Research Paper

Linking the Environment, SDGs and Economic Growth: Are We Doing Enough?

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ABSTRACT
"One thing leads to the other. Deforestation leads to climate change, which leads to ecosystem losses, which negatively impacts our livelihoods – it's a vicious cycle" – this is the famous quote by the Supermodel and United Nations Goodwill Ambassador, Gisele Bundchen. Nowadays, one of the most topical issues that have received extensive attention in Environmental and Development Economics centers on what Bundchen was talking about. Attempts at demystifying Bundchen's statements have spawned an avalanche of policy positions, pronouncements and discussions. Motivated by the dynamic interaction between the environment, SDGs and the economy, this paper systematically explores literature. Results indicate that the Environmental Kuznets Curve (EKC) is valid in most parts of the world. Amongst other policy prescriptions, the study recommends the adoption of "green growth" if the environment is to be conserved for current and future generations across the globe amid the visible threats of climate change.

I.   INTRODUCTION

The history of the concept of sustainable development is associated with the changing perceptions of environmental concern, nature conservation and development during the last century. The flourishing of the sustainable development concept can be explained by the rise of international environmentalism and development studies in the mid 20th century. The emergence of sustainable development can also be explained in connection to the rise of environmentalism as a global concern and the growing awareness that human actions have had serious ecological implications. The recognition of the importance of nature preservation and conservation in all countries emerged post World War Two. Since the first commemoration for the World Environment day on 5 June 1974 under the theme 'only one Earth' awareness on environmental issues have gained significant momentum though a lot needs to be done for current and future generations. Consequently, this formed the most deep seated root of sustainable development thinking as sustainable development came to be viewed as a means to promote preservation and conservation. The idea of the balance of nature was recognized; that the stable state of equilibrium of ecological systems can be upset by human actions. The evolution of sustainable development was also spearheaded by the growing awareness of global environmental problems. Sustainable development, indeed, has deep and complex roots.

In 2015, on the 25th -26th of September, the United Nations (UN) launched the 2030 Agenda for Sustainable Development, which is composed of 17 Sustainable Development Goals (SDGs) (UN, 2015). This came into effect from 01st January 2016. The UN's SDGs are now a reference point for policy making processes worldwide (Kornov *et al.*, 2020). The SDGs, built on the Millennium Development Goals (MDGs); aim to eradicate poverty, leaving no one behind, and to shift the world on to a sustainable and resilient growth trajectory. Table 1 below is a summary of the 17 SGDs:

Table 1: Summary of the SDGs

SGD	Statement	Explanation
1	No poverty	To eradicate extreme poverty; and ensure that all men and women have equal rights to economic resources, as well as access to basic services, create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender- sensitive development strategies, to support accelerated investment in poverty eradication actions.
2	Zero hunger	To ensure access by all people to safe, nutritious and sufficient food, end all forms of malnutrition, double the agricultural productivity and incomes of small-scale food producers, ensure sustainable food production systems and implement resilient agricultural practices, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species.
3	Good health and well-being	To reduce the global maternal mortality, neonatal and children mortality and mortality for illnesses from hazardous chemicals and air, water and soil pollution and contamination, the number of global deaths and injuries from road traffic accidents, to end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases, to strengthen the prevention and treatment of substance abuse, to have access to quality essential health-care services and to safe, effective, quality and affordable essential medicines and vaccines for all.
4	Quality education	To ensure global literacy and numeracy, equitable and quality primary, secondary and tertiary education and effective learning outcomes, to increase the number of youth and adults who have relevant skills, including technical and vocational skills.
5	Gender equality	To end all forms of discrimination, violence, harmful practices (such as child, early and forced marriage and female genital mutilation) against women, ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life, recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies.
6	Clean water and sanitation	To increase access to safe and affordable drinking water, adequate and equitable sanitation and hygiene and end open defecation, improve water quality, address water scarcity.
7	Affordable and clean energy	To increase the share of renewable energy and improve energy efficiency.
8	Decent work and economic growth	To sustain per capita economic growth, achieve higher levels of economic productivity, support productive activities, decent job creation, entrepreneurship, creativity and innovation, reduce the proportion of youth not in employment, education or training (NEETs), protect labour rights and promote safe and secure working environments for all workers.
9	Industry, innovation and infrastructure	To enhance scientific research, upgrade the technological capabilities, encourage innovation and access to information and communications technology, upgrade infrastructures.
10	Reduce inequality	To reduce disparities in income growth within countries and reduce inequalities of outcome.
11	Sustainable cities and communities	To ensure access to adequate, safe and affordable housing and basic services, to safe, affordable, accessible and sustainable transport systems and enhance inclusive and sustainable urbanization by providing accessible green and public spaces and supporting positive economic, social and environmental links between urban, peri-urban and rural areas.
12	Responsible consumption and production	To encourage lifestyles in harmony with nature through sustainable and efficient use of natural resources, waste generation prevention, reduction, recycling and reuse, inefficient fossil-fuel subsidies rationalization.
13	Climate action	To strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries and integrate climate change measures into national policies, strategies and planning.
14	Life below water	To prevent and significantly reduce marine pollution, manage and protect marine and coastal ecosystems, minimize and address the impacts of ocean acidification, effectively regulate harvesting and end overfishing.
15	Life on land	To promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests, land and soils, combat desertification, ensure the conservation of mountain ecosystems, reduce the degradation of natural habitats.
16	Peace, justice and strong institutions	To promote the rule of law at the national and international levels, ensure equal access to justice, strengthen the recovery and return of stolen assets and combat all forms of organized crime, reduce corruption.
17	Partnerships to achieve the goals	To strengthen international cooperation on education, science, technology and innovation and domestic resource mobilization including through support and development assistance commitments to developing countries.

Even-though Marsden (2018) and Weitz *et al*. (2019) specifically point to only SGDs 12, 14 and 15 as "environmental SDGs" the bulk part of the literature for example, UN (2017), Jenkins (2018) and Menton *et al*. (2020); acknowledges the fact that all these SDGs are most relevant to the environment; hence the term "environmental SDGs" applies to all the 17 SDGs.

Rationale for Linking the Environment to SDGs

Many reasons exist as to why we need to embed the environment in SDGs, firstly because environment is a prerequisite for socio-economic development, secondly, human health and wellbeing depend on good environmental quality and thirdly, environment has intrinsic values. As a prerequisite for socio-economic development, environment is the backbone for agriculture, including healthy off-farm and on-farm biodiversity. The environment is the chief provider of basic inputs to the economy, for example, water, energy and fuels, productive soils, and so on but the need to balance economic growth and environmental sustainability is increasingly critical as shown in Figure 1 below. Further, the absence of quality environmental conditions, for example, in the form of contaminated water or polluted air, endangers our health and wellbeing. Last but not least, nature also provides us with educational, cultural, recreational, aesthetic, religious, spiritual and various other intrinsic values (UNEP, 2013).
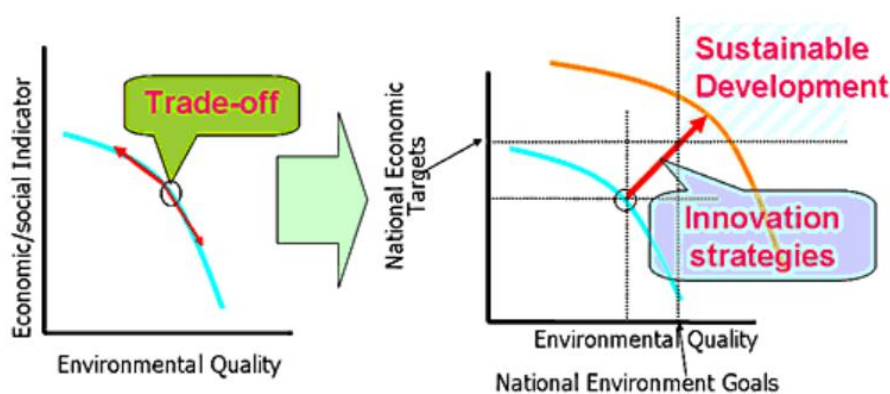

Figure 1: Trade off between Economic Targets and Environmental Quality Source: National Institute of Environmental Studies Japan, 2020

II. LITERATURE REVIEW

Theoretical Literature Review

The link between economic growth and the environment is a relatively new subject in economics and due to this, there are not many established theories on the area. However, the most extensive theory is the Environmental Kuznets Curve (EKC) theory (Kuznets, 1955) which has theoretical roots in classical economics. The EKC, as shown below in fig 2, follows an inverted U-shape where the environmental damage initially increases with a growing economy to later decrease after a certain point of wealth. The opposite trend can be observed for the Brundtland Curve Hypothesis (BCH), as shown in fig 3 below, where environmental damage increases in the beginning of economic growth, followed by decrease in environmental stress when the economies grow, until a point is reached, after which the environmental degradation will further aggravate. This, according to Brundtland; is because poverty is a major cause for environmental problems and their activities like deforestation, overuse of marginal land leading to desertification and urbanization which become so intense and stressful for the environment (WCED, 1987). The upward movement of the environmental damage curve is due to increased consumption which further leads to increased production. Therefore, according to BCH theory environmental degradation caused by increased production is as damaging as the problems initially caused by poverty (Field and Field, 2013). The similarity between these two curves is the existence of a turning point as well as the theoretical explanation behind the increase in environmental damage. Even though it might not be called the scale effect in the BCH, the mechanism is the same. The reason for the decrease in environmental damage, however, differs between the two theoretical frameworks. For the EKC theory, it is the effective production, international trade and increased demand for a clean planet that mainly drives down environmental damage at the later stages of economic growth. According to the BCH, the reduced poverty creates possibilities to prioritize the environment, which drives down the environmental damage at an early stage of economic growth. However, as the economies grow and poverty declines, the consumption levels of the population increases which drives for more production, thus further giving more stress to the environment as much as caused by poverty initially. The two contradicting theories are accompanied by a third, the Daly theory (Daly, 1973), depicted in fig 4 below; that does not accommodate any type of turning point. According to

the Daly theory, the environmental damage increases with economic growth unless the very principles of the modern world economy changes. Again, the scale effect is responsible for the increase in environmental damage and is regarded as a common denominator for the three most acknowledged theories on the subject. Broadly these theories show the existence of co-integration between environmental damage due to carbon dioxide emissions and the macroeconomic variables.
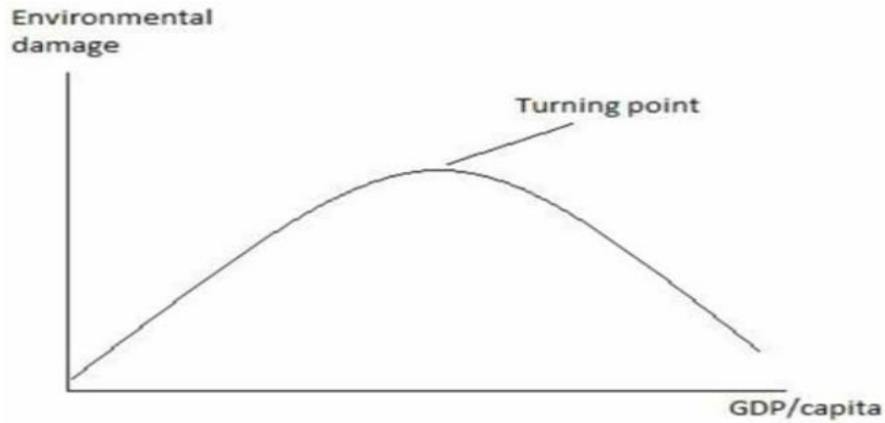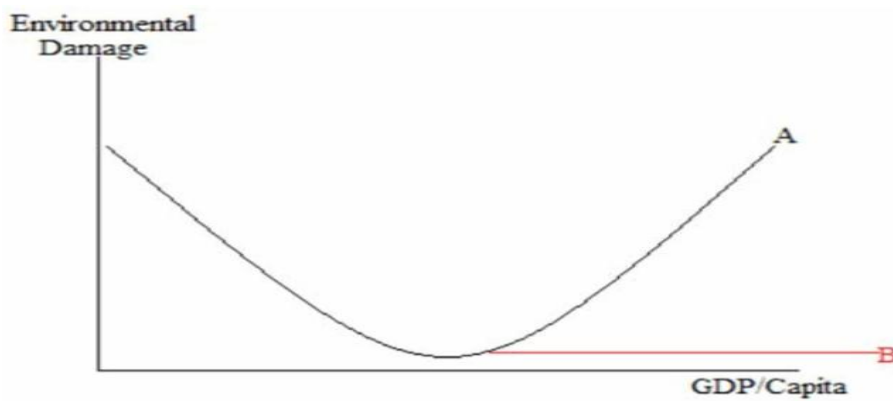
Figure 2: Environmental Kuznets Curve
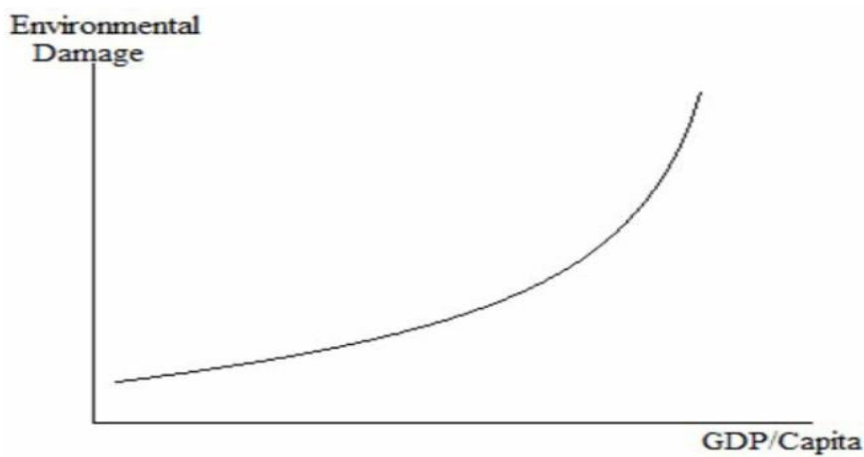
Figure 3: Brundtland Curve Hypothesis

Figure 4: Environmental Daly Curve

Source: Figures 2, 3 and 4 are taken from Onyango *et al*. (2021).

The empirical part of this analysis is presented in table 2 below:

Empirical Literature Review

Table 2: Empirical Literature Review

Author/s (Year)	Country	Method	Study Period	Key Findings
Cialani (2007)	Italy	OLS and IDA	1861 – 2002	"U" form of EKC is not confirmed from IDA; OLS shows a positive relationship between economic growth and CO_2 emission
Ahmed & Long (2012)	Pakistan	ARDL	1971-2008	EKC hypothesis supported in the short-run and long-run
Saboori et al. (2012)	Indonesia	ARDL	1971-2007	Energy consumption, along with economic growth and foreign trade explain CO_2 emission
Azam & Khan (2016)	Tanzania, Guatemala, China, USA	Panel regression	1975-2014	EKC hypothesis valid for Tanzania and Guatemala while invalid for China and USA
Zaied et al. (2017)	MENA Countries	DOLS	1980-2013	EKC hypothesis validated
Acar et al. (2018)	Middle East, OECD, and OPEC countries	GMM Estimation	1970-2016	N-shaped EKC exists for all countries
Rifa & Dewi (2018)	10 ASEAN countries	Panel regression	1994-2015	Population, forest area and CO_2 emissions significantly affect economic growth
Beyene & Kotosz (2020)	East African countries	Panel OLS	1990-2013	EKC hypothesis was confirmed
Amar (2020)	UK	Monte Carlo technique	1751-2016	EKC hypothesis is validated
Sheikh & Hassan (2021)	India	FMOLS	2001-2018	EKC hypothesis is supported
Zhang (2021)	China	ARDL	1980-2014	N-shaped EKC confirmed in the long-run
Arnaut & Lidman (2021)	Greenland	ARDL	1970-2018	"U" shaped EKC hypothesis validated
Onyango et al. (2021)	Kenya	ARDL	1963-2017	BCH confirmed
Seri & Fernandez (2021)	Latin American countries	ARDL	1960-2017	EKC hypothesis was confirmed
Simionescu et al. (2021)	European Union Member States	ARDL	1996-2019	"N" shaped EKC supported

Source: Reviewed Literature (2021)

Most researchers have applied the ARDL econometric model shown in table 1 above. Below table 2, we discuss the outcome of our systematic literature review.

III.   METHODOLOGY

The researchers conducted a systematic review of literature in order to carry out a reliable analysis of the dynamics amongst the environment, SDGs and the economy. The accidental sampling technique was employed in order to select the representative sample which consisted of 15 studies done across the globe.

IV.   RESULTS & DISCUSSION

Table 3: Results from the Systematic Literature Review

Author/s	Year	EKC	BCH	Daly theory
Cialani	2007			*
Ahmed & Long	2012	*		
Saboori et al	2012			*
Azam & Khan	2016	*		
Zaied et al	2017	*		
Acar et al	2018	*		
Rifa & Dewi	2018			*
Beyene & Kotosz	2020	*		
Amar	2020	*		
Sheikh & Hassan	2021	*		
Zhang	2021	*		
Arnaut & Lidman	2021	*		
Onyango et al	2021		*	
Seri & Fernandez	2021	*		
Simionescu et al	2021	*		
Summary Statistics [$\frac{\pi}{15}x100\%$]		73.3%	6.7%	20%

Source: Reviewed Literature (2021)

Table 3 above shows that most studies (73.3%) support the validity of the EKC while a few researchers (6.7%) such as Onyango *et al*. (2021) confirm validity of the BCH. From our analysis, the Daly theory is confirmed by 20% of the studies reviewed. Indeed, for most countries across the globe, environmental damage initially increases with growing economy but as countries turn to effective production technologies and start prioritizing green growth, environmental damage decreases. The classic example in this context is how China has started to prioritize the environmental protection by going green after decades of industrial pollution in the midst of China's economic boom. It is estimated that China needs around $ 6.4 trillion to $ 19.4 trillion to finance the transition to a greener economy. And China has started to impose environmental tax to finance its environment improvement policies apart from attracting green investment (WEF, 2018).

However, if we look at the newly emerging economies way of development, it is clear that the economic development and environment correlations may not turn into inverted U-shaped postulated by the Environmental Kuznets Curve, neither Brundtland U-shape (BCH) nor Daly's positive upward movement trend. Rather the curve could be turned into negative downward sloping curve as shown in figure 5. The aforementioned figure depicts the developmental policy inclusive of environmental conservation from the initial stage. In the initial stage there is little environmental stress due to existence of poverty as in the case of Brundtland curve hypothesis. After that as the economy grows; the environmental damage declines. However, since the economic development policy is inclusive of environmental conservation the curve will not take U-shaped rather the curve will have negative slope and touch the X-axis line depicting carbon neutral phenomenon. The curve will even go negative depicting carbon negative as in the case of Bhutan a small eastern Himalayan country. However, the curve might take U-shaped as in the case of EKC but it will be in the region of negative zone which is below X-axis. This U-shaped will take place due to the fact that the gestation period of the tress, plants etc planted decades back will be over and they might be cut down at some point of time in the future. The curve will sustain at the carbon neutral for some years and then depending on the policies adopted by the economies, the curve will move either upward or downward. For instance, if the number of trees cut or environmental stresses created are not replaced by the equal number of trees planted or replenished, the environmental damage will increase and the curve will move upward as shown in the figure. However, if the replenishment is done the curve will again move downward depicting carbon neutral phenomenon. Economic development policies of lesser developed countries of Africa like in the Sahel region are inclusive of the environmental conservation. The Great Green Wall (GGW) which stretches from western part of Africa to the eastern coast plans to combat desertification by planting millions of trees. The project is under the leadership of the African Union Commission and Pan-African Agency of the Great Green Wall. The GGW project is not only to combat desertification, however, this can provide livelihood to millions of African people in the form of growing fertile land, thus maintain food security, provide immense opportunities to the African youths apart from creating climate resilience region. Therefore, economic development models need not be based only on the established theories that has been practiced by many developed countries since decades, however, there should be a paradigm shift to embrace environmental conservation vis-à-vis economic growth and development and not only focus on environmental restoration. This is because environmental conservation will be much better than environmental restoration. At times the damage caused by the environmental destruction may not be reversible and thus cannot be restored. Therefore, economic development policy which is inclusive of environmental conservation may experience the phenomenon like the one shown in figure 5. And the economic model of this kind will allow economic development and environmental conservation simultaneously and there may not be any necessity to spend quantum of money on environmental restoration.
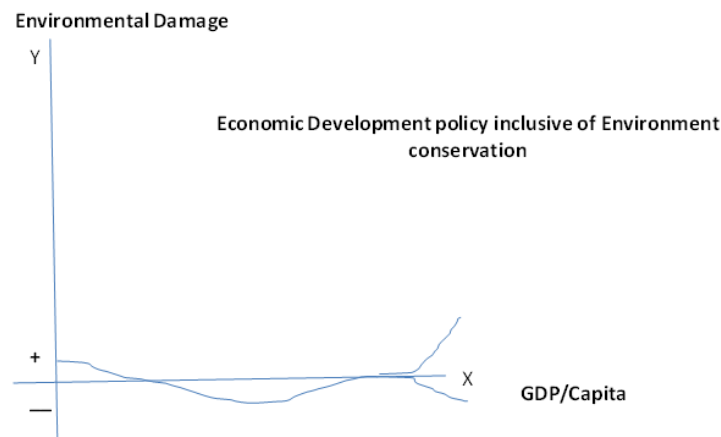

Figure 5: Economic development policy inclusive of environmental conservation
Source: Created by the Authors

V.   POLICY RECOMMENDATIONS

Given the overwhelming empirical confirmation of the EKC and the fact that SDGs are largely "environmental", countries across the globe are encouraged to embrace the policy directions suggested below:

i.   Communities need paradigm shift in taking action at household level and enact robust bi-laws to safeguard the environment. In fact, communities need to be at the forefront of preserving and protecting the environment. Furthermore, there is need for intensive training and catalytic investment to initiate innovative solutions at grassroots level;

ii.   Governments need to shift from rhetoric to action towards sustaining the environment and implement enforcement measures with punitive consequences for environmental offenders. Reviewing and enacting incentives to promote environmental action need to be prioritized;

iii.   Non- state actors such as NGOs and Private sector to engender environmental issues in day to day operations. Private sector involvement is indeed key in ensuring multi-stakeholder support towards the environmental cause in tandem with 2021 theme for World Environment Day, "Restoring the ecosystem" and which has become the launch of the UN decade on Ecosystem Restoration. The ecosystem restoration can take place in the form of growing tress, greening cities, cleaning up rivers and coasts amongst others;

iv.   There is need for robust budgetary allocation and monitoring to enable fiscal allocation towards the environment management. The government may consider incentivizing community based activities which add value to environmental sustainability. Environment tax/levy could be considered to channel revenue towards funding diverse environmentally oriented initiatives;

v.   Governments around the globe need to embrace the so-called "green growth", not just growth; this will go a long way in ensuring that countries around the globe foster economic growth and development while conserving the environment;

vi.   Developing countries ought to modernize their existing industries, especially by adopting new technologies that reduce environmental damage.

VI.   CONCLUSION

Mankind's activities continue to exert the greatest threat to the environment. The rise in marine pollution, global warming, air pollution and human population calls for multi-stakeholder and systems change approach to slow down and possibly reverse the adverse pressure on the environment. This review paper indicates that the EKC holds water in many countries around the globe, essentially confirming that indeed economic growth is good for the environment. However, there is still no guarantee that economic growth will lead to an improved environment, hence the urgent need to embrace the policy recommendations suggested above.

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