

Innovative solutions for environmental challenges and sustainable consumption and production

Background Report of the Executive Director

The Executive Director of the United Nations Environment Programme submits to the United Nations Environment Assembly of the United Nations Environment Programme a report entitled “Innovative solutions to environmental challenges and sustainable consumption and production” as a background document for discussions during the high-level segment of the fourth session of the UN Environment Assembly.

The Report focuses on identifying innovative solutions for pressing environmental challenges in the framework of sustainable development that 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.

The Report defines innovative solutions as “business unusual” approaches encompassing the promotion of enabling environments for creative approaches in policy, financing, partnerships, processes and the use of data to understand environmental issues and improve sustainability – thus not restricted to an intervention or a technological innovation in the traditional meaning of the innovation. The Report provides insights on the enabling conditions to stimulate and strengthen a culture of innovation and presents also a short summary of pressing environmental trends as reflected in major environmental assessments. The Report then proceeds to cover 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, chemicals and waste management; (c) Innovative sustainable business development at a time of rapid technological change.

The report concludes by emphasizing 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 for effectively addressing sustainable development challenges. Ultimately, we have twelve years remaining to fundamentally shift our global economic systems towards more sustainable trajectories to avoid catastrophic climate change and loss of biodiversity and ecosystems. This kind of exponential transformation can only be achieved if it is catalysed and underpinned by innovation at all levels.

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I Introduction

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. The resolution (A/RES/66/288) 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. These 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 nor fully realize their economic potential if half of their populations are not able contribute their creativity, skills and entrepreneurship. Such imperative is grounded in legal obligations 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 and the Sustainable Development Goals as set out in General Assembly Resolution A/RES/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, chemicals and waste management; and (c) innovative sustainable business development at a time of rapid technological change.
7. This Report addresses these three focus areas from the lens of innovation. It defines innovative solutions as “business unusual” approaches. The solutions described herein include creative approaches – in fields as diverse as policy, financing, partnerships, education and the use

of data – that improve sustainability and promote better understanding of environmental issues. In this sense, “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 also streamlining and simplifying processes and removing barriers to act as an enabler of innovation -- “doing different things and doing things differently”.

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; that encourage investment in technology, promote research excellence, and develop human and knowledge-based capital; that use open science and international cooperation to increase economic and social returns on public investment in research; that commercialize publicly funded research and introduce research and development tax incentives; that promote technologies and practices that have intrinsic exponential growth rates and that develop infrastructure relating to computing, telecommunications, “big data” and the open internet.¹

10. Technology and innovation can also support transparency, a critical enabling condition for better governance. Environmental transparency is a fundamental pre-condition and catalyst towards 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 help make these 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.

Investing in education and transitioning to an inclusive, knowledge society can foster a generation that solves global environmental challenges.

11. Meeting a constantly evolving skills gap for a dynamic and 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. However, 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, States and the Convention on the Rights of the Child.

¹ OECD 2015 The Innovation Imperative: Contributing to Productivity, Growth and Well-Being. <https://www.innovationpolicyplatform.org/document/effective-innovation-policies-innovation-imperative-contributing-productivity-growth-and>

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

12. Widely investing in environmental education in the framework of sustainable development with a strong gender focus, can foster a generation that innovates and more rapidly adapts 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. These include creative thinking, design skills, organizational change management, and the ability to work in teams to solve problems. Equally important, integrating topics such as green and sustainable chemistry as well as sustainable business models into existing curricula will assist in creation a new generation of scientists and entrepreneurs that will help advance implementation of the 2030 Agenda.

Channeling 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 for achieving 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 has been initiated in 2014 by the United Nations Environment Programme.

14. To drive investments into circular, green and low-carbon growth and to align global financing and investments to the Sustainable Development 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 UN Environment Programme 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 Climate Agreement. The six principles set out by the Finance Initiative 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.

15. Some national, international and multilateral banks are already paving the way to this approach. Two such examples include 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 case of the Southern Development Bank of Brazil (BRDE) which established a **credit line of R\$1,500 million (approx. USD 400 million)** to support the implementation of this country’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 which could have substantial positive environmental impacts 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 heavily rely. 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 to habitat modification.

II Evidence from the latest global assessments

The time to change is now.

18. We live on a rapidly warming, polluted planet that is quickly losing its biodiversity.³ 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 of achieving the 2°C target of the Paris Agreement could be as high as \$54.1 trillion dollars, at a global cost of only USD 22.1 trillion.

19. By 2050, the median projected population is expected to rise to almost 10 billion⁴ and to grow to more than 11 billion by the end of the century. If 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 overstressing 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 within informal sectors.

20. In order to feed the world's population in 2050, agricultural production will likely need to increase by 50 per cent by 2050, while the environmental impact of food production will need to decrease by two-thirds. Much of this environmental impact is caused by meat production, where 77% of agricultural land is currently linked to the production of meat. Cutting global food waste, currently at 33 per cent, could also help 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 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 during the third session of the UN Environment Assembly with the adoption of the Ministerial Declaration "Towards a Pollution-Free Planet". Nevertheless, air pollution remains a major environmental contributor to the global burden of disease with approximately 7 million premature deaths and economic losses of \$5 trillion annually. Of these, 4 million² are due to

³ United Nations Environment Programme (2019) Global Environmental Outlook 6; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2018) Summaries for Policy Makers of the Assessment Reports for Asia and the Pacific, the Americas, Africa, Europe and Central Asia and thematic Assessment on Land degradation and restoration <https://www.ipbes.net/event/ipbes-6-plenary>; United Nations Convention to Combat Desertification (2017) Global Land Outlook <https://www.unccd.int/actions/global-land-outlook-glo>; Intergovernmental Panel on Climate Change (2019) Special Report on

ambient air pollution and 3 million to indoor air pollution. Exposure to air pollution is highest in low 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 human rights harms caused by environmental degradation. Yet, 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 showed persistent declining trends in productivity, due to climate change, biodiversity loss and poor management practices. Land degradation decreases resilience to environmental stresses, which has a direct impact on the poor, women and children, leading to intense competition for scarce natural resources and an irreversible and continuing decline in genetic and species diversity. The total global ecosystem services have been valued at \$125 trillion per year, while the value of lost ecosystem services between 1995 and 2011 have 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 services. It is therefore of great concern that 40 per cent of the world's wetlands have been lost since 1970 due to land-use changes; agriculture continues to account for 70 per cent of the world's freshwater 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 how much water they store, but also for the vast quantities of greenhouse gases stored in peat.

27. Coral reefs and other acidity- 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 tonnes 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. The steepest increase occurred from 2000 to 2010, driven mainly by the industrialization and urbanization of emerging economies. Resource use is expected to reach nearly 90 billion tonnes in 2017 and may 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 three people lack access to controlled waste disposal facilities.

Global warming of 1.5°C <https://www.ipcc.ch/report/sr15/>; International Energy Agency (2018) World Energy Outlook 2018 <https://webstore.iea.org/world-energy-outlook-2018>; Food and Agriculture Organization (2018) The State of Food and Agriculture 2018 <http://www.fao.org/publications/highlights-detail/en/c/1157519/>; IRP (2017) Assessing global resource use: A systems approach to resource efficiency and pollution reduction <http://resourcepanel.org/reports/assessing-global-resource-use>; United Nations Environment Programme (2017) Towards a Pollution Free Planet <http://web.unep.org/environmentassembly/node/41653>

⁴ United Nations World Population Prospects 2017 (2017) <https://population.un.org/wpp/Publications/>

Decoupling economic growth from environmental degradation is indispensable to achieve the Sustainable Development Goals.

29. Given the projected population growth,³ it will be necessary to decouple economic growth and negative environmental impacts if we are to achieve the Sustainable Development Goals. For example: the current rate of decoupling of CO₂ emissions from economic growth (GDP) will need to triple if we are to meet the ambitious targets in 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 Global Environment Outlook shows, focusing on one policy at a time, such as emissions abatement or resource efficiency, cannot effectively mitigate negative environmental impacts. Innovative solutions that address systems rather than issues – such as changes to governance and business models as well as to our way of living – can reduce the environmental pressures associated with unsustainable consumption and production. But 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 small-holder 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 and 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 safe production, use, recycling and disposal of chemicals also causes significant 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 in-door 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 only for a small number of chemicals, the WHO estimates that **1.6 million lives and 45 million disability-adjusted life years** (DALYs) were lost in 2016 due to exposures to selected chemicals. Chemical pollution also threatens ecosystem functions. Given knowledge gaps and uncertainties, future trends and impacts are uncertain.

³ IRP (2017) Assessing global resource use: A systems approach to resource efficiency and pollution reduction <http://resourcepanel.org/reports/assessing-global-resource-use>

34. While many countries have made significant strides in managing chemicals, not all hazardous manufactured chemicals are systematically regulated, particularly in low 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. Also, current data gaps and assessment methods fall short of allowing to assess the impacts of exposures to multiple chemicals, or over the life cycle of chemicals.

35. The mining sector will play a key 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 per cent 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 and sustainable development or reinforces weak governance, potentially exacerbating tensions or conflicts, in the countries with strategic reserves.

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 draws from 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 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 resources management, including sustainable food systems, food security and halting biodiversity loss

Food systems are putting increasing pressure on our environment.

37. The environmental impacts of unsustainable agricultural practices cost an estimated \$3 trillion per year. A growing global population, a degraded natural resource base, food losses and waste, together with unsustainable trends in the consumption and production of food, combine to present 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 the over-pricing and the under-pricing of food respectively, which in turn distorts rational policy responses as well as 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 each year.

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 & Clean Air Coalition (CCAC) working together with the UN Food and Agriculture Organization (FAO) and the World Bank have 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 long-term sustainable development of their agricultural economies.

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

39. 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.

40. Despite the world producing enough calories, undernutrition remains the greatest cause of premature mortality and is one of the greatest impediment for children to reach 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; however, the reality is different. The double burden of malnutrition and over-consumption is increasingly evident in many low and middle-income countries, where often both extremes can coexist within the same communities.

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

Long-term global food security depends largely on a shift towards sustainable food systems.

42. Sustainable food systems offer a holistic, integrated way to address food security, environmental health and human well-being, which can be applied to all countries at national and local levels.⁶

43. Food systems need to function within the context of a finite and shrinking resource base. They need to deliver increasing productivity while utilizing natural resources in a sustainable manner, while 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.

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

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

45. Transitioning to more resilient and 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.

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

46. 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, environment and health, as well as ensuring 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 systems 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, for example between agriculture, environment, health, business development, education and employment.

47. 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 this transformation calls for an urgent shift to a more holistic approach to agriculture.

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

48. As a key aspect of a holistic and integrated approach to food systems, governments must start measuring their food waste. A common use of measurements and protocols, such as the Food Waste Index currently under development by UN Environment and FAO, can provide an effective means of measuring waste among both retailers and consumers; the index can also help to identify the causes of waste.

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

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

50. 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 Agricultural Commodities Programme, the Global Alliance for Climate-Smart Agriculture and the Good Growth Partnership. In these cases, companies that are interested in promoting environmentally sound technologies and best practices are collaborating with civil society organizations, academics and local communities to seek innovative solutions. The One Planet Network Sustainable Food Systems Programme, established under the Ten-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.

51. In collaboration with the Climate & Clean Air Coalition (CCAC), some countries are implementing practical solutions for their agricultural systems. For example, Vietnam is using “alternate wetting and drying” in rice cultivation, a less resource-intensive alternative to growing rice in continuous standing water. This has 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.

52. Governments can also reduce the environmental impacts 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 an increased dialogue with private sector companies to encourage them to improve the nutritional quality of their food.

53. 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.

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

55. There is the need to be sure that the direction of travel is correct. The Economics of Ecosystems and Biodiversity for Agriculture and Food (TEEBAgriFood) has developed a comprehensive and 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.

Individual actions can go a long way to achieve sustainable food-systems

56. Individual changes and actions can also add up to major reductions in food waste, reduced climate change impacts and a healthier environment. They can also help to stimulate a vibrant and 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

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

57. Life-cycle approaches are essential tools to inform 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 those sectors that are responsible for bigger shares of an economy’s environmental footprint.

58. Life-cycle approaches provide intelligence on the environmental (and often social) impacts 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 to mitigate climate change in the context of nationally determined contributions. The systemic information provided by life-cycle approaches allows decision-makers to understand trade-offs between social, environmental and economic impacts, thus accelerating the progress towards more sustainable consumption and production patterns and advancing the 2030 Agenda for Sustainable Development.

59. Countries, regardless of their stage of development, with policies that encourage decoupling economic activity and human well-being from resource use and environmental impacts have improved the quality of their citizens’ lives, created jobs, and achieved better socio-economic 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

60. Policymakers have multiple policy instruments at their disposal to develop and implement a balanced and comprehensive strategy to enhance resource efficiency and improve the management of energy, chemicals and waste based on life-cycle approaches. These include bans 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.

61. The right mix of policy instruments must be accompanied by an effective implementation plan as well as monitoring measures. Only then will the instruments succeed in accelerating innovation for sustainable consumption and production.⁴

⁷ International Resource Panel (2018) Re - defining Value – The Manufacturing Revolution. Remanufacturing, Refurbishment, Repair and Direct Reuse in the Circular Economy; (2017) Assessing Global Resource Use. A systems approach to resource efficiency and pollution reduction; See www.resourcepanel.org

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

62. 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.

63. 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 actions from retailers, waste managers, consumers and entrepreneurs to find and diffuse alternative solutions and adjust common behaviours. Such regulations have triggered innovative changes to the design, production, consumption and disposal of plastics, contributing to more resource efficient and sustainable use of resources, reducing pollution, and accelerating the transition to circularity in our economies.

64. 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 and eco-friendly alternatives.

Public procurement policies can stimulate demand for sustainable products.

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

66. 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 negative impacts on the environment. Sustainable public procurement can accelerate the shift to sustainable patterns of consumption and production.

67. Engaging all countries to incorporate sustainability in 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.

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

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

69. 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 and 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. However, current institutions in government and indeed in other organizations are not constructed to reflect the transversal nature of these objectives, nor necessarily to design the policies, practices and partnerships necessary to achieve them.

70. One example of how an innovative partnership is working to bring global and local benefits can be found in the clothing and footwear industry. This industry is valued at between \$2.5 trillion and \$3 trillion, and it 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. Nearly 20 per cent of global wastewater is produced by the industry, which also emits more carbon emissions globally than all international flights and maritime shipping combined. The clothing and footwear industry has been identified in recent years as a major contributor to plastic pollution in our oceans, which 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 labor standards and dangerous working conditions due to unsafe processes and hazardous substances used in production.

71. The United Nations Alliance for Sustainable Fashion is an innovative approach by the United Nations and specialized agencies, 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 UN Member States, the industry and the public.

We must support governments and other stakeholders to act on the ground.

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

73. At the global level, the One Planet Network,⁸ 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 Rio+20 Conference. The Network has 611 partners, which are grouped into six programmes: food, buildings, tourism, public procurement, consumer information and sustainable lifestyles. The Network's 2018-2022 strategy focuses on supporting the achievement of Sustainable Development Goal 12, which aims to "ensure sustainable consumption and production patterns". More than 20 United Nations entities and 130 national focal points are engaged in this network, which has a strong focus on implementing and scaling up existing policies and practices. A global commitment to implement

the Network's strategy is required to support innovation and the development of more sustainable value chains in developing countries.

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

74. 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.⁹

75. The Life Cycle Initiative is another example of a public-private, multi-stakeholder partnership that is helping both public and private stakeholders apply life-cycle knowledge. Since 2002, this initiative has been working to enhance the enabling conditions for the global application of life-cycle approaches, such as improved access and interoperability of Life Cycle Assessment datasets, consensus on impact indicators, and guidance and capacity development, especially in developing countries.

76. There is, however, an opportunity to strengthen and streamline 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. To this end, the visibility and authority of the International Resources Panel could be enhanced if the Panel were to provide regular reports to the UN Environment Assembly and other international forums on progress in achieving resource management-related goals and targets.

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

77. 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 re-directing 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.

78. 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 (CIFs), the Global Environment Facility (GEF) and the Green Climate Fund (GCF). The African Development Bank has identified the potential to scale up projects managed by National Cleaner Production Centres (NCPCs) 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 (SEF) 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

79. 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 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 and accessible manner. Innovative governance approaches also show promise. For example, the Extractive Industries Transparency Initiative (EITI) 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

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.

80. 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.

81. Technological change includes new and powerful tools that can help to realize the vision of the 2030 Agenda for Sustainable Development.⁵ The report of the Secretary-General on harnessing new technologies to achieve the Sustainable Development Goals points out however to 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.⁶

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

82. Businesses that adopt sustainable innovative business models create significant value for themselves and for society.⁷ Such new approaches appeal to businesses because they can 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 and 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 acquire and develop innovation capabilities and resources.

83. 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.

84. Companies of all sizes are applying innovative models, which have also stimulated the creation of many startups. Innovative models have been developed to, among other things, improve asset sharing; provide products as services; promote closed-loop resource recovery; make supply

⁵ Resolution (A/RES/73/17)

⁶ E/2018/66

⁷ UNEP 2014, The Business Case for Eco-innovation

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 and 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.

85. 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.⁸ An additional approach to promote longevity, reliability and reusability is through the “product as service” business model. In this case, the 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.

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

86. As the world’s middle classes get richer, more populous and more mobile, the world’s appetites for commodities, meat, fish and natural resources will grow, with negative impacts in 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.¹³ Thus, there are significant market opportunities for innovative business solutions that promote sustainable consumption and production through low-carbon lifestyles.

87. 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,” to 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 behavioral changes that can make our economies greener and more circular.

We must invest in data sharing and participatory science.

88. 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 enterprises.

⁸ <http://www.resourcepanel.org/reports/re-defining-value-manufacturing-revolution>

89. 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.

90. There have recently been two important developments in participatory science: the increased use of mobile technology to crowd source information to create awareness on pollution. Open-source technologies have been 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 for companies to publish and share relevant non-commercial environmental data.

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

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

40. 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. Such strategy could have three main functions: first, to support the provision of comprehensive and 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 collaborations and enhance initiatives that catalyze and accelerate positive change.

VI Fundamental change for a regenerative planet

92. 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 and multi-beneficial 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.

93. 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** will be needed:

- **Society needs to foster a culture of innovation that spans sectors and actors.**
- **Sustainable food systems, including food security, needs to be addressed through a systems approach that tackles all aspect of production and consumption and that makes best use of the latest technologies and innovative thinking.**
- **Life-cycle approaches need to be adopted in manufacturing and production systems to increase resource efficiency and the circular use of resources.**
- **We need to support innovative business practices that enhance livelihoods and sustainable development.**

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

95. By embracing a culture of innovation, the United Nations and specifically the UN Environment Programme can scale up its ability to enable nations and peoples 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), the UN Environment Programme can respond to the policy needs of Member States and help to scale up successful approaches and innovative solutions, whatever their source.

96. The UN Environment Programme 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. The UN Environment Programme can improve its support to coalitions and partnerships, if it effectively harnesses the powerful tools of the latest information technologies including big data and artificial intelligence.

The Programme therefore needs to deepen its ability to harness these tools and assist countries and their citizens to use them as well in line with UN strategies and frameworks.

97. The Programme 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 Programme's Medium-Term Strategy and the reform of the UN development system. By closely working with Member States and other stakeholders, the Programme can prioritize its work on circularity and pollution as well as in securing a new deal for nature and biodiversity as inter-connected priorities contained in its Programme of Work.

98. In 2022 the UN Environment Programme, established after the United Nations Conference on the Human Environment (also known as the Stockholm Conference), will mark its 50th 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 for Sustainable Development.