



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



# The implications of the Covid-19 pandemic for delivering the Sustainable Development Goals

Richard Fenner<sup>a,\*</sup>, Thomas Cernev<sup>b</sup>

<sup>a</sup> Centre for Sustainable Development, Cambridge University Engineering Department, UK

<sup>b</sup> Australian National University, Canberra, Australia

## ARTICLE INFO

### Keywords:

Sustainable Development Goals  
COVID 19  
Pandemic  
Scenario analysis  
Health

## ABSTRACT

Global responses to COVID-19 will impact on delivery of the 17 Sustainable Development Goals by 2030, creating large uncertainties just at the time efforts need to be accelerated. This paper explores how COVID-19 could impact the success of meeting the targets with priority given to the four 'foundational' goals: SDG 1 No Poverty; SDG3 Good Health; SDG 14 Life Below Water and SDG 15 Life on Land as these are critical in maintaining a healthy human and environmental resource base on which progress towards all goals can be built. A scenario analysis examines futures across a spectrum in which i) social and health imperatives (lives) dominate, to ii) where economic imperatives (livelihoods) take precedence. Similarly levels of international co-operation are considered ranging from international recognition of urgent global agendas to fragmentation due to the isolation of individual states around national priorities. These give rise to 4 scenarios: a) Global Well-being Prioritized b) World Trade Recovers c) Poverty Gaps Widen c) Earth Systems in Danger and the likelihood of achieving the foundational SDGs in each is discussed. The paper concludes opportunities exist to refocus efforts on delivery of the SDGs but may be hampered by the competing interests of a new geopolitics.

## 1. Introduction

Current global responses to the COVID-19 crisis are likely to impact on the ability to deliver the United Nation's 17 Sustainable Development Goals (SDGs) within the intended timescales, and create large uncertainties just at the time efforts need to be accelerated. Indeed the pandemic itself is likely to hinder reactions to concurrent threats such as heat waves, wildfires, drought and extreme weather in many parts of the world as under resourced systems and emergency responses become stretched and disrupted (Islam et al., 2020) and radically transforming the current state of global development (Gulseven, Al Harmoodi, Al Falasi, & Al Shomali, 2020). Mounting costs to deal with these stressors will divert funding from the existing SDG targets, leading to the potential for geopolitical unrest (Naidoo & Fisher, 2020).

The new circumstances created by the pandemic may also present an opportunity both for increased motivation towards the completion of such goals and a redefining of future targets to be achieved. A range of views is emerging with regard to which goals are essential for a sustainable recovery post COVID-19, and whether a more rigorous and urgent focus on some goals is warranted. For example Chapman and Tsuji (2020) argue that Reduced Inequality (SDG 10), Climate Action (SDG 13) and Partnerships (SDG17) are critical for a successful transition towards sustainability. The United Nations Environment Programme (2020) have identified four

\* Corresponding author.

E-mail address: [raf37@cam.ac.uk](mailto:raf37@cam.ac.uk) (R. Fenner).

Sustainable Development Goals that help future-proof global recovery: Climate Action (SDG13), Life on Land (SDG15), Life Below Water (SDG14), and Responsible Consumption and Production (SDG12). [Naidoo and Fisher \(2020\)](#) agree that cash-strapped governments need to focus on a few strategic goals, recognising some goals underpin or positively interact with many others. However some have questioned whether the SDGs are fit for the post pandemic age (e.g [Heggen, Sandset, & Engebretsen, 2020](#)) with a recent Nature editorial claiming “the coronavirus pandemic has put the Sustainable Development Goals (SDGs) out of reach” ([Nature, 2020](#)).

[Bhattacharya et al. \(2020\)](#) have countered by pointing out that the COVID-19 crisis has stemmed from exactly the interconnected failure that the SDGs aim to address and that “great feats are rarely a product of lowered ambition”. The executive director of the Sustainable Development Solutions Network, Guido Schmidt-Traub, has been reported as saying the SDGs should still guide post COVID-19 recovery as “There is nothing else to replace the SDGs right now” ([Nature, 2020](#)). Similarly the President of Ghana and the Prime Minister of Norway have exhorted: “what we cannot afford to do, even in these crucial times, is shift resources away from crucial SDG actions. The response to the pandemic cannot be de-linked from the SDGs”. Others agree that the SDG framework remains the best guide for identifying integrated solutions to protect the health of current and future generations while minimizing negative trade-offs during the COVID-19 crisis and subsequent recovery ([Tonne, 2020](#)). COVID-19 can be seen as a stress test for the SDGs where the SDGs should be revamped “as a navigating platform and frame for helping societies move beyond COVID-19 by adding to their resilience” ([van Zanten & van Tulder, 2020](#)).

The COVID-19 crisis has highlighted the links between environmental change and the emergence of infectious diseases with long term strategies needed to ensure improvements in human health and sustainability, which may be compromised by short term economically driven contingencies ([Barouki et al., 2020](#)). Post pandemic strategies should create synergies across several SDGs simultaneously, such as: boosting job creation, poverty reduction, environmental improvements, economic activity and health outcomes ([Barbier & Burgess, 2020](#)). Achieving the transformative vision of the SDGs by 2030 will require a major realignment of most countries’ national priorities towards long-term, cooperative and drastically accelerated action ([The Lancet, 2020](#)) though whether this is achievable remains in doubt. In an ambitious manifesto on how to respond to the changes needed [Ashford, Hall, Arango-Quioroga, Metaxa, and Showalter \(2020\)](#) explore over 30 interventions across 9 categories to address inequality, provide all citizens with access to essential goods and services and achieve progress towards sustainability after the pandemic, mapping each of these on to the SDGs where there is a direct or reinforcing connection, or where there is potential for a negative impact. They recognise that a focus on a growing economy must also be accompanied by action that mitigates resulting compromises to health, safety and the environment from increasing unsustainable consumption.

In this paper we briefly review the progress of the Sustainable Development Goals to date, and explore how COVID-19 will impact the success of meeting the targets. As the medium and long-term impacts of the current pandemic are presently uncertain we adopt a scenario analysis examining the consequences of SDG delivery in a number of possible futures. These are determined by whether social imperatives (i.e. lives) or economic imperatives (i.e. livelihoods) dominate and whether levels of international co-operation become enhanced by the recognition of the urgency of global agendas, or fragmented due to the isolation of individual states around national agendas. We conclude by exploring ways in which the Sustainable Development Goals can be focused around achieving planetary and human health.

## 2. Faltering progress towards the Sustainable Development Goals

The Sustainable Development Goals developed and implemented by the United Nations with an end date of 2030 were launched in 2015, and incorporate 169 targets across 17 goals. Before the pandemic significant progress had been reported ([United Nations, 2020a](#)) with positive signs that more progress would be made before 2030. However the United Nations admit in *The Sustainable Development Goals Report 2019*, that: “It is abundantly clear that a much deeper, faster and more ambitious response is needed” ([United Nations, 2020b](#)), and that “action to meet the Goals is not yet advancing at the speed or scale required” ([United Nations, 2020c](#)).

The 2020 Sustainable Development Report ([Sachs et al., 2020](#)) indicated most rapid progress had been made towards SDG 1 (No Poverty), SDG 9 (Industry Innovation and Infrastructure) and SDG 11 (Sustainable Cities and Communities). However the report also noted that even before the pandemic “many parts of the world were progressing slowly or experiencing reversal in progress made towards SDG 2 (Zero Hunger) and SDG 15 (Life on Land)” with some indication of declining trends in SDG 10 (Reduced Inequalities) and SDG 17 (Partnerships for the Goals). With respect to ending hunger (SDG 2) the number of people affected by food insecurity had risen between 2014–2018 and the COVID-19 crisis has added more pressure on production, supply chains and household incomes with the poorest being most affected ([The Lancet, 2020](#)), and created an unprecedented rise in the use of food banks in rich countries such as the UK and USA.

COVID-19 has not only stopped work towards some of these goals but has largely shifted the immediate focus of international agencies such as the United Nations and the World Health Organization towards dealing with the imminent threats of the pandemic. Many countries have been unable to even record what is happening with 96 % of national statistic offices of the UN and World Bank having fully or partially stopped face-to-face data collection ([Nature, 2020](#)). It is therefore foreseeable that after the immediate health crisis has passed the ability to deliver the SDGs will be severely compromised, such that many may not be achieved by 2030. [Barbier and Burgess \(2020\)](#) have identified 12 of the 17 SDGs likely to be adversely impacted by the pandemic, and [Moyer and Hedden \(2020\)](#) have indicated 28 poor countries are unlikely to attain SDGs 1-4, 6 and 7 by 2030, even before the full implications of the pandemic are known. [Naidoo and Fisher \(2020\)](#) have shown COVID 19 impacts threaten or partially threaten all the SDGs noting that achieving Goal 1 (No Poverty) would have helped prevent pandemic impacts whilst suggesting progress with Goal 9 (Industry, Innovation and Infrastructure) would have made pandemic impacts worse by increasing connectivity to remote areas and facilitating global travel as this is one of the main human-mediated drivers of the spread of zoonotic disease ([United Nations Environment Programme &](#)

International Livestock Research Institute, 2020).

There have been calls for the efforts towards the SDGs to be neither diminished nor reallocated with respect to the COVID-19 response, with recognition that much of the progress towards the goals has already been adversely affected (Solberg & Akufo-Addo, 2020). As new inequalities and imbalances emerge between regions, successfully completing the SDG agenda may be set back indefinitely, with the President of the UN Economic and Social Council, Mona Juul seeing “the true scale of the social and economic crisis that lies ahead of us.....(with) incomprehensible setbacks to our hard-won development gains” (UN Development News, 2020). The pandemic threatens to slow the progress on SDGs even further, combining the economic shock of a depression with rising death tolls in countries at every level of development (Kadokia & Tjhoumia, 2020).

Sachs et al. (2020) explicitly recognise the direct negative impact of the pandemic on poverty (SDG1), food security (SDG 2), health (SDG3), the economy (SDG8) and multilateralism (SDG 17), as well as the disproportionate impact on women (SDG 5 Gender Equality), and the functioning of political systems and the rule of law (SDG 16). UNESCO estimates that some 1.25 billion students are affected, posing a serious challenge to the attainment of SDGs Goal 4 (Quality Education). With regard to women’s welfare, SDG 5 has similarly suffered during the COVID-19 outbreak, with incidences of domestic violence increasing by 30 % in some countries and a greater demand on women for unpaid care work (The Lancet, 2020).

The goals are highly interlinked and inter-dependent, with progress towards one influencing others and vice-versa (Barbier & Burgess, 2017). For example Kadokia and Tjhoumia (2020) point out that the public health goals of SDG3 are related to reductions in air, water, and soil pollution and the climate crisis. Similarly the best way to prevent infections is to first inoculate against poverty (SDG 1). One estimate is that extreme poverty in the world will rise by about 50 million people compared to the original 2020 forecast, and by 40 million people compared to 2019 estimates, suggesting that all the progress in reducing poverty since the launch of the Sustainable Development Goals (SDGs) in September 2015 has been lost (Kharas & Hamel, 2020).

The pandemic has exposed fundamental weaknesses in the global system, showing how the prevalence of poverty, weak health systems, lack of education, and a lack of global cooperation has exacerbated the crisis (Solberg & Akufo-Addo, 2020). Whilst quantifying progress towards development efforts such as the SDGs can be difficult and subjective during the COVID-19 pandemic, the economic impact is readily noticeable with unemployment increasing to record levels in many countries, and large GDP contractions occurring. This will not only impact employment numbers but it will also impact planetary and human health. The COVID-19 pandemic will increase unemployment as manufacturing and other industries close due to social isolation mandates and create a descent into poverty in communities that have not yet had the opportunity to build up resilience mechanisms. The movement of global economies towards recession and possibly depression will potentially make sustainable development projects, in particular foreign aid ones, less appealing as countries seek to restore their own economies and deal with issues at home before looking elsewhere. Overseas development aid could drop by US\$25 billion in 2021 (Naidoo & Fisher, 2020) with the UK announcing in November 2020 a temporary reduction in the UK’s aid budget from 0.7 % to 0.5 % of national income. Furthermore, these new realities will lessen the appeal of starting fresh ambitious projects for governments and industry as they address budgetary and employment issues. The Economist Intelligence Unit (2020a) reports the virus also has disrupted a number of industries that serve as essential vehicles for Foreign Direct Investment. Hospitality, tourism, retail, entertainment and transport (particularly airlines) have all suffered from sharp falls in demand, owing to social distancing measures, lockdowns and travel restrictions. Whilst these economic impacts are at a large scale, they will also impact individuals as unemployment rates have soared with millions finding themselves without a job, thus affecting human health and increasing poverty levels in many parts of the developed world.

From the COVID-19 pandemic, there are certain positive aspects that should also be considered that provide some optimism as to the future of sustainable development. Above all, the pandemic provides an opportunity for the creation of a greater international

**Table 1**

Classification of the Sustainable Development Goals (Cernev & Fenner, 2020 and Sachs et al., 2020).

Classification	Goals	Description
Outcome/foundational	SDG 1 (No Poverty) SDG 3 (Good Health and Well-Being) SDG 14 (Life Below Water) SDG 15 (Life on Land)	Failure to meet these goals would have extensive consequences on human and ecological resources and the planetary system
Human input goals	SDG 2 (Zero Hunger) SDG 4 (Quality Education) SDG 5 (Gender Equality) SDG 10 (Reduced Inequality) SDG 13 (Climate Action) SDG 16 (Peace, Justice and Institutions)	Have the potential to help meet or undermine other SDG
Physical assets goals	SDG 6 (Water and Sanitation) SDG 7 (Affordable and Clean Energy) SDG 9 (Industry, Innovation and Infrastructure) SDG 11 (Sustainable Cities) SDG 12 (Responsible consumption and Production)	Infrastructure and service related goals
Enabling goals	SDG 8 (Decent Work and Economic Growth) SDG 17 (Partnership for Goals)	Necessary for investment in other goals

awareness and sense of global co-operation (Department of Global Communications, 2020). This has the potential to result in increased global motivation to address sustainable development issues but the ability to make progress will be likely diminished due to COVID-19 restrictions and effects, such as increased travel/trade restrictions and increased levels of poverty respectively. This urgent sense of motivation is seen across several of the SDGs, such as the call for widespread social security measures in accordance with SDG 8 (Decent Work and Economic Growth). Similarly the SDG 6 (Clean Water and Sanitation) Global Acceleration Framework seeks to deliver faster results to countries in line with the SDG 6 targets, as it is essential in slowing the transmission of COVID-19 that people have access to quality sanitation facilities (Department of Global Communications, 2020). But achieving universal access to even basic sanitation services by 2030 would require doubling the current annual rate of progress before the pandemic struck (Hansford, 2020).

### 2.1. Foundational Sustainable Development Goals

Cernev and Fenner (2020), undertook a systems analysis in order to identify the strong causal connections and feedback loops that exist between the 17 Sustainable Development Goals, and to subsequently classify each of the goals. This led to the development of an SDG hierarchy, (Table 1), and the identification of risk within the system: including cascading failures, existential risk, and global catastrophic risk. From this analysis, it was determined that even through prioritising resources towards a critical subset of *foundational* SDGs, it would be highly unlikely that all the 2030 targets would be met and that a longer term outlook, past 2030, should be taken. Foundational SDGs are those identified from the systems analysis that “are considered to represent social and environmental improvements directly resulting from making progress towards other goals... regression in these goals restrict and limit the human and ecological resources required to support a safe planetary system” (Cernev & Fenner, 2020). These foundational goals are: SDG 1 (No Poverty); SDG3 (Good Health and Well Being); SDG 14 (Life Below Water) and SDG 15 (Life on Land) as these represent vital outcomes of achieving other goals and they are also critical in maintaining both a healthy human and environmental resource base on which progress towards all goals can be built.

The United Nations Environment Programme (2020) Executive Director Inger Andersen has stated “The pandemic has exposed that gains made to address poverty, hunger, good health and well-being may face serious setbacks, unless the global community also urgently addresses the global environmental threats that have similar capacity to gravely undermine the systems that enable humanity and the planet to survive and thrive”. This reinforces the importance of urgently pursuing the foundational SDGs as they have an overarching influence on other SDGs and specifically their emphasis on planetary and human health. Others have suggested the need to rethink the world’s sustainable development strategy (e.g. Naidoo & Fisher, 2020) and van Zanten and van Tulder (2020) have recently argued “the world needs to better define priorities and probably focus on a few broad strategic goals rather than all 17 SDGs”.

Table 1 classifies the SDGs into their different groups, with a description provided for each, and those identified by Sachs et al. (2020) as being highly negatively impacted by the pandemic are highlighted in red and moderately negatively impacted highlighted in purple (with impacts still unclear for the remainder).

## 3. Scenario analysis

### 3.1. Possible futures

The Economist Intelligence Unit (2020b) has concluded the coronavirus crisis will sharpen great power rivalries between nation states and hasten the shift in the global balance of power from west to east. Their report suggests that the extraordinary fiscal and monetary measures that many western countries are taking to support businesses and households will be hard to reverse resulting in years of slower growth and raising the chances of sovereign debt crises. The EU is likely to emerge damaged from the crisis whilst emerging powers may capitalise on increasing fragmentation of the global order. Social tensions are predicted to re-emerge in regions such as the Middle East and North Africa as pandemic conditions ease and the economic fall-out becomes apparent with civil unrest becoming widespread (The Economist Intelligence Unit, 2020c). Thus COVID-19 will act as a conflict multiplier for parts of the globe where tensions were already high. Dieter Helm (2020) sees the pandemic accelerating and exaggerating effects that were already happening including the increased return of the state; the greater exacerbation of intergenerational conflict; the future retreat from globalisation and a reconsideration of climate change policies.

The pandemic will also fundamentally reshape trade, accelerating the trend towards shortening supply chains to regionalised networks that will be an enduring outcome of this crisis. Many see a very high risk of the coronavirus driving the global economy into an economic depression leading to a string of sovereign defaults and financial contagion (The Economist Intelligence Unit, 2020d). Therefore as the world is seized with containing the spread of the virus and addressing its negative impacts, the reality is that countries are resetting their priorities, and reallocating resources to deal with the pandemic. The World Bank estimates that the crisis will push some 11 million people into poverty. The International Labour Organisation (ILO) estimates some 25 million people could lose their jobs (Hansford, 2020). The full size and persistence of the economic impact is unknowable but with supply chain contagion forecast in virtually all nations the manufacturing sector will be hit hard as demand from disruptions due to macroeconomic drops in aggregate demand (i.e. recessions) and wait-and-see purchase delays by consumers and investment delays by firms (Baldwin & Weder di Mauro, 2020).

Most developing countries are commodity dependent and account for over 60 percent of exports in most cases, yet prices had fallen by 21 % by May 2020 (Kharas & Hamel, 2020). Many parts of Africa depend on food imports for staples and these countries will likely lose a substantial proportion of their foreign exchange income with Sachs et al. (2020) warning the consequences could be dire and translate into social and political instability, as well as hunger.

But COVID-19 has also been seen as an opportunity to reduce over the longer term the prevalence of lifestyles premised on large volumes of energy and material throughput (Cohen, 2020). Similarly (Hepburn, O'Callaghan, Stern, Stiglitz, & Zenghelis, 2020) argue that the COVID-19 crisis is likely to have dramatic consequences for progress on climate change (SDG 13) with emissions rebounding once mobility restrictions are lifted and economies recover, unless governments intervene. Initially, the intense lockdown policies mandated by governments world wide resulted in a 17 % reduction in daily global CO<sub>2</sub> levels by April 2020, with almost half due to transport reductions (Le Quéré et al., 2020). At their peak, emissions in individual countries decreased by -26 % on average, and in April 2020 UK emissions fell by nearly a third. However in China CO<sub>2</sub> and emissions of Nitrogen Dioxide rebounded strongly as industrial productions restarted (CREA, 2020). The long-term effects on global emissions are entirely due to the length of time for which lockdown policies are enforced, (Le Quéré et al., 2020) with a UK study finding that by December 2020 air pollution in 80 % of the 49 UK cities analysed, met or exceeded pre-pandemic levels, driven by an increase in the use of private cars (Quiniho & Enkelow, 2020). Greenpeace senior climate campaigner Paul Morozzo has said "The only way this reduction will mean anything if governments lock it in as we recover and rebuild" (The Environment, 2020). The pandemic also seems to have fuelled excess use of plastics and disposables, thus failing sustainability targets in this area (Barouki et al., 2020).

Thus the rush to re-generate economies needs to be done in ways sensitive to the environment with opportunities taken for reconfiguring growth in climate sensitive ways whilst boosting employment with a green stimulus. Yet Randers et al. (2018) have shown that accelerating economic growth leads to higher GDP, more energy use, more CO<sub>2</sub> emissions and more use of resources with negative effects on planetary health.

A white paper prepared by the German Zukunfts Institut (2020) describes four possible scenarios of how the coronavirus crisis can transform the world. These are based on considering successful relationships versus unsuccessful relationships (optimistic versus pessimistic) and a local versus global future (disconnected versus connected). This gives rise to a number of possibilities. Everyone is against everyone, and global trade collapses. The world enters a permanent crisis mode, where the focus is on national interests and confidence in global co-operation is severely damaged. Society returns to more local structures with sustainability only dealt with locally and not globally. Alternatively, a more positive outlook sees world society learning from the crisis and developing resilient, adaptive systems in a desire to ensure real healthy environments for all peoples.

### 3.2. Developing scenarios

In looking ahead over the next decade at the prospective delivery of the SDGs by 2030, three distinct phases are apparent. In the short term (2021–22) Government efforts will be focussed on the direct health and other impacts of COVID-19 and controlling the spread of the disease. Whilst new vaccines are offering hope, the emergence of new mutations of the virus are causing concern. In the medium term (2023–2026) when the health emergency has passed attention will turn to rebuilding economies and avoiding global depression, such that affordability of meeting SDG targets comes into question, with many commentators pointing to developing countries suffering disproportionately having the very circumstances where most progress is needed. In the longer term (2027–2030 and beyond) actions to complete SDG delivery may regain some momentum, but in a very short window. Expecting significant progress by 2030 may already be unrealistic but two innovations beyond the SDG programme to date should be considered: a greater emphasis on strengthening the system interactions between goals and at least a priority focus on the outcome/foundational goals and climate action.

Whilst governments grapple with balancing the need to respond to the twin but conflicting imperatives of a public health crisis and economic collapse we agree that both positive and negative futures can be envisaged (and hence planned for). Positive outcomes are where the COVID-19 pandemic provides renewed motivation to global sustainable development and drives nations forward to become more ambitious, and increase collaboration, this would most likely be through a revitalisation of the sustainable development agenda and renewed commitment to delivering the SDGs. On the other hand, a negative outcome would mean that the COVID-19 pandemic inhibits sustainable development progress, collective efforts to achieve the SDGs *for all* falter, countries become less motivated to achieve results, and ultimately global sustainable development is in decline. In the stages post COVID-19, there needs to be both renewed motivation for achieving sustainable development milestones as well as recognition that global economies and societies need to recover but that this should not be at the expense of either planetary health nor human health.

In order to examine these possibilities we develop a scenario analysis using the descriptors provided below:

- Lives – *Focus on planetary and human welfare and well-being, societies strive for equal access to services for their individual members*
- Livelihoods - *Focus on economic performance and return to full employment, with a consequential return to damaging uncontrolled growth*
- International Cooperation - *Global effort to address common threats and risks, agencies such as UN are central players, pooling and sharing of information and resources across borders; boost to find global solutions and enhanced respect for experts*
- International Fragmentation/Isolation - *Strong competition for resources between nations, rise of nationalism, closed borders, inward looking prioritising in-country needs first.*

This reflects a major challenge in responding to COVID-19 in balancing reduced economic activity to control disease spread and save lives and restoring economic activity to avoid the harsh social consequences of frequent shutdowns (Barouki et al., 2020). The current political debate in many countries is polarised around saving lives (focusing on direct health outcomes regardless of cost) and safeguarding economies (maintaining employment regardless of infection rates). Of course there is a continuum between these factors (lives vs livelihoods) where clear interrelationships exist, but the purpose here is to look at reasonable extremes to develop plausible futures against which strategies and policies can be appraised. The health versus economy debate this represents also reflects balancing

of short term crisis alleviation with managing longer term negative consequences.

Many governments have been forced into short term interventions to respond to the pandemic and its socio-economic impacts with more active and interventionist roles than ever previously contemplated. A key question is will these measures mitigate the COVID-19 impacts enough to allow a return to “business as usual” practices, or whether they will serve as catalysts for long term planning to achieve transformation towards more sustainable and resilient societies (van Zanten & van Tulder, 2020).

Other concerns relate to how the COVID-19 pandemic has undermined the resilience of many countries which some suggest could affect their willingness to work together to achieve common socio-economic objectives (Oldekop et al., 2020). The political tensions stoked by COVID-19 could threaten SDG 16 (Peace Justice and Strong Institutions) to promote safety from violence and SDG 17 (Partnerships for Goals) (The Lancet, 2020). There are fears that in rolling out the new vaccines individual nations will act in their own interests first, not necessarily in the wider global interests, creating further division and inequality. As countries such as the UK and USA address their shortages of qualified medical professionals through aggressive recruiting of foreign candidates from low and middle and income countries, staffing levels and health responses will become undermined in those countries (Chapman & Tsuji, 2020). As the direct health impacts of the pandemic pass the world is facing a once-in-a-century depression, where governments are co-operating much less, crucial international meetings on climate, biodiversity and wetlands have been postponed, and aid to help the poorest countries meet their goals is set to fall (Nature, 2020).

There are some signs of optimism emerging with the EU embracing the pandemic as an opportunity to achieve long term sustainability through a 1.85 trillion euro recovery/budget fund for a Green Deal that aims to transition from food production, mobility, energy, and buildings to create the world’s first climate neutral continent by 2050. (European Commission, 2020). In contrast the Trump administration in the USA have taken the pandemic as a pretext to ease environmental regulation by reducing standards for major construction projects, lowering fuel economy standards for cars, encouraging new oil and gas exploration on national forests and opening marine protected areas to commercial fishing (Financial Times, 2020) whilst neglecting social inclusion and using emergency powers under the pandemic to expel migrants (The Guardian, 2020a). The contrast in these policies suggest two clear futures, where in some regions SDG performance will further improve, while elsewhere it will fall further behind.

Therefore our scenario descriptors reflect ways in which global society could move after the COVID-19 pandemic, especially given geopolitical and economic uncertainties. The interplay of these descriptors is illustrated in Fig. 1, where their interactions give rise to either positive or negative future scenarios over the next 10 years to 2030. Of the four descriptors, each provides a different way that nations and the world as a whole could potentially react after the COVID-19 pandemic, suggesting differing consequences for the SDGs. From these four descriptors, two can be considered to stimulate positive outcomes: Lives, and International Cooperation. On the other hand, International Fragmentation/Isolation are likely to produce negative results. The outcome classification of the descriptor Livelihoods is less certain, as whilst a return to full employment is a constructive outcome, a focus on unregulated economic performance and growth is not inherently positive as it would likely be at the expense of planetary health through unconstrained energy usage and resource depletion and perhaps human health through the pollution associated with increased production and consumption.

The scenarios described below differentiate clearly between impacts on human health and social well being and environmental degradation and are based on a combination of trends and polices reviewed in the earlier part of the paper, and capture a wider range of drivers and inhibitors for SDG success. They can loosely be mapped onto scenario categories used by others (and reported by Amer, Daim, & Jetter, 2013) as follows:

- Continued growth: World Trade recovers

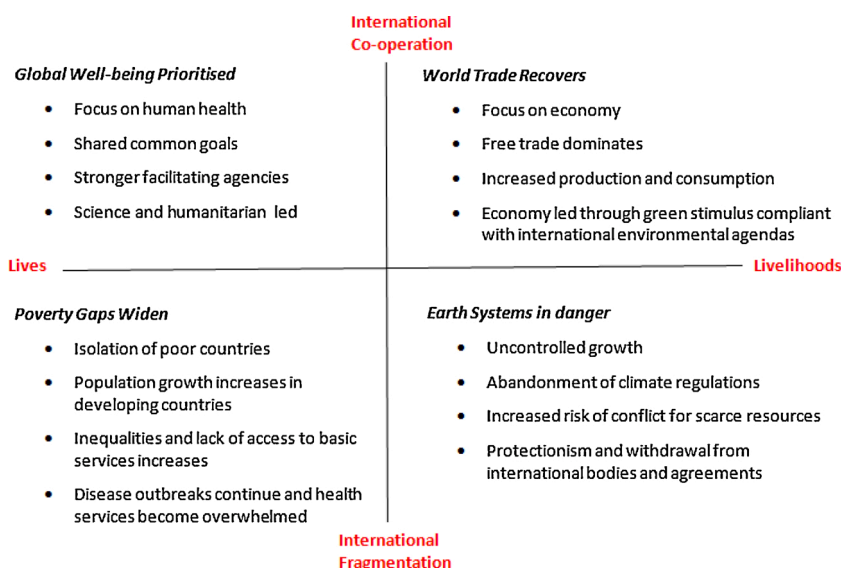


Fig. 1. Possible scenarios post COVID-19 pandemic.

- Collapse: Poverty Gaps Widen
- Steady State: Global well being prioritised
- Transformation: Earth Systems in Danger

3.2.1. Global well-being prioritised (Scenario 1)

The scenario *Global Well-being Prioritised* occurs at the intersection of the *International Co-operation* and *Lives* descriptors and provides potential for positive outcomes from the COVID-19 pandemic. This scenario prioritises human and planetary health through ambitious global development goals that are led by science. In the short term a reinvigorated commitment to dealing with existential global challenges is delivered at the COP 26 meeting in Glasgow in late 2021 by reinforcing the targets set in the 2015 Paris Climate Treaty and a recommitment to action from major industrialised countries. This is followed in the medium term by a review of global institutions such as the United Nations and World Health Organisation and their processes strengthened and improved. As economic stability returns in the longer term, recently imposed temporary caps and reduction on aid spending are removed with additional resources provided to poorer countries to meet their SDG targets.

This is the ideal outcome post the COVID-19 pandemic and would see an accelerated pursuit of the targets behind the Sustainable Development Goals, with either the possibility for the achievement of the goals by 2030 or a review that prioritises and accelerates

**Table 2**  
Impact on SDGs of four post pandemic scenarios (foundational SDGs in bold).

	Scenario	1	2	3	4	
SDG	Title	Global Well-being Prioritised	World Trade Recovers	Poverty Gaps Widen	Earth Systems in Danger	
		Positive influence		Negative influence		
1	<b>NO POVERTY</b>					HUMAN HEALTH
2	Zero Hunger					
3	<b>GOOD HEALTH AND WELL BEING</b>					
4	Quality Education					
5	Gender Equality					
6	Clean Water and Sanitation					
7	Affordable and Clean Energy					
8	Decent Work and Economic Growth					
9	Industry, Innovation and Infrastructure					
10	Reduced Inequalities					
11	Sustainable Cities and Communities					PLANETARY HEALTH
12	Responsible Consumption and Production					
13	<b>CLIMATE ACTION</b>					
14	<b>LIFE BELOW WATER</b>					HUMAN AND PLANETARY HEALTH
15	<b>LIFE ON LAND</b>					
16	Peace, Justice and Strong Institutions					
17	Partnerships for the Goals					



progress towards a select few – such as the foundational SDGs. In this scenario, it is possible that the foundational SDGs, as well as the majority if not all of the SDGs, are achieved if efforts are accelerated.

Table 2 explores which SDGs might be expected to be positively or negatively impacted under each scenario. If a desire for *Global Well-being Prioritised* is the outcome which focuses on human health, direct progress in 10 SDGs might be expected, including all four foundational goals. The U.N. has called the pandemic “an opportunity for the human family to act in solidarity” to achieve the SDGs (Kadakia & Tjhoumia, 2020).

### 3.2.2. World trade recovers (Scenario 2)

This scenario occurs at the intersection of the *International Co-operation* and *Livelihoods* descriptors. Whilst a somewhat optimistic outcome from the COVID-19 pandemic, instead of prioritising planetary and human health, this prioritises the global economy as nations begin to address the economic damage caused by the pandemic and seek to rebuild their economies. Inherently, as free trade is prioritised, there will be an emphasis on production and consumption to stimulate growth that will in turn negatively impact planetary health. This scenario will also ensure that globalization continues, with borders open and countries preferring to not pursue an isolationist approach in order to ensure that their economies recover, which provides some optimism that global development efforts may not totally be abandoned.

However in the short term barriers to growth will be removed or reduced to stimulate economic activity, such as relaxation of planning laws in the UK and lowering of environmental standards and scrutiny in the USA. In the medium term the emergence of China as the dominant global economy, already accelerated by the pandemic, will exacerbate dangerous geo-political tensions. In the longer term, whilst a post COVID-19 economy led scenario will result in widespread financial recovery, it will not help with, and most likely hinder, the achievement of the SDGs, except for the few that have economic growth related targets. Thus it is likely that in this scenario, the foundational SDGs will not be achieved since efforts toward the targets behind SDG 13 (Climate Action), SDG 14 (Life below) and SDG 15 (Life on land) would be sidelined in favour of free trade and economic expansion. However, it is likely that other SDGs that have economic related targets would gain momentum such as SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation and Infrastructure) that seek to increase economic growth and infrastructure respectively. In this scenario progress may be stimulated directly across 4 goals (Table 2). van Zanten and van Tulder (2020) see the understanding of how specific economic activities promote, but also hamper, each of the SDGs as imperative “for escaping the economic bias currently plaguing the SDG agenda”.

### 3.2.3. Poverty gaps widen (Scenario 3)

In this scenario, the outlook post COVID-19 is pessimistic with the intersection of the *International Fragmentation/Isolation* and *Lives* descriptors presenting the case in which the poverty gap widens. This occurs as a result of the countries of the world looking inwards, resulting in diminishing international co-operation and thus an isolation of developing countries from the rest of the world that without the continued development programs from international organisations will experience population growth, increased inequality, lack of services, and events such as disease outbreaks. Filho, Brandli, Salvia, Rayman-Bacchus, and Platje (2020) have pointed to a danger of divergent positions undermining the solidarity needed by the UN to realise the SDGs, with significant consequences for recipient developing economies.

In the short term, impacts on human welfare will drive migration of desperate communities across borders and act as catalysts for local conflicts over scarce resources, reinforcing isolationist measures in rich countries. In the medium term strong regional imbalances will occur further widening the gap between North and South. Longer term risks include further environmental degradation and as illegal trades in animal resources increases, the transmission of zoonotic diseases to a weakened and unresilient human population may occur, triggering further pandemic cycles.

Evidently, in this scenario, the foundational SDGs will not be achieved with SDG1 (No Poverty) and SDG3 (Good Health and Well-being) badly impacted, and as global inequality grows there will be increased fragmentation with achievements made towards the SDG targets coming undone, and the progress over the previous decades being lost entirely. Table 2 suggests 9 SDGs may be adversely affected under this scenario.

### 3.2.4. Earth systems in danger (Scenario 4)

This scenario could yield the most negative outcome from the pandemic and occurs at the intersection of the *Livelihoods* and *International Fragmentation/Isolation* descriptors, combining the worst aspects of all possible futures. Here, there is uncontrolled growth as nations focus on returning to full employment at pre-COVID-19 economic levels. Furthermore, isolationism occurs as nations look inwards and as a result international co-operation is abandoned with governments increasingly following protectionism policies. Effective global governance for both climate change, resource control and biodiversity protection is challenging in an era of economic nationalism (Oldekop et al., 2020).

In the short term climate targets would be missed with an increasing number of countries renege on existing agreements, leading in the medium term to extreme weather events and increasing inundation of coastal communities. In the longer term, but realistically within 10 years, there would be increased global catastrophic risk stemming from uncontrolled global warming, depletion of resources, and biodiversity loss related events. This scenario presents a high risk for international conflict due to the lack of international co-operation and the likely competition over essential resources that will result. As international co-operation diminishes and countries follow isolationist approaches, climate targets such as the 2015 Paris Agreement will be abandoned, and international bodies such as WHO and the UN will be at risk of being dismantled or actively impeded, removing any co-ordinated governance and consistent monitoring of progress in the SDGs. All the foundational SDGs will not be achieved in this scenario with SDG 14 (Life Below Water) and

SDG 15 (Life on Land) particularly at risk. Such setbacks in achieving these goals, together with threats to others such as SDG 13 (Climate Action) and SDG 6 (Clean Water and Sanitation) will create adverse feedbacks into SDG1 (No Poverty) and SDG3 (Good Health and Well-being).

### 3.3. Dangers for planetary and human health

The SDGs seek to alleviate poverty, by developing the infrastructure, economic and organisational systems needed to improve the standard of living across the world whilst ensuring that sustainable development standards are upheld and that the environment is protected (United Nations, 2020a). These goals can then be considered to be achieved through various political, economic, legal, and engineering devices. On this basis the SDGs can be separated into those that concern planetary health and those that concern human health, (Table 2). The majority of the SDGs can be considered to be related to Human Health, whereas only four are directly related to Planetary Health.

In the Global Well Being scenario planetary health is protected through the effective interventions of consensual international regulations which are based on shared goals and a science led agenda. Conversely all the SDGs reflecting planetary health are negatively impacted in the Earth Systems in Danger scenario as unregulated economic growth and industrial expansion is prioritised to drive the recovery. Human Health is most impacted under Scenario 3 which sees none of the benefits of an economic stimulus but leaves many countries with unimproved services due to the inward looking policies of richer nations. Avoiding these outcomes should be the focus as renewed momentum is established towards delivering the SDGs.

## 4. Achieving SDG recovery

Following the COVID-19 pandemic, and the shift of global resources towards containing, treating and then rebuilding from the current crisis, the SDGs are now less likely to be attainable by their 2030 deadline, especially since so many were already not on target for completion before the pandemic.

Sachs et al. (2019) have described 6 SDG Transformations which can inform SDG recovery from the pandemic focusing on: education and skills, health and well being, clean energy and industry, sustainable land use, sustainable cities and digital technologies. We highlight here the importance of the 4 foundational SDGs plus SDG 13 Climate action, as climate change is an overarching priority that cannot be ignored and must be reflected through all future development endeavours. Achieving these goals need shifts in whole systems, particularly in our patterns of production and consumption, and to achieve this a more ambitious trajectory is required (Auckland, 2020). The systems interaction of the foundational SDGs could be the basis for reframing priorities so that both Planetary and Human Health are advanced.

### 4.1. SDG 1 no poverty

Causal connections can be developed from the literature (e.g. Cernev & Fenner, 2020; Cleveland, 2013; Madhav et al., 2017) and available information regarding the coronavirus outbreak (Politico Magazine, 2020; Time, 2020; World Health Organization, 2020). A reinforcing feedback connection from the reduction in health (SDG3) due to the COVID-19 pandemic, suggests the poverty rate has the potential to drastically increase (ABC News, 2020; Madhav et al., 2017; The Guardian, 2020b), as many lose their jobs and livelihoods, with a disproportionate impact on the poor. Whilst estimates are unclear as to the number of people that will be pushed into poverty the global efforts of the last 30 years are likely to be undone (ABC News, 2020; The Guardian, 2020c).

Achieving SDG 1 needs progress to be accelerated in other goals including access to safe water and sanitation (SDG 6), education access (SDG 4), food access (SDG 2) and mobile and internet access to digital technologies. As the world emerges from the pandemic, renewed commitment to "leaving no one behind" is critically needed, but emerging signs of isolation and a redistribution of economic power from West to East may widen poverty gaps further (Scenario 3). This not only reduces the human resources available to contribute to achieving the other goals, but the lack of access to basic services associated with poverty creates conditions and encourages practices which will exacerbate the spread of future pandemics.

### 4.2. SDG 3 good health and well being

Higher mortality will occur not just from COVID-19 but from overburdened health systems, whilst health gains due to lower environmental pollution and reductions in road accidents etc are likely to be shortlived. Target 3d of SDG 3 states the need to : "strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks". However, the COVID-19 pandemic is placing enormous stress on healthcare systems globally, which in turn is leading to their deterioration and rendering them unable to assist populations in other areas of health concern (ABC News, 2020; Liotta, 2020; The Guardian, 2020c). If the targets within the Good Health and Well-Being SDG can be universally delivered then the impact of such a future pandemic on societies around the world would not be so severe. Reducing the pressures on fragile health systems overburdened by communicable disease reduces the risk associated with non-communicable diseases such as diabetes, chronic kidney disorders and cancer (Tonne, 2020).

For most of human history natural global pandemics have posed the greatest risk of mass global fatalities (Farquhar et al., 2017), and in terms of global and existential risks they are classified by Turchin and Denkenberger (2018) as a yellow risk representing possible global catastrophe, and hence a risk to the achievement of sustainable development (Di Marco et al., 2020). Consideration

should be given as to the frequency and impact of such outbreaks, with efforts accelerated to achieve universal health care partly through digital health solutions, and rapid improvements in digital health statistics to inform surveillance and disease prevention strategies. Whilst influenza pandemics have been limited to four in the 20th and 21st centuries, including in 1918, 1957, 1968, and 2009 (Department of Health, 2020), there have been numerous cases of emerging disease that are highly infectious such as Ebola, SARS, and MERS, which have had devastating economic and societal impacts (Di Marco et al., 2020). Whilst this is an inherent risk in our highly connected and globalised world, the risk can be mitigated through integrating pandemic preparedness into sustainable development planning and ensuring that the interplay between biodiversity, agriculture, and society is understood (Di Marco et al., 2020).

A clear outcome of the COVID-19 crisis is that countries with universal health coverage and effective social protection safety nets are best equipped to respond to future health emergencies, and ultimately providing this is less costly than suffering the economic consequences of extended and repeated lockdowns. At least half of the world's population still do not have full coverage of essential health services and about 100 million people are still being pushed into extreme poverty (defined as living on 1.90 USD or less a day) because they have to pay for health care (World Health Organisation, 2019).

#### 4.3. SDG 14 life below water

Whilst the long term environmental impacts of the pandemic are less clear, the goals relating to planetary health are critical in maintaining vital ecosystem services and resources on which humanity depends. These are likely to be significantly adversely impacted in Scenario 4 which sees rapid growth unrestricted by the lack of a global consensus on careful international management and regulation. Thus actions to preserve fish stocks by enforcing fishing quotas to the creation of marine parks, and promoting reef restoration are vitally important.

#### 4.4. SDG15 life on land

The causal connections between the COVID-19 pandemic and the SDGs representing SDG 14 (Life Below Water) and SDG 15 (Life on Land) can see improvements in pollution levels as economies have ultimately shut down in the short term, and the environment is given a breathing space to regenerate. This has been seen in the form of smog clearing over major cities, and a reduction in greenhouse gas emissions, however, it is expected that this will not be long term and will end as soon as government lockdown and social isolation mandates end (National Geographic, 2020; Time, 2020). Over twenty percent of the Earth's land surface is degraded and rising levels of extinction, and wildlife trafficking is exposing humans to new zoonotic diseases and putting millions of lives at risk.

In a world straining to recover by prioritising rapid growth and industrial expansion to balance the huge costs the pandemic has caused, pressures will develop to reduce environmental standards and safe guards, which may be seen as constraining economic activity. For example the UK has announced a recovery strategy to "build, build, build" enabled in part by the relaxation of planning regulations (Booth et al., 2020).

#### 4.5. Climate action (SDG 13)

Whilst global momentum for climate actions had been growing through 2019, partly due to the exposure of the rapidly approaching dangers of an overheating world by Greta Thunberg and others, the hard won gains of the 2015 Paris Agreement seem currently under threat from countries withdrawing or encouraging actions to create further damage to rainforests and other critical elements of the global ecosystem. The damage predicted to be wreaked by climate change will dwarf the current pandemic issues and cannot be ignored. Whilst reductions in global industrial output may have bought a little time the need for suitable responses to maintain this momentum is critical and failure here will simply negate progress in all the other SDGs.

Clearly progress towards meeting these goals will vary across regions, with large disparities already existing between Eastern Asia, OECD countries and sub-Saharan Africa (United Nations, 2020b). However the scenarios represent global impacts affecting to some degree SDG performance in all countries, so whilst the direction of impacts in Table 2 remains valid, the magnitude of change under each scenario will of course be location specific.

### 5. Conclusion

Understanding sustainability requires an understanding of the intersections between complex contexts. Many of these contexts have irreversibly changed as a result of the COVID-19 pandemic, and in ways that are as yet unknown and unknowable. As Stiglitz (2020) has observed the COVID-19 pandemic has thrust us into a new reality, and this presents new dangers and challenges. Although there is a high risk of rebounding to business as usual, Tonne (2020) has encouraged seizing on COVID 19 as an opening for transformation. The COVID-19 emergency is a clear and present danger to all, and this is galvanising a collective response, for example in the remarkable and successful scientific efforts to provide a vaccine, which is seen by many as the panacea for *returning to business-as-usual normality*. By comparison the SDGs are relatively abstract and for many remote and out of sight with no immediate clear consequences (except for climate change) and in many cases require fundamental change *away from* hitherto business as usual normality, suggesting the momentum achieved by the pandemic in some areas will be hard to translate into sustained action for SDG delivery.

To date, the dominant policy responses to sustainability have tended to follow siloed approaches in which one sustainability

challenge is tackled at a time, with little regard to interactions with other aspects of sustainability. The SDGs have been criticised as being contradictory, whereby progress towards targets in one particular goal inhibit the success of another goal (Carant, 2017). With respect to the COVID-19 crisis this approach can lead to improvised and unco-ordinated responses which only address the direct symptoms of the crisis, with the risk of exacerbating negative sustainable impacts (van Zanten & van Tulder, 2020).

Furthermore, global corporations are not included in the targets for the goals (Madeley, 2015) and there has been strong criticism that not enough priority is placed on environmental targets (Kopnina, 2016), and there is not a goal for the decoupling of economic growth and resource consumption (Kopnina, 2016). Proposals discussed at the close of the Millennium Development Goals emphasized the theme of planetary stability, goal measurability and acknowledgement of planetary boundaries (Griggs, Stafford-Smith, & Gaffney, 2013).

This paper has highlighted the implications of the COVID-19 pandemic on 5 critical SDGs which are foundational for achieving success in the others. In reappraising the progress towards achieving the SDGs, taking into account the possible new circumstances which will emerge from the current pandemic, planetary and human health should become the key focus.

The future is uncertain. Our ability to deliver the Sustainable Development Goals by 2030 is in doubt, and will depend on how the world emerges from the COVID-19 pandemic. This presents opportunities to refocus efforts and strengthen humanity's global perspective to rise to challenges that go beyond national borders and transcend us all. Such recalibration may happen but is more likely to lead to an increasingly fractured world order, with the competing interests of a new geo-politics creating barriers to progress with the SDGs. Therefore now is the time to build on the work already achieved and re-invigorate the drive for sustainability around a new re-focused urgency which puts planetary and human health at the centre of its programme.

## References

- ABC News. (2020). *Half a billion people could be pushed into poverty by coronavirus economic fallout, study finds*. Available at: <https://www.abc.net.au/news/2020-04-09/coronavirus-poverty-study-research-oxfam-anu/12136222> (Accessed 12 April 2020).
- Amer, M., Daim, T. U., & Jetter, A. (2013). A view of scenario planning. *Futures*, 46, 23–40.
- Ashford, N. A., Hall, R. P., Arango-Quioroga, J., Metaxa, K. A., & Showalter, A. L. (2020). Addressing inequality: The first step beyond COVID-10 and towards sustainability. *Sustainability (MDPI)*, 12, 5404. <https://doi.org/10.3390/su12135404>.
- Auckland, E. (2020). *Engaging with the SDGs can help us build a better future post-pandemic the UK Stakeholders for Sustainable Development*. <https://www.edie.net/blog/Engaging-with-the-SDGs-can-help-us-build-a-better-future-post-pandemic-6098765>.
- Baldwin, R., & Weder di Mauro, B. (Eds.). (2020). *Economics in the time of COVID-19* (pp. 37–44). CEPR Press. Online ISBN: 978-1-912179-28-2.
- Barbier, E. B., & Burgess, J. C. (2017). The Sustainable Development Goals and the systems approach to sustainability. *Economics: The Open-Access, Open-Assessment E-Journal*, 11(2017-28), 1–22. <https://doi.org/10.5018/economics-ejournal.ja.2017-28>.
- Barbier, E. B., & Burgess, J. C. (2020). Sustainability and development after COVID-19. *World Development*, 135. <https://doi.org/10.1016/j.worlddev.2020.105082>.
- Barouki, R., Kogevinas, M., Audouze, K., Belesova, K., Bergman, A., Birnbaum, L., et al. (2020). The COVID-19 pandemic and global environmental change: Emerging research needs. *Environment International*, 146. <https://doi.org/10.1016/j.envint.2020.106272>.
- Bhattacharya, A., Kharas, H., & McArthur, J. W. (2020). SDGs: a North Star to guide us through this dark time. *Nature (Correspondance)*, 584(20 August), 2020 page 344.
- Booth, P., Bradely, Q., Brownhill, S., Chapman, K., Clifford, B., Edwards, M., et al. (2020). *The wrong answers to the wrong questions Town and Country Planning Association* (available at: <https://www.tcpa.org.uk/the-wrong-answers-to-the-wrong-questions>) accessed 6 January 2021.
- Carant, J. B. (2017). Unheard voices: A critical discourse analysis of the Millennium Development Goals' evolution into the Sustainable Development Goals. *Third World Quarterly*, 38(1), 16–41.
- Cernev, T., & Fenner, R. A. (2020). The importance of feedback loops and tipping points in achieving the Sustainable Development Goals and reducing global risk. *Futures Journal Published on line November 2019 Futures*, 115(2020), Article 102492. <https://doi.org/10.1016/j.futures.2019.102492>.
- Chapman, A., & Tsuji, T. (2020). Impacts of COVID-19 on a transitioning energy systems, society and international co-operation. *Sustainability (MDPI)*, 12, 8232. <https://doi.org/10.3390/su12198232>.
- Cleveland, B. (2013). *Mobilizing informal workers for urban resilience: Linking poverty alleviation and disaster preparedness*. UCLA Institute for Research on Labor and Employment Research & Policy Brief.
- Cohen, M. J. (2020). "Does the COVID-19 outbreak mark the onset of a sustainable consumption transition?," *Sustainability: Science. International Journal of Human Resource Development Practice Policy & Research*, 16(1).
- CREA. (2020). *China's air pollution overshoots pre-crisis levels for the first time*. Centre for Research on Energy and Clean Air.
- Department of Global Communications. (2020). *UN working to fight COVID-19 and achieve Global Goals*. Available at: <https://www.un.org/en/un-coronavirus-communications-team/un-working-fight-covid-19-and-achieve-global-goals> (Accessed 15 April 2020).
- Department of Health. (2020). *History of pandemics*. Available at: <https://www1.health.gov.au/internet/main/publishing.nsf/Content/about-pandemic-history> (Accessed 3 May 2020).
- Di Marco, M., Baker, M., Daszak, P., De Barro, P., Eskew, E., Godde, C., et al. (2020). Opinion: Sustainable development must account for pandemic risk. *Proceedings of the National Academy of Sciences of the United States of America*, 117(8), 3888–3892.
- European Commission. (2020). *A European Green Deal: Striving to be the first climate-neutral continent*. [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en).
- Farquhar, S., Halstead, J., Cotton-Barratt, O., Schubert, S., Belfield, H., & Snyder-Beattie, A. (2017). *Existential risk diplomacy and governance*. Global Priorities Project, 2017.
- Filho, W. L., Brandli, L. L., Salvia, A. L., Rayman-Bacchus, L., & Platje, J. (2020). COVID-10- and tee UN sustainable development goals: threat to solidarity or an opportunity? *Sustainability (MDPI)*, 12, 5343. <https://doi.org/10.3390/su12135343>.
- Financial Times. (2020). *Trump eases environmental rules during pandemic*, 23 June 2020 <https://www.ft.com/content/77e21727-7f26-4480-b250-5b50b30352a4> (accessed 6 January 2021).
- Griggs, D., Stafford-Smith, M., Gaffney, O., et al. (2013). Sustainable development goals for people and planet. *Nature*, 495, 305–307. <https://doi.org/10.1038/495305a>.
- Gulseven, O., Al Harmoodi, F., Al Falasi, M., & Al Shomali, I. (2020). *How the COVID-19 will affect the UN sustainable development goals (SDGs)*, 5 May 2020. SSRN 3592933 2020. Available online: <https://papers.ssrn.com/abstract=3592933> (accessed on 4 January 2021).
- Hansford, M. (2020). *COVID-19 makes delivering on the UN sustainable development goals ever more vital institution of civil engineers news and insight*. The Civil Engineering Blog (May 15th 2020 (see: [https://www.ice.org.uk/news-and-insight/the-civil-engineer/may-2020/covid-19-complicates-delivery-of-un-sdgs?\\_ccCt=vw8XKNBcrAMGa4sG7frhf36~EfidEzZ~GmacE1AZHPuP5LroTRlf35BLdDPXGoSX](https://www.ice.org.uk/news-and-insight/the-civil-engineer/may-2020/covid-19-complicates-delivery-of-un-sdgs?_ccCt=vw8XKNBcrAMGa4sG7frhf36~EfidEzZ~GmacE1AZHPuP5LroTRlf35BLdDPXGoSX)).
- Heggen, K., Sandset, T. J., & Engebretsen, E. (2020). *COVID-19 and sustainable development goals*. Editorial Bulletin World Health Organisation.
- Helm, D. (2020). *September 2020 (and March 2021): The temporary and the permanent impacts of coronavirus*. <http://www.dieterhelmD.co.uk/publications/september-2020-and-march-2021-the-temporary-and-the-permanent-impacts-of-coronavirus/>.

- Hepburn, C., O'Callaghan, B., Stern, N., Stiglitz, J., & Zenghelis, D. (2020). Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change? *Oxford review of Economic Policy*, 36(S1). Oxford Smith School of Enterprise and the Environment | Working Paper No. 20-02 ISSN 2732-4214.
- Islam, M. S., Sarkar, T., Khan, S. H., Mostofa Kamla, A.-H., Hasan, S. M. M., Kabir, A., et al. (2020). COVID-19 related infodemic and its impact on Public Health: A global social media analysis. *The American Journal of Tropical Medicine and Hygiene*, 103(4), 1621–1629. <https://doi.org/10.4269/ajtmh.20-0812>.
- Kadakia, K., & Tjhoumia, A. (2020). *The coronavirus is a siren for the health related Sustainable Development Goals Future Development (Brookings Community)*. <https://www.brookings.edu/blog/future-development/2020/05/13/the-coronavirus-is-a-siren-for-the-health-related-sustainable-development-goals/>.
- Kharas, H., & Hamel, K. (2020). *Turning back the Poverty clock: How will CID 10 impact the worlds' poorest people Future Development (Brookings Community)*. <https://www.brookings.edu/blog/future-development/2020/05/06/turning-back-the-poverty-clock-how-will-covid-19-impact-the-worlds-poorest-people/>.
- Kopnina, H. (2016). The victims of unsustainability: A challenge to sustainable development goals. *The International Journal of Sustainable Development and World Ecology*, 23(2), 113–121.
- Le Quéré, C., Jackson, R. B., Jones, M. W., Smith, A. J. P., Abernethy, S., Andrew, R. M., et al. (2020). Temporary reduction in daily global CO<sub>2</sub> emissions during the COVID-19 forced confinement. *Nature Climate Change*. <https://doi.org/10.1038/s41558-020-0797-x>.
- Liotta, M. (2020). *Coronavirus posing significant mental health threat*. Available at: <https://www1.racgp.org.au/news/clinical/coronavirus-posing-significant-mental-health-impac> (Accessed 12 April 2020).
- Madeley, J. (2015). Sustainable development goals. *Appropriate Technology*, 42(4), 32–33.
- Madhav, N., Oppenheim, B., Gallivan, M., Mulembakani, P., Rubin, E., & Wolfe, N. (2017). *Disease control priorities: Improving health and reducing poverty*. Available at: [https://www.ncbi.nlm.nih.gov/books/NBK525302/?fbclid=IwAR2Q\\_IP8ZziAu1jP4VGTiBytu2juDV3GyJ2P2MkxkqBrYUhrDZ6nacpJWg](https://www.ncbi.nlm.nih.gov/books/NBK525302/?fbclid=IwAR2Q_IP8ZziAu1jP4VGTiBytu2juDV3GyJ2P2MkxkqBrYUhrDZ6nacpJWg) (Accessed 16 April 2020).
- Moyer, J. D., & Hedden, S. (2020). Are we on the right track to achieve the sustainable development goals. *World Development*, 127(104749).
- Naidoo, N., & Fisher, B. (2020). Sustainable development goals: Pandemic reset. *Nature* (Vol 583., 198–210 (9 July 2020).
- National Geographic. (2020). *Pollution made COVID-19 worse. Now, lockdowns are clearing the air*. Available at: <https://www.nationalgeographic.com/science/2020/04/pollution-made-the-pandemic-worse-but-lockdowns-clean-the-sky/> (Accessed 12 April 2020).
- Nature. (2020). Time to revise the sustainable development goals. *Nature (Editorial)* (Vol 583), 16 July 2020.
- Oldekop, J. A., Horner, R., Hulme, D., Adhikari, R., Agarwal, B., Alford, M., et al. (2020). COVID-19 and the case for global development. *World Development*. <https://doi.org/10.1016/j.worlddev.2020.105044>. Published online June 2020.
- Politico Magazine. (2020). *Coronavirus will change the world permanently. Here's how*. Available at: <https://www.politico.com/news/magazine/2020/03/19/coronavirus-effect-economy-life-society-analysis-covid-135579> (Accessed 11 April 2020).
- Quinho, O., & Enkelow, K. (2020). *How have the Covid pandemic and lockdown affected air quality in cities?* London UK: Centre for Cities (Accessed 4 January 2021) <https://www.centreforcities.org/wp-content/uploads/2020/12/How-have-the-Covid-pandemic-and-lockdown-affected-air-quality-in-cities.pdf>.
- Randers, J., Rockstrom, J., Stoknes, P. E., Goluke, U., Collste, D., & Cornell, S. (2018). *Transformation is feasible! How to achieve the sustainable development goals within planetary boundaries*. Stockholm: Stockholm Resilience Centre.
- Sachs, J., Schmidt-Traub, G., Kroll, C., LaFortune, G., Fuller, G., & Woelm, F. (2020). *The sustainable development goals and COVID-19. The sustainable development report 2020*. Cambridge: Cambridge University Press.
- Sachs, J., Schmidt-Traub, G., Mazzucato, M., Messner, D., Nakicenovic, N., & Rocjstrom, J. (2019). Six transformations to achieve the sustainable development goals. *Nature Sustainability*, 2(9), 805–814.
- Solberg, E., & Akufu Addo, N. (2020). *Why we cannot lose sight of the Sustainable Development Goals during coronavirus*. Available at: <https://www.weforum.org/agenda/2020/04/coronavirus-pandemic-effect-sdg-un-progress/> (Accessed 29 June 2020).
- Stiglitz, J. (2020). *Four priorities for pandemic relief efforts*. Roosevelt Institute (see [https://rooseveltinstitute.org/wp-content/uploads/2020/04/RI\\_Four-Priorities-for-Pandemic-Relief-Effort-WP-202004-1.pdf](https://rooseveltinstitute.org/wp-content/uploads/2020/04/RI_Four-Priorities-for-Pandemic-Relief-Effort-WP-202004-1.pdf)).
- The Economist Intelligence Unit. (2020a). *Down but not out. Globalisation and the threat of COVID-19*. London.
- The Economist Intelligence Unit. (2020b). *Geopolitics after COVID-19: Is the pandemic a turning point?*. London.
- The Economist Intelligence Unit. (2020c). *Protests in the Middle East and North Africa out of the frying pan into the fire?*. London.
- The Economist Intelligence Unit. (2020d). *The Great Unwinding COVID-19 and the regionalisation of global supply chains*. London.
- The Environment. (2020). *COVID -19 Lockdown cuts this year's global carbon emissions*. CIWEM. July/August 2020.
- The Guardian. (2020a). *US expelling hundreds of child migrants, citing coronavirus pandemic* (Accessed 6 January 2020) <https://www.theguardian.com/us-news/2020/may/13/us-expelling-central-american-child-migrants-coronavirus-pandemic>.
- The Guardian. (2020b). *Coronavirus could turn back the clock 30 years on global poverty*. Available at: <https://www.theguardian.com/global-development/2020/apr/09/coronavirus-could-turn-back-the-clock-30-years-on-global-poverty> (Accessed 12 April 2020).
- The Guardian. (2020). *Coronavirus pandemic exacerbates inequalities for women, UN warns*. Available at: <https://www.theguardian.com/world/2020/apr/11/un-coronavirus-pandemic-gender-inequalities-women> (Accessed 12 April 2020).
- The Lancet. (2020). *“Will the COVID-19 pandemic threaten the SDGs?”*. Editorial Vol 5 August.
- Time. (2020). *Global air pollution has fallen due to the coronavirus outbreak, but experts warn it isn't a silver lining*. Available at: <https://time.com/5812741/air-pollution-coronavirus/> (Accessed 12 April 2020).
- Tonne, C. (2020). Lessons from the COVID-19 pandemic for accelerating sustainable development. *Environmental Research*. published on-line 17 November 2020.
- Turchin, A., & Denkenberger, D. (2018). Global catastrophic and existential risks communication scale. *Futures*, 102, 27–38.
- UN Development News. (2020). *‘Urgency to act’ for sustainable development, greater than ever as coronavirus pandemic continues*. May 11 2020 <https://news.un.org/en/story/2020/05/1063742>.
- United Nations. (2020a). *Sustainable development goals*. Available at: <http://www.un.org/sustainabledevelopment/> (Accessed 11 April 2020).
- United Nations. (2020b). *The sustainable development goals report 2019*. Available at: <https://unstats.un.org/sdgs/report/2019/> (Accessed 11 April 2020).
- United Nations. (2020c). *Decade of action*. Available at: <https://www.un.org/sustainabledevelopment/decade-of-action/> (Accessed 15 April 2020).
- United Nations Environment Programme. (2020). *COVID-19: Four sustainable development goals that help future-proof global recovery*. Available at <https://www.unenvironment.org/news-and-stories/story/covid-19-four-sustainable-development-goals-help-future-proof-global> (Accessed 29 June 2020).
- United Nations Environment Programme and International Livestock Research Institute. (2020). *Preventing the next pandemic: Zoonotic disease and how to break the chain of transmission*. ISBN, Nairobi ISBN 978-92-807-3792-3799.
- van Zanten, J. A., & van Tulder, R. (2020). Beyond COVID -19: Applying “SDG logics” for resilient transformations. *Journal of International Business Policy*, 3, 451–564. Published on-line 16 October 2020.
- World Health Organisation. (2019). *Universal health coverage factsheet*. [https://www.who.int/news-room/fact-sheets/detail/universal-health-coverage-\(uhc\)](https://www.who.int/news-room/fact-sheets/detail/universal-health-coverage-(uhc)).
- World Health Organization. (2020). *Coronavirus*. Available at: [https://www.who.int/health-topics/coronavirus#tab=tab\\_1](https://www.who.int/health-topics/coronavirus#tab=tab_1) (Accessed 11 April 2020).
- Zukunftsinsttitut. (2020). *White paper: The corona effect — Four future scenarios*. Kaiserstr. 53 60329 Frankfurt am Main: Zukunftsinsttitut GmbH Internationale Gesellschaft für Zukunfts- und Trendberatung.