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## Innovative solutions for environmental challenges and sustainable consumption and production

### Report of the Executive Director

*Summary*

The Executive Director of the United Nations Environment Programme has prepared this report on innovative solutions to environmental challenges and sustainable consumption and production to serve as a background document for discussions during the high-level segment of the fourth session of the United Nations Environment Assembly of the United Nations Environment Programme.

The report focuses on identifying innovative solutions to pressing environmental challenges within the framework of sustainable development that will have a positive impact on society, the economy and the environment and on creating the conditions for an effective transition towards sustainable consumption and production patterns.

Innovative solutions are defined as "business as unusual" approaches, including creative approaches to policy, finance, partnerships, education and the use of data, that help us understand environmental issues and improve sustainability. They are thus not restricted to an intervention or a technological innovation in the traditional sense of innovation. The report provides insights into the enabling conditions for stimulating and strengthening a culture of innovation and presents a summary of the pressing environmental trends as reflected in major environmental assessments. It then proceeds to cover three focus areas: (a) environmental challenges related to poverty and natural resource management, including sustainable food systems, food security and halting biodiversity loss; (b) life cycle approaches to resource efficiency, energy and chemicals and waste management; and (c) innovative sustainable business development in a time of rapid technological change.

The report concludes that innovative solutions and systemic changes towards sustainability in governance models and at various stages of the life cycle of products and services are a necessary condition for achieving sustainable consumption and production and effectively addressing sustainable development challenges. Ultimately, 12 years remain to fundamentally shift global economic systems towards more sustainable trajectories to avoid catastrophic climate change and loss of biodiversity and ecosystems. Such exponential transformation can only be achieved if catalysed and underpinned by innovation at all levels.

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# I. Introduction

## A. Innovation means pursuing solutions to today's problems and embracing a culture that fosters ingenuity

1. Only through innovation can our generation move our world closer to the vision set out in "The future we want", the outcome document of the 2012 United Nations Conference on Sustainable Development.[1] The outcome document affirms that "poverty eradication, changing unsustainable and promoting sustainable patterns of consumption and production and protecting and managing the natural resource base of economic and social development are the overarching objectives of and essential requirements for sustainable development."

2. The key features of an innovative culture are creativity, openness and participation. A culture of innovation cuts across sectors and actors and ensures their right to participation.

3. Several conditions are required to stimulate and strengthen a culture of innovation. They include leadership and governance instruments that reward innovation and circularity while stimulating openness and collaboration; education and continuous capacity-building that facilitate the transition to a knowledge society; and the dedication of finance and technology to sustainability.

4. Countries and businesses alike can boost a culture of innovation and the economy at large by unleashing the creativity and entrepreneurship of women. Countries cannot achieve sustainable development or fully realize their economic potential if half the population is unable to contribute their creativity, skills and entrepreneurship. Such an imperative is grounded in the legal obligation of States to respect, protect and fulfil women's rights and eliminate all forms of discrimination against women. Women's empowerment, particularly in the sustainable development sectors, makes social, business and economic sense.

5. In promoting a culture of innovation, no one should be left behind. This report therefore embraces a holistic, inclusive and participatory approach to development that is underpinned by human rights and recognizes the interlinkages and integrated nature of the 2030 Agenda for Sustainable Development and the Sustainable Development Goals as set out in General Assembly resolution 70/1, entitled "Transforming our world: the 2030 Agenda for Sustainable Development".

6. Our societies, economies and indeed our environment face myriad environmental issues, and a growing number of innovative approaches have been developed to tackle those challenges. This report broaches this broad topic from three focus areas: (a) environmental challenges related to poverty and natural resources management, including sustainable food systems, food security and halting biodiversity loss; (b) life cycle approaches to resource efficiency, energy and chemicals and waste management; and (c) innovative sustainable business development in a time of rapid technological change.

7. This report examines the three focus areas through the lens of innovation, with innovative solutions defined as "business as unusual" approaches. The solutions described herein include creative approaches – in fields as diverse as policy, finance, partnerships, education and the use of data – that improve sustainability and promote better understanding of environmental issues. "Innovation" is meant in the broadest sense of the word, not limited to technology, but rather a mind-set or an enabling culture accessible to all countries and organizations alike, which includes streamlining and simplifying processes and removing barriers to act as an enabler of innovation –"doing different things and doing things differently".

## B. Leadership and governance instruments can promote innovation by stimulating openness and collaboration

8. Governance instruments can help create a cultural framework in which innovation thrives. Getting the right mix of governance instruments to stimulate innovative solutions is crucial.

9. Policy frameworks and governance instruments, driven by leaders who are committed to change, can provide powerful drivers for innovation in the environmental sphere. Effective measures include those that: discourage negative environmental externalities and encourage life cycle approaches; encourage investment in technology, promote research excellence and develop human and

[1] General Assembly resolution 66/288. Available at https://sustainabledevelopment.un.org/index.php?page=view&nr=1102&type=111&menu=35.

knowledge-based capital; use open science and international cooperation to increase economic and social returns on public investment in research; commercialize publicly funded research and introduce research and development tax incentives; promote technologies and practices that have intrinsic exponential growth; and develop infrastructure relating to computing, telecommunications, "big data" and the open internet.[2]

10. Technology and innovation can also support transparency, a critical enabling condition for better governance. Environmental transparency is a fundamental precondition and a catalyst for sustainability, because it generates the data needed to strengthen accountability, stimulate public participation and increase market pressure. A range of technologies, including Earth observation and sensors, can both measure environmental performance and make the data more publicly available. Generating or having access to disaggregated data is at the heart of how citizens can hold their public institutions and private companies to account; it also offers opportunities for innovation. For example, these kinds of data can empower consumers to choose products that have lower environmental footprints across their supply chains. They can also be used to demonstrate whether specific environmental standards have been followed.

## C. Investing in education and making the transition to an inclusive knowledge society can foster a generation that solves global environmental challenges

11. Meeting a constantly evolving skills gap for a dynamic, resource-efficient economy is a leading social issue intrinsically linked to innovation and sustainable development. Effective education and training are proving to be essential enabling conditions for triggering innovation, capturing investment flows and accelerating technological progress. Persistent skills gaps limit the capacity to reduce poverty and create good quality jobs, hindering the universal application of international instruments such as the International Covenant on Economic, Social and Cultural Rights and the Convention on the Rights of the Child.

12. Investing widely in environmental education within the framework of sustainable development, with a strong gender focus, can foster a generation that innovates and adapts more rapidly to innovations that address global environmental challenges. Educational institutions can lead by example by prioritizing education techniques that develop competencies conducive to innovation and innovation management, including creative thinking, design skills, organizational change management and the ability to work in teams to solve problems. Equally important, integrating topics such as green, sustainable chemistry and sustainable business models into existing curricula will help to produce a new generation of scientists and entrepreneurs that can advance the implementation of the 2030 Agenda.

## D. Channelling finance towards sustainable investments is key to accelerating innovation

13. In recent years, substantial progress has been made on financial policy, including banking regulations, pension regulations, insurance regulations and macro-prudential approaches that can catalyse environment-smart investment. National and international efforts to shift the financial flows required to achieve sustainable development through the transformation of the global financial system have been documented and promoted by the Inquiry into the Design of a Sustainable Financial System, launched by the United Nations Environment Programme (UNEP) in 2014.

14. To drive investments in circular, green and low-carbon growth and align global financing and investments with the 2030 Agenda, Governments and regulators must pay increased attention to the "rules of the game" governing financial and capital markets. The finance sector can also adopt responsible banking principles in line with their respective responsibilities. The "Principles for Responsible Banking", launched by the UNEP Finance Initiative in 2018, is a promising and innovative approach that will help banks align their business models with the Sustainable Development Goals and the Paris Agreement on climate change. The six principles provide a clear purpose for the banking industry while enabling stakeholders to compare banks and hold them accountable for their environmental, social and economic impacts. In adopting the principles, banks agree to set public targets to address their most significant negative impacts and scale up their positive impacts to align with national and international sustainable development and climate targets.

[2] Organization for Economic Cooperation and Development, *The Innovation Imperative: Contributing to Productivity, Growth and Well-Being*. (OECD Publishing, Paris, 2015). Available at https://doi.org/10.1787/9789264239814-en.

[2] International Resource Panel 2017 Assessing global reuse: A systems approach to resource efficiency and pollution reduction.

15. Some national, international and multilateral banks are already paving the way to that approach. Two examples are the Sustainable India Finance Facility, supported by BNP Paribas, which unlocks capital from investors and private finance institutions to channel resources into overlooked environmental sectors with positive transformative potential in India, and the credit line of R$1,500 million ($400 million) established by Banco Regional de Desenvolvimento do Extremo Sul to support the implementation of Brazil's national sustainable consumption and production plan. These credits, which are directed to small and medium sized enterprises, have all been taken up by the private sector.

16. Despite the progress in mobilizing finance, one persistent challenge is that business models for environmental products and services, particularly those that target low-income households or overlooked regions (such as solar lamps, clean cookstoves, next-generation toilets and drip irrigation systems), often face a major obstacle in the form of "middle-men" and up-front costs, even when products pay for themselves relatively quickly and offer other benefits. Promoting standardization can also trigger virtuous network effects and establish and disseminate, in an accessible way, new approaches to deal with long-standing challenges. This includes broader adoption of smart, "frugal" innovations that could have a substantial positive environmental impact with very limited investments.

17. While extractive industries and industrial-scale agriculture can help lift people out of poverty, operations must be sensitive to the biodiversity values and ecosystem services on which local communities and wildlife rely heavily. Hence, inclusive and integrated land-use planning processes and implementation of biodiversity-friendly business practices are required if such economic activities are to be accommodated in areas of high biodiversity. The most sensitive ecosystems and biologically-rich areas should be protected, ideally through designation as off-limits for habitat modification.

# II. Evidence from the latest global assessments[3]

## A. The time to change is now

18. We live on a rapidly warming, polluted planet that is quickly losing its biodiversity. The world continues to use a growing amount of resources to such an extent that we have now surpassed several of the ecological thresholds mapped by science. Pollution-related costs have been estimated at $4.6 trillion annually. The global health benefits of reducing air pollution and achieving the 2°C target of the Paris Agreement could be as high as $54.1 trillion dollars, at a global cost of only $22.1 trillion.

19. The median projected population is expected to rise to almost 10 billion by 2050 and more than 11 billion by the end of the century.[4] If the population increase is linked to rising levels of consumption, the pressures on global resources will be greater than at any other time in human history, creating competition for resources and overstretching the planet's regenerative capacity. Of these 10 billion people, 6.5 to 7 billion will live in cities and 2 to 3 billion will live in informal settlements in these cities. Innovative solutions will need to consider issues of equity and equitable distribution to this large population living and working in informal sectors.

[3] UNEP, *Global Environment Outlook 6* (publication pending).

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, *Summary for Policymakers of the Assessment Report on Biodiversity and Ecosystem Services for: Asia and the Pacific; the Americas; Africa; and Europe and Central Asia*; and *Summary for Policymakers of the Assessment Report on Land Degradation and Restoration* (IPBES secretariat, Bonn, Germany, 2018). Available at www.ipbes.net/event/ipbes-6-plenary.

United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, *Global Land Outlook*. (Bonn, Germany, 2017). Available at www.unccd.int/actions/global-land-outlook-glo.

Intergovernmental Panel on Climate Change, *Global warming of 1.5 °C: summary for policymakers*. (Switzerland, 2018). Available at https://www.ipcc.ch/report/sr15/.

International Energy Agency, *World Energy Outlook 2018*. Available from https://webstore.iea.org/world-energy-outlook-2018.

Food and Agriculture Organization of the United Nations, *The State of Food and Agriculture 2018: migration, agriculture and rural development*. (Rome, 2018). Available at www.fao.org/publications/highlights-detail/en/c/1157519/.

International Resource Panel, *Assessing global resource use: A systems approach to resource efficiency and pollution reduction*. (Nairobi, 2017). Available at http://resourcepanel.org/reports/assessing-global-resource-use

UNEP, *Towards a pollution-free planet: Background report*. (Nairobi, 2017) Available at www.unenvironment.org/resources/report/towards-pollution-free-planet-background-report.

20. To feed the world's population in 2050, agricultural production will likely need to increase by 50 per cent, while the environmental impact of food production will need to decrease by two thirds. Much of the environmental impact is caused by meat production, with 77 per cent of agricultural land currently linked to the production of meat. Cutting global food waste, currently at 33 per cent, would also increase food security.

21. Climate change is a threat multiplier. Increases in atmospheric greenhouse gas concentrations have put the world on an extended warming trajectory that, without rapid decarbonization, are projected to lead to sea-level rise, ocean warming and acidification and increases in the frequency and severity of extreme weather events such as severe flooding and wildfires and the spread of zoonoses and infectious diseases.

22. Climate change can also amplify existing risks, especially in States that lack the institutional capacity to plan and sustainably manage natural resources. In such States, climate change may contribute to fragility and conflict, with the poor and vulnerable most deeply affected.

23. Pollution today is pervasive and persistent. Pollution is not a new phenomenon; it is largely controllable and often avoidable, but considerably neglected. A major step forward was achieved in 2017 with the adoption of the ministerial declaration of the United Nations Environment Assembly at its third session, entitled "Towards a pollution-free planet". Nevertheless, air pollution causes economic losses of $5 trillion annually and remains a major environmental contributor to the global burden of disease, causing approximately 7 million premature deaths annually, including 4 million due to ambient air pollution and 3 million to indoor air pollution. Exposure to air pollution is highest in low-income and middle-income countries, especially among the 3 billion people who rely on burning wood, charcoal, crop residue and manure for heating, lighting and cooking. Under international law, States have obligations to prevent foreseeable harm to human rights caused by environmental degradation. Nevertheless, the international community has not adequately addressed environmental harms.

24. Over the last two decades, approximately 20 per cent of the Earth's vegetated surface have shown persistent declining trends in productivity owing to climate change, biodiversity loss and poor management practices. Land degradation decreases resilience to environmental stresses, which has a direct impact on women and children and the poor, leading to intense competition for scarce natural resources and an irreversible and continuing decline in genetic and species diversity. Total global ecosystem services have been valued at $125 trillion per year, while the value of lost ecosystem services between 1995 and 2011 has been estimated at between $4 trillion and $20 trillion.

25. Freshwater ecosystems are important for providing basic life-giving services such as drinking water and sanitation. It is therefore of great concern that 40 per cent of the world's wetlands have been lost since 1970 owing to land-use changes. Agriculture continues to account for 70 per cent of the world's water withdrawals.

26. Peatlands and the permafrost regions of the world are also being lost; one study estimated that 15 per cent of global peatlands had been drained by 2015. These ecosystems are vital to the global climate, not only because of the volume of water they store, but also for the vast quantities of greenhouse gases stored in peat.

27. Coral reefs and other acidity-sensitive and temperature-sensitive marine ecosystems are under threat from climate change, and many reefs have been irretrievably damaged by chronic bleaching. Marine pollution in the form of litter and plastics is estimated to be increasing by 8 million metric tons annually. The damage caused by plastics to marine species has been widely reported, but accurate mortality rates have yet to be determined. Overfishing of much of the fish stocks continues to be a problem, putting at risk the health of fish stocks, the livelihoods of those who depend on fishing and aquaculture and the nutrition of the estimated 3.1 billion people who depend on marine species for 20 per cent of their protein.

28. Global material resource use continues to grow. Metal ore extraction and metal production increased threefold from 1970 to 2010, with the steepest increase occurring from 2000 to 2010, driven mainly by the industrialization and urbanization of emerging economies. Resource use is expected to reach nearly 90 billion metric tons in 2017 and could more than double from 2015 to 2050, with high-income countries currently consuming ten times more per person than low-income countries.[5] Globally, two out of every three people lack access to controlled waste disposal facilities.

## B. Decoupling economic growth from environmental degradation is indispensable for achieving the Sustainable Development Goals

29. Given the projected population growth,[5] it will be necessary to decouple economic growth and negative environmental impact if we are to achieve the Sustainable Development Goals. For example, the current rate of decoupling of carbon dioxide emissions from economic growth (i.e., GDP) will need to triple if we are to meet the ambitious targets of the Paris Agreement, namely, to limit temperature increase to well below 2°C.

30. Environmental challenges are interconnected and must be addressed at a systemic level rather than simply one by one. A first step in addressing our most pressing environmental challenges is to recognize their systemic nature. As the sixth Global Environment Outlook report shows, focusing on one policy at a time, such as emissions abatement or resource efficiency, cannot effectively mitigate negative environmental effects. Innovative solutions that address systems rather than issues – such as changes to governance and business models or our way of living – can reduce the environmental pressures associated with unsustainable consumption and production. However, implementing such solutions requires investment, guided innovation and well-designed policies.

31. For example, designing more durable and non-toxic products that are easier to disassemble and recycle reduces pressure on landfills and can create local markets. There is also good evidence that agroforestry schemes, where food trees or specialized product trees are planted among crops, can both sequester carbon and improve the nutrition levels and livelihoods of smallholder farmers. Lifetime extension policies that aim to increase the effective service life of products or parts can reduce the material and carbon footprint of such products while allowing consumers to enjoy their services for a longer time.

32. It is not enough to optimize products and production processes if consumers do not align with this effort. Policies to encourage sustainable consumption need to go hand in hand with innovation to promote more resource-efficient, climate-friendly production and design. Knowing about hazardous chemicals in the supply chain is an important factor in ensuring non-toxic material cycles.

33. The production, use, recycling and disposal of chemicals are also cause for concern. Driven by global megatrends, the production, use and trade of chemicals continues to grow in all regions. Available information shows that chemical releases to indoor and outdoor environments continue at a large scale. Some products in everyday use, such as cosmetics, plastic containers, household cleaners and pesticides, contain hazardous chemicals that are known to interfere with human and environmental health. These chemicals are found in lakes, rivers, wetlands and water systems. Based on data available for only a small number of chemicals, the World Health Organization estimates that 1.6 million lives and 45 million disability-adjusted life years were lost in 2016 due to exposure to selected chemicals. Chemical pollution also threatens ecosystem functions. Given the knowledge gaps and uncertainties, however, the future trends and impacts are uncertain.

34. While many countries have made significant strides in managing chemicals, not all hazardous manufactured chemicals are systematically regulated, particularly in low-income and middle-income countries. Current legislation in many countries is lacking or insufficient to handle the risks of chemicals accumulating in the environment or being transmitted to remote parts of the planet, such as the polar region, deep oceans and high mountains. In addition, the current data gaps and assessment methods fall short of allowing assessment of the impacts of exposure to multiple chemicals or over the life cycle of chemicals.

35. The mining sector will play an important role in the transition to a low-carbon future and the adoption of green economy strategies. The technologies required to facilitate these shifts, including wind turbines, solar panels and improved energy storage, all require significant mineral and metal inputs. Notably, a significant amount of the minerals and metals needed for green technology are sourced from fragile States (ranging from 20 to 70 per cent); in the future, however, they may come from deep-sea beds. Where and how these materials are sourced will determine whether this transition supports peaceful, sustainable development or reinforces weak governance, potentially exacerbating tensions or conflicts, in the countries with strategic reserves.

[5] International Resource Panel, *Assessing global resource use: A systems approach to resource efficiency and pollution reduction*. (Nairobi, 2017). Available at http://resourcepanel.org/reports/assessing-global-resource-use.

### C. Scenario thinking and data modelling can inform smart policies and improve decision-making

36. Comprehensive long-term and real-time environmental monitoring systems are key to anticipating risks and promoting action at all levels. Continually improving such innovative systems and encouraging their adoption is thus critical to managing today's environmental challenges. Scenario thinking and integrated analysis of environmental data draw on both traditional and new sources of information (including remote sensing, citizen science and, increasingly, the use of artificial intelligence and big data analysis). Such tools can help us to explore interactions across domains. By drawing on such data, policymakers can develop targeted policy packages to forecast risks, promote shared governance of natural resources and foster greater resource efficiency.

## III. Environmental challenges related to poverty and natural resource management, including sustainable food systems, food security and halting biodiversity loss

### A. Food systems are putting increasing pressure on our environment

37. The environmental impact of unsustainable agricultural practices costs an estimated $3 trillion per year. A growing global population, a degraded natural resource base and food losses and waste, together with unsustainable trends in the consumption and production of food, combine to pose a serious threat to the global food system. Climate change is seriously exacerbating these threats.

38. Most of the external costs associated with unsustainable agricultural practices go unnoticed and unaccounted for, as they do not have a market price. The exclusion of both positive and negative externalities leads to over-pricing and under-pricing of food, which in turn distorts rational policy responses, as well as the individual decisions and actions of food producers, retailers and consumers. Acute resource inefficiencies in the way our food is harvested, processed, marketed and consumed exacerbate these unsustainable production and consumption trends. Together, these inefficiencies result in the loss or waste of approximately 30 per cent of all food produced globally.

39. Livestock is the largest source of agricultural anthropogenic methane, which has an acute effect on the global climate system. The main source of these emissions, enteric fermentation, is increasing rapidly. The Climate and Clean Air Coalition to Reduce Short-lived Climate Pollutants, working together with the Food and Agriculture Organization of the United Nations (FAO) and the World Bank, has underscored the mitigation potential of enteric methane. The three organizations are promoting cost-effective solutions that allow farmers to reduce the intensity of emissions related to enteric fermentation while improving the productivity of their ruminants, thus supporting food security and strengthening their livelihoods. Countries such as Bangladesh, Ethiopia and Uruguay are implementing these solutions in the context of the long-term sustainable development of their agricultural economies.

### B. Food systems are failing to provide for the world's food-insecure people, both in terms of agricultural yield and nutritional quality

40. Maximizing agricultural productivity is critical to eradicating poverty, creating income opportunities, enhancing inclusive socioeconomic growth and reducing vulnerabilities across the globe. Over 500 million smallholder farmers provide food for two thirds of the Earth's growing population. Achieving a zero-hunger world by 2030 depends on increasing smallholder productivity and mitigating crop loss from pests, diseases and post-harvest losses. In addition, agriculture employs most of the world's poor, implying that maximizing its productivity is critical to creating income opportunities, enhancing inclusive socioeconomic growth and reducing vulnerabilities across the globe.

41. Despite the world producing enough calories, undernutrition remains the greatest cause of premature mortality and is one of the greatest impediments to children reaching their potential. Nearly 46 per cent of deaths in children under 5 are attributable to undernutrition. This translates into an avoidable loss of about 3 million young lives a year. Approximately 800 million people are hungry, yet at the same time, 1.6 billion people are classified as overweight or obese. It could be assumed that those who are hungry are mostly in developing countries, with obesity as a developed country problem, but the reality is different. The double burden of malnutrition and overconsumption is increasingly evident in many low-income and middle-income countries, where both extremes often coexist within the same community.

42. The global phenomenon of a nutrition transition, where diets high in carbohydrates and processed meats replace healthy diets, is not only affecting human health, it is also changing farming systems as they become more intensive. This shift carries clear implications for biodiversity and the resilience of ecosystems and the ecosystem services on which our lives depend.

43. Long-term global food security depends largely on a shift towards sustainable food systems. Sustainable food systems offer a holistic, integrated way to address food security, environmental health and human well-being that can be applied to all countries at the national and local levels.[6]

44. Food systems need to function within the context of a finite, shrinking resource base. They need to deliver increasing productivity while utilizing natural resources in a sustainable manner and conserving ecosystems and biodiversity. FAO estimates that by 2050, to satisfy the demand of a growing and richer population with higher levels of meat consumption, food production must increase by at least 60 per cent from its current level. This additional pressure on supply growth can be reduced significantly by improving production efficiency, increasing yields, influencing dietary trends and reducing food losses and waste.

## C. Sustainable food systems offer a holistic, integrated way to address food security, environmental health and human well-being

45. Sustainable food systems facilitate the production and consumption of sufficient, nutritious food in an affordable way. This approach is accessible to all countries at the national and local levels.

46. Transitioning to more resilient, sustainable food systems concerns all the interrelated activities that go into producing and consuming food. The "systems" approach is therefore rooted in an understanding of these linkages, the interactions among them and the policy levers and options available to all actors in the sector.

## D. Embracing a holistic approach to food security and nutrition at all levels will help to eradicate poverty and achieve multiple Sustainable Development Goals

47. A "food systems" approach to policymaking allows food system actors across the whole life cycle to take a holistic view that values resource use efficiency, food security and nutrition, and environment and health, as well as ensuring the equitable distribution of economic benefits throughout the supply chain. It also recognizes the role of global consumption trends as a driver of the way food is produced. If sustainable food system policies are designed and implemented in a systemic way, we will be able to achieve at least 12 of the 17 Sustainable Development Goals. A holistic approach requires cross-sectoral alignment and coordination, such as among agriculture, environment, health, business development, education and employment.

48. Maximizing the sustainability, productivity and efficiency of the agricultural sector, particularly in developing countries, has the catalytic potential to accelerate the type of inclusive growth that can pull people out of extreme poverty and hunger. Orchestrating such a transformation calls for an urgent shift to a more holistic approach to agriculture.

## E. We can create the momentum to reduce food losses and halve waste among consumers and promote healthier, more sustainable diets

49. As a key aspect of a holistic, integrated approach to food systems, Governments must start measuring their food waste. A common system of measurement and protocols, such as the Food Waste Index currently under development by UNEP and FAO, can provide an effective means of measuring waste for both retailers and consumers; the index can also help to identify the causes of waste.

50. Partnerships and voluntary agreements with the private sector can help to reduce food waste and facilitate changes to date labelling and consumer shopping habits and behaviour at the household level. Working with players in the food industry and bearing in mind their national circumstances, Governments can develop policies or regulatory measures to reduce their food waste.

## F. We need to invest in resilient, climate-smart agriculture and sustainable value chains

51. Governments can lead by supporting partnerships with private actors and creating conditions that encourage investment in resilient, climate-smart agriculture and sustainable value chains. Relevant examples in this regard are the Sustainable Rice Platform, the Biodiversity and Agricultural Commodities Programme, the Global Alliance for Climate-Smart Agriculture and the Good Growth Partnership. In such cases, companies interested in promoting environmentally sound technologies and

best practices collaborate with civil society organizations, academics and local communities to seek innovative solutions. The One Planet Network Sustainable Food Systems Programme, established under the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, also functions as a global multi-stakeholder partnership to accelerate the transition towards sustainable food systems.

52. In collaboration with the Climate and Clean Air Coalition, some countries are implementing practical solutions for their agricultural systems. Viet Nam, for example, is using "alternate wetting and drying" in rice cultivation, a less resource-intensive alternative to growing rice in continuous standing water. This has been proven to reduce methane emissions by 48 per cent; it also allows farmers to save money, as it improves the quality of the soil and requires one third less water than the traditional method.

53. Governments can also reduce the environmental impact of food consumption by adjusting national dietary guidelines and related nutrition policies. Additional measures that can be considered include the promotion of sustainably raised and grown foods, including sustainably produced plant-based meals in public institutions, such as schools and hospitals, and increased dialogue with private sector companies to encourage them to improve the nutritional quality of their food.

54. Through rapid advances in ready-to-use technologies, we are beginning to see innovative solutions to complex food system challenges that have hitherto proven intractable. These include food traceability and certification, crop monitoring, pest and disease prediction and climate monitoring. Technology convergence has led to a wide range of innovative digital solutions supported by public-private partnerships. By using new technologies to measure food loss, Governments and industry actors can identify the steps in their supply chains that require targeted intervention.

55. Equally relevant, indigenous knowledge, integrated pest management, permaculture and agroecology are effective means of maintaining (and in some cases increasing) yields, while empowering local communities and protecting workers and the environment by minimizing the use of highly hazardous pesticides.

56. The Economics of Ecosystems and Biodiversity for Agriculture and Food has developed a comprehensive, inclusive evaluation framework for agri-food systems that adopts a multiple-capitals approach and accounts for the myriad externalities and impacts across the agri-food value chain, including human health.[6]

### G. Individual actions can go a long way towards achieving sustainable food systems

57. Individual changes and actions can also add up to major reductions in food waste, less climate change impact and a healthier environment. They can also help to stimulate a vibrant, diverse smallholder production sector that can thrive alongside agribusiness. The most significant changes that individuals and households can make are to reduce food waste and opt for sustainably raised and grown foods, including sustainably produced plant-based meals.

## IV. Life cycle approaches to resource efficiency, energy and chemicals and waste management

### A. Life cycle approaches and strategies are essential tools for decoupling economic activity and human well-being from resource use and negative environmental impacts

58. Life cycle approaches are essential tools for informing innovation to improve resource efficiency, promote sustainable consumption and production and encourage the efficient management of energy, chemicals and waste. For many years, industry players have successfully used such approaches to identify and address "hotspots" in their value chains. This has allowed them to ramp up production without necessarily using more resources or increasing their impact on the environment. Life cycle approaches can also help to identify the sectors responsible for bigger shares of an economy's environmental footprint.

[6] The Economics of Ecosystems and Biodiversity. *Measuring what matters in agriculture and food systems: a synthesis of the results and recommendations of TEEB for Agriculture and Food's Scientific and Economic Foundations report*. (Geneva, UNEP, 2018). Available at http://teebweb.org/agrifood/measuring-what-matters-in-agriculture-and-food-systems/.

59. Life cycle approaches provide intelligence on the environmental (and often social) impact of production and consumption systems. As such, these approaches are essential to informing sustainable business models and other innovative solutions that can advance circularity in our economies. Life cycle approaches can also help to identify effective actions for mitigating climate change in the context of nationally determined contributions. The systemic information provided by life cycle approaches allows decision makers to understand the trade-offs between social, environmental and economic impacts, thus accelerating progress towards more sustainable consumption and production patterns and advancing the 2030 Agenda.

60. Regardless of their stage of development, countries with policies that encourage the decoupling of economic activity and human well-being from resource use and environmental impact have improved the quality of their citizens' lives, created jobs and achieved better socioeconomic outcomes than countries that have followed a business-as-usual approach over the long term. In many cases, they have also avoided shifting burdens between sectors, regions and resources.[7]

61. Policymakers have multiple policy instruments at their disposal for developing and implementing a balanced, comprehensive strategy for enhancing resource efficiency and improving the management of energy, chemicals and waste based on life cycle approaches. These include energy-efficiency subsidies, eco-taxes, product sustainability requirements and various voluntary schemes and policies. Each of these instruments has strengths and limitations; one instrument on its own may not be sufficient to lead to a systemic transformation. What makes them effective – in terms of driving sustainable consumption and production and building circularity in our economies – is their ability, when used in combination, to address systemic issues and barriers.

62. The right mix of policy instruments must be accompanied by an effective implementation plan and monitoring measures. Only then will the instruments succeed in accelerating innovation for sustainable consumption and production.

## B. Regulations can be used to set environmental targets or to mandate or prohibit specific practices

63. By setting stringency levels and applying life cycle approaches, regulatory policy instruments provide a level playing field for all economic actors. They are normally combined with a monitoring mechanism and sanctions for non-compliance. By providing a clear signal across the market, regulations can also help focus various parts of the system towards a common direction of change.

64. The regulations on single-use plastics announced by the European Union and implemented by numerous developed and developing countries alike have helped to create joint action by retailers, waste managers, consumers and entrepreneurs to find and disseminate alternatives and adjust common behaviours. Such regulations have triggered innovative changes to the design, production, consumption and disposal of plastics, contributing to more resource efficient, sustainable use of resources, reducing pollution and accelerating the transition to circularity in our economies.

65. An international commitment to work towards phasing out single-use plastics, starting with plastic bags, straws, plates, cups and cutlery as early as 2025, to be implemented taking into account national circumstances, would bring to scale existing efforts by all actors in the plastics value chain, including in the private sector, to find or scale up affordable, eco-friendly alternatives.

## C. Public procurement policies can stimulate demand for sustainable products

66. In some countries, public purchases represent 10 to 15 per cent or more of national GDP. In this respect, government has considerable purchasing power and can create significant market demand for innovative products and services.

67. Sustainable public procurement can be understood as the process through which public organizations meet their needs for goods, services, works and utilities in line with national policies and priorities, in a way that achieves value for money on a whole life cycle basis, in terms of generating benefits not only to the Government making the purchase but also to society and the economy, while significantly reducing the negative impact on the environment. Sustainable public procurement can accelerate the shift to sustainable patterns of consumption and production.

[7] International Resource Panel, *Re-defining Value – The Manufacturing Revolution. Remanufacturing, Refurbishment, Repair and Direct Reuse in the Circular Economy*. (Nairobi, 2018). Available at http://www.resourcepanel.org/reports/re-defining-value-manufacturing-revolution; *Assessing Global Resource Use. A systems approach to resource efficiency and pollution reduction*. (Nairobi, 2017). Available at http://www.resourcepanel.org/reports/assessing-global-resource-use.

68. Engaging all countries to incorporate sustainability into their public procurement and increasing the level of ambition in those countries that have policies in place will drive innovative solutions for sustainable consumption and production.

69. Sustainable procurement strategies in the private sector are also gaining momentum. A growing number of retailers, product manufacturers and manufacturing companies are adopting measures to include sustainability objectives in their corporate policies and supply chain management and procurement processes, to reduce the use of chemicals of concern, for example.

## D. New governance approaches and partnerships are required to support the transition to sustainable consumption and production

70. Achieving sustainable patterns of consumption and production requires cooperation across a wider range of government agencies, strategic macro-level planning of the necessary supporting infrastructure and more successful, larger-scale public-private partnerships than have generally been seen to date. Both of these types of collaboration are key enablers for the achievement of the Sustainable Development Goals. Current institutions in government and indeed in other organizations are not constructed to reflect the transversal nature of these objectives, however, nor necessarily to design the policies, practices and partnerships necessary to achieve them.

71. One example of how an innovative partnership is working to bring global and local benefits can be found in clothing and footwear, an industry valued at $2.5 trillion to $3 trillion that employs approximately 60 million people worldwide. As a major economic sector, the clothing and footwear industry has an essential role to play in achieving the Sustainable Development Goals. There is an urgent need to place improvement of the fashion industry's environmental, social and ethical footprint on the global sustainable development agenda. The industry produces nearly 20 per cent of global wastewater and emits more carbon emissions annually than all international flights and maritime shipping combined. The clothing and footwear industry has been identified in recent years as a major contributor to the plastic pollution in our oceans that seriously threatens marine ecosystems. A third of all primary microplastics in our oceans come from washing textiles, including our clothes. Some forms of "fast fashion" are also linked to unfair labour standards and dangerous working conditions due to the unsafe processes and hazardous substances used in production.

72. The United Nations Alliance for Sustainable Fashion is an innovative approach by the United Nations, specialized agencies and international and regional organizations to put textiles and fashion on a path to long-term prosperity financially, socially and environmentally. The alliance aims to enhance collaborative action to make the topic more prominent among Member States of the United Nations, the industry and the public.

## E. We must support Governments and other stakeholders to act on the ground

73. More efforts need to be made to raise awareness of the benefits and impact of sustainable consumption and production and its role in addressing key environmental and societal challenges as called for in the Sustainable Development Goals. Spreading this message can help to catalyse ambitious action by Governments and other stakeholders on the ground.

74. At the global level, the One Planet Network is a key global multi-stakeholder partnership anchored in the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns and its six thematic programmes adopted at the United Nations Conference on Sustainable Development. The network has 611 partners grouped into six programmes: food, buildings, tourism, public procurement, consumer information and sustainable lifestyles. Its strategy for the period 2018–2022 focuses on supporting the achievement of Sustainable Development Goal 12 (ensure sustainable consumption and production patterns). More than 20 United Nations entities and 130 national focal points are engaged in the network, which has a strong focus on implementing and scaling up existing policies and practices. A global commitment to implementing the network's strategy is required to support innovation and the development of more sustainable value chains in developing countries.

## F. Research and innovation are key to strengthening life cycle management and resource efficiency

75. The capacity to understand and apply life cycle approaches is needed on several fronts. The International Resource Panel is one of the most authoritative sources of knowledge, with strong links to research and development based on life cycle approaches in relation to resource efficiency and global resource management.

76. The Life Cycle Initiative is another example of a public-private, multi-stakeholder partnership that is helping both public and private stakeholders to apply life cycle knowledge. This initiative has

been working since 2002 to enhance the enabling conditions for global application of life cycle approaches, such as improved access to and interoperability of life cycle assessment datasets, consensus on impact indicators and guidance and capacity development, especially in developing countries.

77. With the objective of strengthening and streamlining existing international initiatives aimed at achieving internationally agreed life cycle management and resource efficiency targets and indicators, including those relevant to the Sustainable Development Goals, the visibility and authority of the International Resource Panel could be enhanced if the panel were to provide regular reports to the Environment Assembly and other international forums on progress in achieving resource management-related goals and targets.

### G. Transparency can unlock practical, affordable and innovative environmental solutions and open opportunities for sustainable investments

78. Considerable attention has so far been focused on policies and capacity-building activities to promote the shift to sustainable consumption and production patterns, but less on redirecting public and private financial investments to support this shift. Increasing the actual uptake of sustainable consumption and production will require substantially greater financial investment with the same objectives, from both public and private sources.

79. Some national and multilateral development organizations are paving the way on this front, notably in the disbursement of climate change funds; examples include the Climate Investment Funds, the Global Environment Facility and the Green Climate Fund. The African Development Bank has identified the potential to scale up projects managed by National Cleaner Production Centres with this type of finance, to support more enterprises in more locations. The bank also manages funds drawn from other international financial institutions, and there are further opportunities to access finance from entities such as the Sustainable Energy Fund and the African Climate Change Fund to support the shift to sustainable consumption and production patterns. There is a need to explore these opportunities more actively, in conjunction with private investors, considering the importance of effective environmental and social safeguards

80. Creative financing options can also help to facilitate the uptake of environmental solutions. “Innovative financing” is less about how instruments are used and more about addressing specific market failures, risk-sharing and risk transfer among various parties and coordinating sources of public and private financing. To this end, greening the financial system to support environmental innovation will increasingly depend on the development of open-access, standardized systems and platforms that allow companies and financial institutions to report on environmental, climate and sustainability performance in an open, accessible manner. Innovative governance approaches also show promise. For example, the Extractive Industries Transparency Initiative extends the concept of transparency beyond financial aspects to include social and environmental performance. By increasing transparency, such approaches improve authorities’ ability to manage disputes and thus reduce the scope for conflict over scarce natural resources.

## V. Innovative sustainable business development at a time of rapid technological change

### A. Rapid technological change, if managed properly, can help unlock a vast set of opportunities to widen prosperity and generate long-term sustainable value from innovative solutions that encourage natural systems to flourish and entrepreneurship to grow

81. Innovative sustainable business represents a trillion-dollar opportunity for companies that can bring value to people and the environment. Since our consumption and production patterns must change so radically, companies can seize the opportunity to drive change by embracing emerging innovative technologies that, for example, support standardization, sustainable production and transparency across the value chain.

82. Technological change includes new and powerful tools that can help to realize the vision of the 2030 Agenda.[8] The report of the Secretary-General on harnessing new technologies to achieve the Sustainable Development Goals points out the potential of these technologies to advance human well-being but also to generate more inequality and more violence, with significant implications for the protection of human rights.[9]

## B. We need to support innovative business models that work for people and the planet

83. Businesses that adopt sustainable innovative business models create significant value for themselves and for society.[10] Such new approaches appeal to businesses because they allow them to: reach new markets and customers, including low-income consumers; access untapped demand by providing a solution that exists nowhere else in the market; and enjoy resource efficiency benefits that multiply across their entire supply chain. The desire to stay ahead of new, more stringent regulations and standards is also an important incentive for change. Cooperation with actors in the value chain in "open innovation" schemes is also helping business to acquire and develop innovation capabilities and resources.

84. Innovative business models that address major societal challenges require a systematic, system-wide perspective. As such, policies should not only regulate and provide incentives, they should also aim to mobilize a variety of stakeholders, facilitate productive partnerships and promote competition to determine the most effective solutions.

85. Companies of all sizes are applying innovative models that have also stimulated the creation of many start-ups. Innovative models have been developed to, among other things, improve asset-sharing; provide products as services; promote closed-loop resource recovery; make supply chains more circular; digitize production processes; and extend product lifespans. Innovative business models such as these can support companies in building circularity into their production processes and along their supply chains, both of which will help ensure long-term system-wide progress in the fight against pollution. This could entail introducing fully renewable, recyclable or biodegradable materials that can be used in consecutive life cycles. Other innovative business models might concentrate on recovery and recycling, which can help create systems that capture and reuse valuable material from products that have been discarded.

86. Consumers may discard products that they no longer want to own but that still hold considerable value. Product lifetime extension business models seek to recapture such value through repairs, upgrades or remanufacturing.[11] An additional approach to promoting longevity, reliability and reusability is through the "product as service" business model. In this case, consumers lease or pay for the service offered by the product rather than the product itself. This can enhance performance and durability and help to build a more responsive relationship with consumers.

## C. We need to harness the power of businesses and citizens as active co-creators and problem solvers

87. As the world's middle class gets richer, more populous and more mobile, the global appetite for commodities, meat, fish and natural resources will grow, with negative impacts in terms of greenhouse gas emissions, water and land use. Of the estimated 90 billion tons of resources used in 2017, more than 50 per cent was dispersed or emitted as waste and less than 10 per cent was cycled back into the economy. Product lifetimes have shortened and a throwaway culture has become the norm. With the global increased demand for electronics, e-waste will also continue to be a growing challenge. Thus, there are significant market opportunities for innovative business solutions that promote sustainable consumption and production through the adoption of low-carbon lifestyles.

88. Individuals, citizens and faith-based initiatives need to be fully engaged in this systemic transformation. New lifestyle trends are emerging, ranging from people going "zero waste" and

[8] General Assembly resolution http://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/73/17 on the impact of rapid technological change on the achievement of the Sustainable Development Goals and targets.

[9] E/2018/66.

[10] UNEP, *The Business Case for Eco-innovation*. (2014) Available at http://wedocs.unep.org/handle/20.500.11822/10613.

[11] International Resource Panel, *Re-defining Value – The Manufacturing Revolution. Remanufacturing, Refurbishment, Repair and Direct Reuse in the Circular Economy*. (Nairobi, 2018). Available at http://www.resourcepanel.org/reports/re-defining-value-manufacturing-revolution.

business building a sharing economy to the use of digital technologies to measure progress and make sustainability more accessible. Such trends – amplified by the support of celebrities, faith leaders and the like – are helping to inspire behavioural changes that can make our economies greener and more circular.

### D. We must invest in data-sharing and participatory science

89. Open science and data-sharing provide access to publicly funded research by disseminating knowledge on digital platforms with little or no restrictions. Treating public research and environmental information as a public good enables people to appreciate a clean environment as the enabler of a prosperous life. It also opens new market opportunities, particularly for small and medium-sized enterprises.

90. By allowing researchers and users to tap into vast data resources, open data and data-sharing are opening new, unanticipated avenues of discovery and enterprise by combining data streams, avoiding duplication and ensuring that claims can be scrutinized.

91. There have recently been two important developments in participatory science: mobile technology is increasingly used to crowdsource information and create awareness of pollution, and open-source technologies are being used to develop solutions to improve product transparency, including labelling systems and digital product resource passports. For example, one of the key challenges in the provision of commercial environmental data for companies is how to move from a high unit cost with a low number of users to a low unit cost with a global network of users. It can be extremely difficult to make this jump while minimizing start-up costs and maintaining the commercial value of the data. Another challenge is establishing the correct mix of incentives to spur companies to publish and share relevant non-commercial environmental data.

### E. Governments, companies and citizens should consider how a digital ecosystem for planetary data will be built, financed and governed to benefit the environment

92. Data and information have become two of the world's most valuable resources. Given Principle 10 of the Rio Declaration on Environment and Development, Governments, companies and citizens should consider how a digital ecosystem for global environmental data will be built, financed and governed. In order to make innovation sustainable, we need to ensure fair, open access to knowledge and relevant environmental information.

93. While some mechanisms exist for sharing critical information and knowledge about solutions within the environmental community, there is a need for a global environmental data strategy under the auspices of the United Nations, building on the Addis Ababa Action Agenda of the Third International Conference on Financing for Development. Such a strategy could have three main functions: first, to support the provision of comprehensive, open environmental data and information; second, to prioritize innovations and measures that coherently address environmental, health and economic benefits and costs, including the cost of inaction and gender impacts; and third, to strengthen strategic partnerships and collaboration and enhance initiatives that catalyse and accelerate positive change.

## VI. Fundamental change for a regenerative planet

94. We urgently need system-wide transformations based on innovation, circularity and sustainable consumption and production, as well as green investments to reduce waste and pollution. Delivering impact often involves system-wide, multi-benefit policymaking that ensures implementation and protects the very poor and vulnerable. The steps proposed by the International Resource Panel constitute a useful guide for member States in this context.[12]

95. New ideas and knowledge, technologies and business processes are providing solutions to some of society's greatest problems: food insecurity, pollution, biodiversity loss and resource scarcity. Some of these solutions have the potential to shift our economies to more sustainable patterns of production and consumption. To ensure that this happens, the following four actions are needed:

(a) Society needs to foster a culture of innovation that spans sectors and actors;

[12] International Resource Panel, *Assessing Global Resource Use. A systems approach to resource efficiency and pollution reduction*. (Nairobi, 2017). Available at http://www.resourcepanel.org/reports/assessing-global-resource-use.

(b) The issue of sustainable food systems, including food security, needs to be addressed through a systems approach that tackles all aspect of production and consumption and makes the best use of the latest technologies and innovative thinking;

(c) Life cycle approaches need to be adopted in manufacturing and production systems to increase resource efficiency and the circular use of resources;

(d) We need to support innovative business practices that enhance livelihoods and sustainable development.

96. Adopting actions such as these will help member States to touch the lives of the poorest and the most disadvantaged in society, by placing their needs at the heart of our thinking on how to respond to today's environmental challenges using the best rapid advances in technology and changes in thinking for sustainability and regeneration of our planet.

97. By embracing a culture of innovation, the United Nations, and specifically UNEP, can boost its ability to enable countries and people to improve their quality of life without compromising that of future generations. By embracing the key enablers of an innovative culture (creativity, openness and participation), UNEP can respond to the policy needs of member States and help to scale up successful approaches and innovative solutions, whatever their source.

98. The UNEP core delivery framework can be further strengthened by continuously investing in a strong science-policy interface and thus enhancing the mobilization and use of science and environmental data to inform better decisions. UNEP can improve its support to coalitions and partnerships by effectively harnessing the powerful tools of the latest information technologies, including big data and artificial intelligence. It therefore needs to enhance its ability to use these tools and assist countries and their citizens to use them as well, in line with United Nations strategies and frameworks.

99. UNEP can also deepen its efforts to develop and implement more innovative policies and partnerships that respond to the systemic nature of the Sustainable Development Goals, the UNEP medium-term strategy and the reform of the United Nations development system. By working closely with member States and other stakeholders, UNEP can prioritize its work on circularity and pollution and in securing a new deal for nature and biodiversity as interconnected priorities in its programme of work.

100. In 2022, UNEP, established following the United Nations Conference on the Human Environment (also known as the Stockholm Conference), will mark its fiftieth anniversary. This important milestone can serve as an opportunity to take stock of progress, raise awareness of global environmental trends and renew the organization's commitment to the implementation of the environmental dimension of the 2030 Agenda.