate a sense of shared empowerment and ownership. All cities should define their medium- and long-term vision or have it defined by the central authorities.
- **Engagement.** Awareness of the wide range of opportunities arising from the application of the green economy paradigm is key to gaining community support. Knowledge sharing and communication campaigns are needed, as are business incubation programmes and knowledge-sharing platforms that engage both individuals and businesses. The participation of stakeholders can be organised around transitional hubs, where specific skills about green innovation can be shared among local businesses and residents.
- **Economic incentives.** City governments in the region should design a common financial support system to incentivise innovation and promote new markets. Specific financial measures, such as local taxes, penalties, and charges, can be used to incentivise or discourage behaviours. PPPs and financing schemes can act as multipliers in green infrastructure development.
- **Urban management.** Urban planning is a powerful tool that can improve the circulation of people and goods in a city, strongly influencing the possibility of recapture

and reuse of materials, products and wastes. It can also promote, through appropriate design of the urban fabric, long-term housing, mobility and behavioural change. Urban planning can improve the delivery of sustainable services, support the implementation of infrastructure with minimal impact, and reduce demand for energy and other resources. City governments can also orient the management of their portfolio of assets and public procurement towards the stimulation of a green market for products and services, supporting the exploitation of sustainable innovations. All EMME cities should adopt the green procurement approach, which requires proper training of the officials dealing with it.

- **Regulations**. Urban policy makers have available to them a set of important interventions that can be implemented at the local level, in alignment with local institutions' prerogatives, or in conjunction and co-operation with national policy makers. They can intervene in many areas, including buildings, mobility and the circular economy. The impact of regulations may be limited, however, if other framework measures are not taken at the national level. The removal of regulatory constraints may be needed to overcome linear practices and unlock green innovations.

Urban action plans could be adopted to force the radical transformation of the construction sector. New regulations can promote the use of local and renewable construction materials and their continuous reuse through appropriate deconstruction practices - which avoid demolition - drastically reducing the demand for virgin materials. City governments can also incentivise the use of new construction techniques and smarter material choices by requiring that they be used in public procurement tenders for construction projects and in building regulations. Fiscal measures, such as landfill taxes, and regulation on material management can strongly encourage resource-efficient and labour-intensive construction and deconstruction practices, which will trigger demand for new skills, to be developed through capacity-building programmes. The creation of material passports that follow their movements, uses, transformations and re-uses, sustainable asset management, as well as partnerships with residents and platform providers could make the essential information available and usable for the most appropriate management of the urban fabric.

Mission 2: Industrial symbiosis

Symbiosis is a relationship in which both parties benefit more than they would on their own. Industrial symbiosis represents a way to increase resource productivity and realise prosperity through the circular economy [126]. The European Union recognises that industrial symbiosis is relevant not only to resource efficiency but also to a broad policy agenda covering innovation, green growth and economic development. The EU Circular

Economy Action Plan (2015–19)[104] paved the way through 54 measures that addressed the entire materials cycle, from production to consumption through waste management and the use of secondary raw materials. This approach is now integrated into the European Green Deal. The paradigmatic example of Kalundborg, Denmark,[105] shows how an oil refinery, a power station, a gypsum board facility and a pharmaceutical company can share ground water, surface water, wastewater, steam and fuel and exchange a variety of by-products that become feedstocks in other processes. The benefits of this integration include the reduction of energy and water consumption, CO_2 emissions and waste disposal. Another example is the synergy observed between power generation and tourism at the Blue Lagoon in Iceland.[106]

Industrial symbiosis would be immensely beneficial in transforming the EMME industrial system, which is largely responsible for emissions and pollution, into a sustainable and integrated platform, maximising the outputs that can be generated from resources. Industries and companies that are connected through symbiotic networks would leverage knowledge and profitable transactions in innovative integrated processes. New cross-border collaboration and economic integration could be envisaged, with positive effects on geopolitical stability.

As waste in the region is projected to double between 2018 and 2050 [127], its reduction and virtuous management should be included in the EMME GEI goals. Pilot industrial symbiosis programmes have been promoted for the intensive industrial zones in the region (including the Persian Gulf Mining and Metal Industries Special Economic Zone in Iran [90], eco-industrial parks in Borg El-Arab, Egypt [128], and Emirates Global Aluminium in the United Arab Emirates.[107] In Israel, the Ministry of Economy and Industry has launched a programme for industrial symbiosis.[108] Most countries in the region envisage deeper integration of water and energy generation, taking into account the extraction of salts as part of the combined processes. Recycling and upcycling businesses are appearing in the EMME region. Enviroserve, the largest e-waste treatment plant in the world (260 000 square meters), is now in operation in Dubai.[109]

An ambitious industrial symbiosis programme should be implemented at the EMME level. A benchmark could be the National Industrial Symbiosis Program (NISP) of the United Kingdom, launched in 2005, which attracted many companies that saw a clear financial benefit in participating.[110] During its first seven years, the NISP generated savings of over

104. https://ec.europa.eu/environment/topics/circular-economy/first-circular-economy-action-plan_en.
105. http://www.symbiosis.dk/en/.
106. https://www.bluelagoon.com/.
107. https://www.geocycle.com/geocycle-uae-receive-award-ministry.
108. https://is4ie.org/media/783.
109. https://enviroserve.org/.
110. https://www.inno4sd.net/one-companys-waste-is-anothers-raw-material-national-industrial-symbiosis-programme-nisp-551.

EUR 1.3 billion and additional sales of EUR 1.3 billion and saved saving 39 million tonnes of CO_2. Material flows and local/regional industrial waste streams should be mapped, and mutual trust established among actors. Long-term public support should be ensured, with binding objectives, regulations, subsidies and other economic incentives. This could possibly be pursued by creating new development companies, regional clusters or similar organisations to promote the establishment of industrial symbiosis networks and the identification of further synergies and business cases. Eco-industrial parks could be promoted, especially for the purposes of symbiotic models and recycling, to serve both local industries and regional networks. In the latter case, environmental and economic sustainability can sometimes be offset by the negative effects of long-distance transport. Industrial symbiosis can provide competitive advantages for EMME industries, especially on a large scale (aluminium, plastics and other oil derivates, food processing, cement and other building materials, steel, textile and clothing, and other manufacturing clusters), paving the way for the emergence of new and innovative businesses and supply chains that will take advantage of otherwise unused industrial flows while reducing environmental pressure.

Mission 3: The water-energy-food nexus

Mission 3 should explore comprehensive approaches to the production of non-polluting energy, fresh and potable water, and sustainable food in the region. By placing water, energy and food at the core of a people-centred decarbonisation strategy, this mission capitalises on the common elements of the challenges faced by countries of the region. As proven in pilot activities and schemes [129], both at the microeconomic and macroeconomic levels, development projects oriented towards long-lasting changes in the socioeconomic structure can achieve economies of scope. Cross-border schemes such as ENI CBCMED, EuropeAid and especially PRIMA[111], as well as 2030 strategic vision adopted by some individual countries, offer examples. Scaling up such actions would boost the economy, achieve decarbonisation goals and improve the quality of life in local communities. By tailoring the approach to each subregional environment, while implementing an integrated and systemic transitional strategy, the mission would leverage a multisectoral stock of co-ordinated activities. The traditional, fragmented approach to water, energy and food resources is characterised by environmentally unsustainable solutions, such as fossil fuel–powered desalination plants, overexploitation of the aquifer, use of unrenovated wood resources for energy purposes, etc.

Integrated and place-based nexus approaches would assure greater wealth in low-income countries without affecting critical environmental boundaries. The same policies will boost

111. https://prima-med.org/what-we-do/nexus/.

both decarbonisation and resilience in high-income countries, reducing their dependency on imported food without affecting emissions and water quality. Renewable energy will play a critical role in this approach to the water-energy-food nexus. More in general, this Mission could mobilize local creativity, capacity and skills in rural and recently urbanised societies, expand the diffusion of open, shared and low-cost innovations, and finally increase the socioeconomic attractiveness of rural and semi-rural environments.

Mission 4: The economy of natural ecosystems

Given the fragility of the biodiversity and natural ecosystems in the region, and their relevance in terms of climate change mitigation and adaptation, a shift is needed in their management from protectionism to fully integrated models in which human communities interact positively with sensitive environments delivering sustainable wealth and prosperity. One best practice in the region is the Shouf Biosphere Reserve (SBR) in Lebanon, which sequesters carbon and produces briquettes, water and food as well as tourism, cultural, and patrimonial services. While some of the SBR ecosystem services can be considered intangible, the economic value of tourism is significant and growing, with its total revenues it brings in exceed the operational cost of the reserve by a factor of 19 to 1 [130].

The model we suggest implementing in valuable natural areas is inspired by the Nature, Wealth and Power 2.0 approach proposed by USAID [131] for leveraging natural and social capital towards resilient development. In this approach, nature encompasses the biophysical aspects of natural capital management, including both marketed and nonmarketed resources and ecosystem services (such as resource productivity, ecological interactions, environmental sustainability, technologies and behaviours for their enhancement, etc.). Principles include the following:

- N1: Safeguard the productive capacities of natural capital.
- N2: Encourage the restoration of degraded or "low-potential" lands and other forms of natural capital.
- N3: Promote sustainable practices and systems that increase the productivity of natural capital.
- N4: Promote climate and socioeconomically resilient rural production systems.
- N5: Strengthen the use of monitoring, science and technology in agriculture and resource management.

Wealth is an economic aspect of natural capital management. Principles include the following:

- W1: Strengthen natural capital accounting, valuation and analytic tools to improve decisions.
- W2: Invest revenues from resource extraction in the creation of new nature-based assets and incomes.
- W3: Create frameworks and incentives to improve the alignment of public and private interests.
- W4: Strengthen markets and the role of rural producers in competitive non-extractive natural resource value chains.
- W5: Plan for the equitable and efficient distribution of costs and meaningful benefits.

Power refers to the governance and social capital related to natural capital, particularly rights, authorities, accountability and representational issues (such as legal frameworks, resource access rights and responsibilities, distribution of power/control, institutional capacity, formal and informal rules, and benefit sharing). Principles include the following:

- P1: Strengthen inclusive rural land and natural resource tenure systems and procedural rights.
- P2: Decentralise powers and responsibilities to representative and accountable authorities.
- P3: Improve broadly based representation and continuous rural input on resource decisions.
- P4: Promote simpler standards.
- P5: Integrate and empower women and marginalised groups to participate in management, decisions and benefits.
- P6: Promote checks and balances, as well as equitable institutional relationships.
- P7: Strengthen public and private institutions for the delivery of technical and intermediary services.

A comprehensive scheme should be introduced across borders, in both sea and land environments, featuring a mix of conservation, sustainable trade and eco-tourism. It should be integrated with the first three missions. The high quality of the environment could make rural and remote sites attractive for individuals and groups who would leave urbanised areas in seek of different quality and rhythms of life, provided a relatively high level of services were locally available. Digitalisation programmes would help ensure services, together with investment in decentralised service hubs and sustainable mobility.

6. Summary and recommendations

A regional policy for accelerating clean innovation should coordinate local efforts under a systemic vision, as the region is the appropriate level at which nations should account for the complex interactions embedded in geopolitical and socioeconomic reality [132, 133].

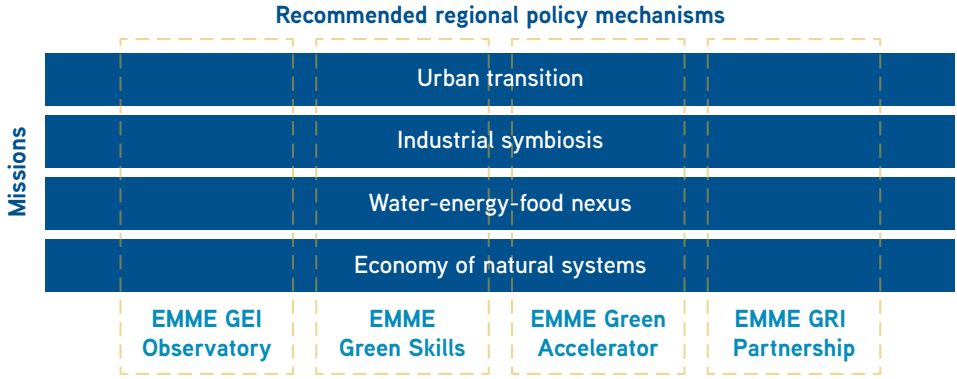
Several factors are hindering the development of a regional green economy in the EMME area. In addition to suffering from geopolitical fragmentation and frictions, the region lacks a systemic process of data collection and analysis, as well as regional policy design and evaluation frameworks.

We recommend the implementation of four regional co-ordinated mechanisms that cross-cut the four missions described in chapter 5 and pave the way towards the full deployment of a data-driven transitional innovation model in the region. The mechanisms and missions are illustrated in Figure 6.1.

Establish an EMME GEI Observatory

Data are not systematically collected and analysed in most of the countries in the region (exceptions are the OECD and EU countries, as well as countries involved in actions of the Global Green Growth Institute - GGGI). The overall picture is fragmented and not easily framed into a regional perspective, which is needed to address the regional climate and ecological challenges. Integrated econometric models at the regional scale are still missing. As a result, cross-border opportunities are not systemically identified and pursued.

FIGURE 6.1. Proposed policy framework for the region



To address the problem the EMME should establish a GEI Observatory to monitor information and data on green innovation in the EMME countries and identify policies and innovative schemes focused on technology, know-how and jobs. Such an observatory would fill knowledge gaps about the EMME region's innovation ecosystem. The observatory should include the following sources of data:

- industry data, such as trends, revenues, and employment in traditional and innovative sectors
- public programme data, including information about the use of government incentives and supporting schemes
- jobs data, in order to identify gaps in the job market and guide the reskilling process (this activity would provide input into the EMME Green Skills Programme, described below)
- firm-level data, in order to track companies that represent best practices and help identify priorities
- natural capital, footprint data and socio-ecological indicators
- green and sustainable taxonomies and labels
- environmentally sound technologies and methods for mitigating and adapting to climate change in the region.

A statistical framework should be established and innovative means of collecting data from multiple and scattered sources used. Private companies, cluster organisations, innovation hubs and governmental offices should be mobilised. Local projects should be constantly monitored in order to identify appropriate actions for regional scale-up/transfer.

An observatory would help harmonise definitions across areas, manage conflicting interests and trade-offs, and promote common awareness of how innovation can support sustainability. It would increase access to information about innovation infrastructure and support schemes among innovators, start-ups, SMEs and other regional actors. It would support the application of solutions to stimulate transformative change, providing access to 1) policy reviews, guidelines and briefs on how to set policy frameworks for sustainability and 2) case studies on policy and business best practices, which could be disseminated in connection with global initiatives and partnerships, such as the European Green Deal, the UN Partnership for Action on Green Economy (PAGE), UNDP, UN Sustainable Development Solutions Network, CEDARE and GGGI, among others.

The observatory should adopt a multidisciplinary approach, and include conceptual modelling, optimisation strategies and systemic simulation, in order to model the complexity of human–nature interactions.

In its first years of operation, the observatory could be hosted in an academic, research or regional development organisation in an EMME country that volunteers to financially support its operation. An intergovernmental agreement is needed so that a large number of ministry departments, innovation agencies, and chambers of commerce and industry in each of the collaborating EMME countries participates as satellites to the observatory, collecting and providing local information and data. The collection of information and data could be optimised if an independent intergovernmental organisation were established and financed by the participating EMME states. In this case, satellite organisations in each EMME state would be appointed, institutionally linked to, financially supported by and accountable to the central observatory.

Create an EMME Green Skills Programme

Inspired by the EU Erasmus+ programme, the proposed policy instrument would establish an international training and mobility programme that would promote:

- efforts to raise youth awareness of the challenges of climate change and opportunities of sustainable development;
- efforts to train residents of the region in skills relevant to the growth of green economy sectors;
- co-operation among institutions to enable transnational co-operation in the EMME region and the development of joint transformation agendas in the domains of vocational education and training.

The programme would support the building of a regional space for skills training and circulation, with the dual aim of avoiding skill shortages and maximising opportunities for workers. It should 1) offer a number of mobility opportunities in green business fields and foster the development of flexible competences in emerging fields such as renewable energy generation and efficiency, sustainable urban development, nature-based solutions, sustainable farming, management of natural resources, soil protection and bio-agriculture. Emerging technologies, practices and business models could be shared across borders. Priority should be given to projects addressing green skills and educational strategies. It is expected that regional curricula would emerge from the programme, aligning with green job policies (as already available in Jordan and the United Arab Emirates).

Actions could help promote the conversion of traditional sectors and the scale-up of new ones. Both educational institutions (schools, universities, vocational education and training providers) and private actors should be invited to collaborate in regional-scale projects, together with NGOs, local and regional authorities, and civil society organisations. A central

secretariat responsible for the co-ordination of the programme, the development of common tools and the implementation of transnational activities should be established following an intergovernmental agreement. National offices, appointed by each participating state, would promote and implement programme activities at the national level.

Common tools would include the following:

- Twinning platforms providing information on training and mobility opportunities and supporting matchmaking and transnational project building.
- Repositories containing selected good practices from all EMME countries as well as educational materials.
- Networking activities, such as fact-finding missions to other EMME countries facilitated by national offices and the exchange of good practices with countries outside the region.
- Public awareness campaigns designed by the central secretariat and promoted and implemented locally by national offices.

Set up an EMME Green Accelerator

An integrated regional model for green innovation would comprise green innovation hubs for the creation and diffusion of knowledge, entrepreneurial experimentation, infrastructure support and resource mobilisation. The proposed EMME Green Accelerator would orient, integrate and empower existing facilitation tools (incubators, accelerators, innovation hubs, and science and technology parks) and open innovation ecosystems to promote the scale-up of transitional businesses across the region. It should consist of the following:

- A regional knowledge and service regional hub, supporting eco-innovators (inspired by but not limited to EU models)
- A network of affiliated eco-innovation hubs that can support the incubation, acceleration and scale-up of green innovations (possibly taking inspiration from the network of eco-innovation hubs of North America).[112]
- A regional eco-innovation investment fund to de-risk novel eco-businesses and blend private venture capital.
- A regional network of real-life validation platforms (sandboxes, living labs, piloting of eco-cities infrastructure) to accelerate the market exploitation of innovative solutions. The network would facilitate the co-operation of actors at the regional level and the sharing of resources, expertise and opportunities.

112. http://ecoinnovationnetwork.org/.

The network of green innovation hubs could be exploited further as a regional mechanism (an "EMME Green Marketplace") to promote cross-border collaborations that increase the possibilities offered by the circular economy and industrial symbiosis. E-commerce and integration services can support the establishment of regional circular industrial loops and cross-border investment schemes, including waste-to-product circular activities in industrial zones. Focusing on circularity at the regional level would help optimise material flows towards almost closed loops. Implementation of the Green Marketplace would benefit from the data collected by the GEI Observatory and be structured in a number of pilots. Establishment of such a mechanism within the Green Accelerator would cross-cut the four missions identified in chapter 5.

Forge an EMME Green Research and Innovation Partnership

Most task forces have identified major gaps in knowledge and climate change–related scientific data, highlighting the need for further research so that policy recommendations are founded on solid facts. Regional research co-operation is limited, resulting in inefficiencies and duplication. Enhanced co-ordination in sharing data, best practices, emerging technologies and methodologies – both between EMME countries and between these countries and international agencies and organisations – could increase the potential for innovation.

An intergovernmental EMME regional research and innovation (R&I) partnership – an EMME Green Research and Innovation Partnership (EMME GRI Partnership) – would promote and finance the implementation of transnational joint R&I activities, including the collection and sharing of scientific data and the identification and sharing of good practices and innovative solutions for adapting to climate change and reducing the environmental footprint. The partnership would support implementation of the four green transitional missions.

The EMME GRI Partnership would aim to achieve the following:

- Co-ordinate the development of a joint strategic R&I agenda in climate change adaptation and footprint mitigation aimed at filling the scientific knowledge and data gaps and facilitating the uptake of new technology in line with the green transitional missions.
- Fundraise from EMME countries, international organisations and private donors to implement the joint R&I agenda.
- Select, finance and manage transnational research, scientific data collection and access to research infrastructure projects, with the participation of academic and research organisations, businesses, public agencies and civil society organisations from the EMME region.

- Identify and develop cutting-edge solutions and practices in eco-innovation, facilitating their dissemination and sharing throughout the EMME region in collaboration with the EMME Green Accelerator and its network of Eco-Innovation Hubs.
- Serve EMME governments as a vehicle for managing regional-scale climate change mitigation, adaptation activities and support measures, such as mutual learning and public awareness.

The EMME Research Partnership would align with international standards of good governance concerning transparency, efficiency and accountability. The appropriate governance structure would be decided at the highest political intergovernmental level, respecting the fundamental requirements of co-ownership, co-financing and co-management by the founding/participating states. The funds for financing the joint research programmes and other co-ordination activities as well as the administration of the partnership itself would originate principally from the participating states. The financial commitment of each country would vary depending on the size of its economy, its willingness and ability to contribute and its capacity to take advantage of the joint research programmes. Private donors or investors could be identified on a project-by-project basis, and green finance tools could leverage environmentally oriented taxation schemes. The partnership could also raise and manage funds from international organisations and agencies. Projects would be selected based on open, competitive calls for proposals designed to induce public and private entities from participating EMME states to produce scientific evidence, knowledge and innovative solutions to climate challenges, in line with the four green transitional missions.

References

[1] G. Ramos and W. Hynes, "A systemic resilience approach to dealing with Covid-19 and future shocks," *OECD*, 2020.

[2] J. R. McNeill and P. Engelke, "The Great Acceleration: An Environmental History of the Anthropocene since 1945," *Harvard Univ. Press*, 2014.

[3] D. H. Meadows, D. L. Meadows, J. Randers, and W. W. Behrens, *The Limits to Growth, Club of Rome*. 1972.

[4] M. J. Green, D. Waquet, and N. Georgescu-Roegen, "The Entropy Law and the Economic Process," *Rev. économique*, 1974, doi: 10.2307/3500601.

[5] H. Daly, "Economics, Ecology, Ethics - Essays toward a Steady-State Economy," *Economics, Ecology, Ethics - Essays toward a Steady-State Economy*. 1980.

[6] E. Ostrom, "Governing the commons: the evolution of institutions for collective action," *Gov. commons Evol. institutions Collect. action*, 1990, doi: 10.2307/3146384.

[7] W. Stahel and Walter and Geneviève Reday, Potential for Substituting Manpower for Energy, Vantage Press, N.Y., 1981

[8] K. Raworth, Doughnut economics: Seven ways to think like a 21st-century economist. London: Random House Business, 2017.

[9] UNIDO and GGGI., "Global Green Growth: Clean Energy Industry Investments and Expanding Job Opportunities. Volume II: Experiences of Brazil, Germany, Indonesia, the Republic of Korea and South Africa.," Vienna and Seoul, 2015.

[10] P. Tecchio, C. McAlister, F. Mathieux, and F. Ardente, "In search of standards to support circularity in product policies: A systematic approach," *J. Clean. Prod.*, 2017, doi: 10.1016/j.jclepro.2017.05.198.

[11] R. Samans, "Green Growth and the Post-2015 Development Agenda," 2013.

[12] OECD, "Towards Green Growth: A summary for policy makers May 2011," 2011.

[13] A. Dechezleprêtre, R. Martin, and S. Bassi, "Climate change policy, innovation and growth," in *Handbook on Green Growth*, 2019.

[14] A. Atıl Aşıcı, *Climate Friendly Green Economy Policies*. Istanbul: Yeşil Düşünce Derneğl, 2017.

[15] P. Ekins, T. Domenech, P. Drummond, R. Bleischwitz, N. Hughes, and L. Lotti, "The Circular Economy: What, Why, How and Where. Managing environmental and energy transitions for regions and cities," *Backgr. Backgr. Pap. an OECD/EC Work. 5 July 2019 within Work. Ser. "Managing Environ. energy transitions Reg. cities" Paris*, 2019.

[16] L. S. and R. S. Laura Järvinen, "How to create a national circular economy road map," 2020.

[17] S. McQuaid, S., Rhodes, ML., Andersson, T., Croci, E., Feichtinger-Hofer, M., Grosjean, M., Lueck, A. E., Kooijman, E., Lucchitta, B., Rizzi, D., Reil, A., "From Nature-Based Solutions to the Nature-Based Economy - Delivering the Green Deal for Europe. Draft White Paper for consultation. Nature-based Economy Working Group of EC Task Force III on Nature Based Solutions," 2021. doi: https://doi.org/10.5281/zenodo.5055605.

[18] M. Miedzinski, G. Dibb, W. McDowall, and P. Ekins, "Innovation for a Green Recovery: Business and Government in Partnership," London, 2020.

[19] T. Zachariadis *et al.*, ""Building Back Better" in Practice. A Science-Policy Framework for a Green Economic Recovery after COVID-19," 2021.

[20] S. Elgie and M. Brownlee, "Accelerating green innovation in Canada," 2017.

[21] UNEP, "Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication – A Synthesis for Policy Makers," 2011.

[22] D. W. O'Neill, A. L. Fanning, W. F. Lamb, and J. K. Steinberger, "A good life for all within planetary boundaries" *Nat. Sustain.*, 2018, doi: 10.1038/s41893-018-0021-4.

[23] L. Croitoru and M. Sarraf, "The cost of environmental degradation: case studies from the Middle East and North Africa," 2010.

[24] Cornell University, "Global innovation index 2020: who will finance innovations," 2021.

[25] J. Rockström *et al.*, "Planetary boundaries: Exploring the safe operating space for humanity," *Ecol. Soc.*, 2009, doi: 10.5751/ES-03180-140232.

[26] B. M. Campbell *et al.*, "Agriculture production as a major driver of the earth system exceeding planetary boundaries," *Ecol. Soc.*, 2017, doi: 10.5751/ES-09595-220408.

[27] M. Mazzucato, "The Value of Everything: Making and Taking in the Global Economy," 2019.

[28] Trucost, "Natural capital at risk: the top 100 externalities of business," *Teeb*, 2013.

[29] OECD, "Sustainable Manufacturing and Eco-Innovation: Framework, Practices and Measurement," 2009.

[30] EEA, "SOER," 2020.

[31] F. W. Geels, "Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study," *Res. Policy*, 2002, doi: 10.1016/S0048-7333(02)00062-8.

[32] T. Jackson, Prosperity without growth: Economics for a finite planet. 2009.

[33] P. Formica, Nature's Voice: Health and Humanities. bioGraph, 2020.

[34] UN Sustainable Development Group, "Foundational Primer on the 2030 Agenda for Sustainable Development," 2019.

[35] A. Wijkman, K. Skånberg, and M. Berglund, "The Circular Economy and Benefits for Society," 2015.

[36] European Commission, "Closing the Loop - An EU Action Plan for the Circular Economy, European Commission 2015," *Off. J. Eur. Communities*, 2015.

[37] European Commission, "A new Circular Economy Action Plan For a cleaner and more competitive Europe," 2020.

[38] Ellen MacArthur Foundation, "Cities in the circular economy: An initial exploration," *Ellen MacArthur Found.*, 2017.

[39] Ellen Macarthur Foundation, "Cities and circular economy for food," *Ellen Macarthur Found.*, 2019.

[40] M. Modica, " G Gardner, T Prugh and M Renner, Can a city be SUSTAINABLE? State of the World (2016) ," *Environ. Plan. B Urban Anal. City Sci.*, 2017, doi: 10.1177/0265813516677614.

[41] C. Kennedy, S. Pincetl, and P. Bunje, "The study of urban metabolism and its applications to urban planning and design," *Environmental Pollution*. 2011, doi: 10.1016/j.envpol.2010.10.022.

[42] P. J. Gerber, Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities. Food and Agriculture Organization of the United Nations (FAO), Rome. 2013.

[43] World Wild Fund for Nature, Living planet report 2016: Risk and resilience in a new era. 2016.

[44] M. Antonelli, "Food & Cities," 2018.

[45] EU High-Level Expert Group on Sustainable Finance, "Financing a Sustainable European Economy Final Report 2018," *Eur. Comm.*, 2018.

[46] AFED, Financing Sustainable Development in Arab Countries. Annual Report of Arab Forum for Environment and Development, Technical. Beirut, 2018.

[47] P. Dasgupta, "The Economics of Biodiversity: The Dasgupta Review," London, 2021.

[48] OECD, "The Labour Share in G20 Economies," *Rep. Prep. G20 Employ. Work. Gr.*, 2015.

[49] OECD, Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition, The Measurement of Scientific and Technological Activities. 2005.

[50] T. Bernauer, S. Engels, D. Kammerer, and J. Seijas, "Explaining green innovation. Ten years after porter's win-win proposition: How to study the effects of regulation on corporate environmental innovation?" *Polit. Vierteljahresschr.*, 2007.

[51] K. Rennings, "Towards a Theory and Policy of Eco-Innovation - Neoclassical and (Co-) Evolutionary Perspectives," *ZEW Discuss. Pap. 98-24*, 1998.

[52] K. Smith, "The challenge of environmental technology: promoting radical innovation in conditions of lock-in," *Rep. to Garnaut Comm. Final Draft*, 2008.

[53] I. Scrase, a Stirling, and F. Geels, "Transformative innovation: a report to the Department for Environment, Food and Rural Affairs," *Sci. Technol. …*, 2009.

[54] World Economic Forum, "Unlocking Technology for the Global Goals," 2020.

[55] C. Perez, "11. Capitalism, Technology and a Green Global Golden Age: The Role of History in Helping to Shape the Future," *Polit. Q.*, 2015, doi: 10.1111/1467-923X.12240.

[56] M. W. Johnson and J. Suskewicz, "How to jump-start the clean-tech economy," *Harv. Bus. Rev.*, 2009.

[57] A. Beltramello, L. Haie-Fayle, and D. Pilat, "Why New Business Models Matter for Green Growth," *Paris, Fr. OECD*, 2013.

[58] P. E. Auerswald, "Enabling Startup Ecosystems," *Kauffman Found. Res. Ser. City, Metro, Reg. Entrep.*, 2015.

[59] M. Krämer, A, Herrndorf, "Policy Measures to Support Inclusive and Green Business Models," 2012.

[60] The World Bank, "Financing for SMEs in Sustainable Global Value Chains," 2017.

[61] OECD, "Environmental Policy Toolkit for SME Greening in EU Eastern Partnership Countries - OECD Green Growth Studies," 2018.

[62] T. K. Eltayeb, S. Zailani, and T. Ramayah, "Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes," *Resour. Conserv. Recycl.*, 2011, doi: 10.1016/j.resconrec.2010.09.003.

[63] OECD, "What have we learned from attempts to introduce green-growth policies?" *OECD Green Growth Pap.*, 2013.

[64] The World Bank, "Jobs for Shared Prosperity, Time for Action in the Middle East and North Africa," 2013.

[65] World Economic Forum, "The Future of Jobs and Skills in the Middle East and North Africa - Preparing the Region for the," *Geneva World Econ. Forum.*, 2017.

[66] Worldwatch Institute, "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World," 2008.

[67] Material Economics, "The circular economy - a powerful force for climate mitigation," *Nature*, 2016.

[68] International Labour Organization (ILO), World employment social outlook 2018: greening with jobs. 2018.

[69] C. Gironde and G. Carbonnier, "Promoting Green Jobs: Decent Work in the Transition to Low-carbon, Green Economies," in *The ILO @ 100*, 2019.

[70] Spain National Observatory of Occupations, "Annual report," 2017.

[71] CEDEFOP, "Skills for green jobs country reports for Denmark, Germany and France," 2018.

[72] MOCCAE, "United Arab Emirates Green Jobs Program," 2019.

[73] ESCWA, "Mapping Green Economy in the ESCWA Region," 2013.

[74] G. eco-union, MIO-ECSDE, "Towards a Green Economy in the Mediterranean," 2016.

[75] A. Makri, "Cyprus asserts itself as regional hub for climate-change research news," *Nature*. 2018, doi: 10.1038/d41586-018-05528-9.

[76] Research and Innovation Foundation, "RESTART 2016—2020 work Programme." 2016.

[77] T. Mesimeris, N. Kythreotou, G. Partasides, and K. Piripitsi, "Cyprus' draft integrated national energy and climate plan for the period 2021-2030," *Republic of Cyprus*, 2019. .

[78] C. Karapataki, "Cyprus Regional Cleantech Innovation and Entrepreneurship Study," 2017.

[79] M. R. A. Rezk, H. H. Ibrahim, A. Radwan, M. M. Sakr, M. Tvaronavičienė, and L. Piccinetti, "Innovation magnitude of manufacturing industry in Egypt with particular focus on SMEs," *Entrep. Sustain. Issues*, 2016, doi: 10.9770/jesi.2016.3.4(1).

[80] A. Radwan, "Analytical view of National STI system," 2015.

[81] A. Radwan and M. Sakr, "Exploring 'brain circulation' as a concept to mitigate brain drain in Africa and improve EU–Africa cooperation in the field of science and technology," *South African J. Int. Aff.*, 2018, doi: 10.1080/10220461.2018.1551151.

[82] L. Rezk, M R A, Radwan, A, Sakr, M, Tvaronaviciene, M, Piccinetti, "Assessing the Status and the Prospects of the Science, Technology and Innovation (STI) System in Egypt," in *Science, Technology and Innovation Policies for Inclusive Growth in Africa: Human Skills Development and Country Cases*, LIT Verlag Münster, 2020, p. Vol.1, 227.

[83] MAGNITT, "MENA Venture Investment Report," 2020.

[84] EG-SDG, "Egypt Sustainable Development Vision 2030," 2015.

[85] "The Impact of Research on Greek Economic Growth," 2016.

[86] Ernst & Young, "EY Study on the circular economy in Greece," *SEV Hell. Fed. Enterp.*, 2016.

[87] A. Afshar Jahanshahi, B. Al-Gamrh, and B. Gharleghi, "Sustainable development in Iran post-sanction: Embracing green innovation by small and medium-sized enterprises," *Sustain. Dev.*, 2020, doi: 10.1002/sd.2028.

[88] UNCTAD, "Science, Technology and Innovation Policy Review, The Islamic Republic of Iran," 2016.

[89] M. Ardestani, M. Shafie-Pour, and A. Tavakoli, "Integration of Green Economy Concept into Fossil Fuels (Production and Consumption: Iran)," *Environ. Energy Econ. Res.*, vol. 1, no. 1, pp. 1–14, 2017.

[90] S. Noori, G. Korevaar, and A. R. Ramirez, "Institutional lens upon industrial symbiosis dynamics: The case of Persian gulf mining and metal industries special economic zone," *Sustain.*, 2020, doi: 10.3390/su12156192.

[91] A. Sekrete, "Green Energy for Green Economy: The Case Study of Kurdistan Region of Iraq (KRI)," *Int. J. Soc. Sci. Educ. Stud.*, 2017, doi: 10.23918/ijsses.v4i3p107.

[92] Bloomberg, "Bloomberg Innovation Index," 2020.

[93] OECD, "Economic Survey of Israel," 2020.

[94] Startup Genome, "Global Start-up Ecosystem Report," *The Startup Genome*, 2019.

[95] World Economic Forum, *The Global Competitiveness Report*. 2019.

[96] GIZ, "Jordan's Startup Economy, Assessing the economic contribution and potential of tech and tech-enabled startups," 2019.

[97] Government of Jordan, "Jordan INDC," 2015.

[98] Prime Minister of Jordan, "Government Action Priorities 2020-2021," 2020.

[99] MEMR, "Executive action plan for the comprehensive strategy for the energy sector 2020-2030," 2020.

[100] MoEnv, "National Strategy and action plan for sustainable consumption and production in Jordan 2016—2025," 2016.

[101] MoEnv, "Energy Sector Green Growth National Action Plan 2021-2025," 2020.

[102] M. Al-Ahmad, M. Dimashki, S. Al-Duaij, and T. Roundell, "Harnessing the potential for green growth in Kuwait," 2013.

[103] Kuwait Government, "Kuwait Voluntary National Review 2019. Report on the Implementation of the 2030 Agenda to the UN High-Level Political Forum on Sustainable Development," 2019.

[104] TRC, "The National Innovation Strategy," 2017.

[105] UNCTAD, "Science, Technology and Innovation Policy review," 2017.

[106] The World Bank, "Oman Economic Update," 2020.

[107] M. Daudi Mbaga, "The Prospects of Sustainable Desert Agriculture to Improve Food Security in Oman," *Cons. J. Sustain. Dev.*, 2014.

[108] Y. Y. Ali, M. M. Al-Nusair, F. S. Alani, F. R. Khan, and L. H. Al-Badi, "Employment in the private sector in Oman: Sector-based approach for localization," *Humanit. Soc. Sci. Rev.*, 2017, doi: 10.18510/hssr.2017.511.

[109] World Bank, "Economic Monitoring Report to the Ad Hoc Liaison Committee," 2018. doi: 10.1596/29511.

[110] State of Palestine - Prime Minister's office, "Sustainable Development Goals: Palestinian National Voluntary Review on the Implementation of the 2030 Agenda.," 2018.

[111] KAPSARC, "Green Growth Pathways for Saudi Arabia," Riyadh, 2020.

[112] OECD, "OECD Environmental Performance Reviews: Turkey 2019," 2019.

[113] E. Turhan and A. C. Gündoğan, "The post-politics of the green economy in Turkey: Re-claiming the future?" *J. Polit. Ecol.*, 2017, doi: 10.2458/v24i1.20807.

[114] Ministry of Development, "Turkey's Sustainable Development Pathway Towards Agenda 2030," 2015.

[115] Ministry of Development, "The Tenth National Development Plan 2014-2018," 2014.

[116] IEA, "Energy Policies of IEA Countries: Turkey 2016 Review," 2016.

[117] Garanti BBVA Group - PwC Turkey, "Capital Projects and Infrastructure Spending in Turkey: Outlook to 2023," 2017.

[118] IEA, "Country Report - Turkey: Solar Heating and Cooling Programme," 2016.

[119] FAS, "New Turkish agricultural policy and projected impacts, GAIN Report N. TR6053," Washington DC, 2016.

[120] Ministry for EU Affairs, "IPA I and IPA II Programming," 2017.

[121] TÜBİTAK, "Ulusal Bilim ve Teknoloji Politikaları 2003-2023 Strateji Belgesi," 2004.

[122] IPP, "STI Outlook 2016 Country Profile: Turkey," Washington DC, 2016.

[123] Abu Dhabi Chamber, "Innovation in Abu Dhabi," 2019.

[124] OpenEconomics, "Applying the water-energy-food nexus approach to catalyse transformational change in Africa," 2019.

[125] M. Brownlee, S. Elgie, and W. Scott, "Canada next age, Why clean innovation is critical to Canada's economy and how we get it right - Discussion Paper," 2018.

[126] J. Henriques, C. Ascenço, J. Domingues, and M. Estrela, "How to create incentives for industrial symbiosis while preventing and mitigating implementation risks," 2019.

[127] S. Kaza, L. C. Yao, P. Bhada-Tata, and F. Van Woerden, What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. 2018.

[128] S. ElMassah, "Industrial symbiosis within eco-industrial parks: Sustainable development for Borg El-Arab in Egypt," *Bus. Strateg. Environ.*, 2018, doi: 10.1002/bse.2039.

[129] RES4Africa, "Africa Counts—Renewables and the Water-Energy-Food Nexus in Africa," 2019.

[130] ECODIT, "Enhancing Sustainable Livelihood and Promoting Community Management of Shouf Biosphere Reserve," 2015.

[131] USAID, "Nature, Wealth and Power 2.0," 2013.

[132] R. Nelson, National Innovation Systems: A Comparative Analysis. Oxford University Press, 1993.

[133] K. Pavitt, "National Systems of innovation: Towards a theory of innovation and interactive learning," *Res. Policy*, 1995, doi: 10.1016/0048-7333(95)90017-9.