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An Analytical Study of Global Progress towards the Sustainable Development Goals

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***Abstract*— A sustainable future has long been a term touted as the need of the hour. The United Nations has established a set of interlinked Sustainable Development Goals (SDGs), which if met, can unlock this utopian future. In reality, it is difficult to execute plans to meet the SDGs due to various factors such as political inclinations, economic conditions, demographic restrictions and so on. In this paper, a systematic, analytics-based study of the progress made so far towards sustainability has been charted out for the major SDGs. In addition, the effects of the unprecedented COVID pandemic have been factored in for a realistic estimate of the current situation, concluding with the outlook for future years and the expanse of efforts needed to be exerted to truly attain sustainability.**

Keywords*— *Sustainable Development, SDGs, UN, Progress, Analytics, Survey, Pandemic.

I. INTRODUCTION

Humans have existed on planet Earth for an incredibly long time, more than 5 million years. Over this gargantuan time period, we have developed by leaps and bounds, right from the discovery of fire, up to the medieval ages, industrial revolution and the rapid advancements of the 20th and 21st century. However, in this transition process, we have excessively exploited the Earth's resources, to the point where some have been permanently lost. In the wake of an increasing awakening that reforms are needed to make humanity tenable, the United Nations has put forth the Sustainable Development Goals.

The Sustainable Development Goals (SDGs) or Global Goals are a collection of 17 interlinked global goals designed to be a "blueprint to achieve a better and more sustainable future for all". The SDGs were set up in 2015 by the United Nations General Assembly and are intended to be achieved by the year 2030. The 17 SDGs are: (1) No Poverty, (2) Zero Hunger, (3) Good Health and Well-being, (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) Reducing Inequality, (11) Sustainable Cities and Communities, (12) Responsible Consumption and Production, (13) Climate Action, (14) Life Below Water, (15) Life On Land, (16) Peace, Justice, and Strong Institutions, (17) Partnerships for the Goals.

Though the goals have been set, it is imperative to track their progress as one-third of the timeline given has elapsed. This paper conducts an analysis-based survey of the progress made in attaining some of the important goals. It is based on the targets and indicators set for each goal and the work done towards achieving those in different world regions.

The flow of the paper is as follows. The first section gives an introduction. This is followed by an in-depth literature review of existing work upon similar topics. The third section is the most crucial one as it actually analyses each goal in detail and the progress as well the future outlook. The penultimate section is a rather special one as it talks about the effect of the unprecedented Covid 19 pandemic upon the SDGs. We wrap up with a conclusion and references.

II. LITERATURE SURVEY

There is a lot of existing literature on the sustainable development goals. A lot of the research done talks about the outlook for the future and whether or not the respective targets would be met. A specific subsection of the literature pertaining to the topic at hand extensively discusses about how technology, specifically artificial intelligence techniques, can be used to map progress and attain these goals and targets.

The paper [4] posits using physiological data from earth observation sources and applying machine learning techniques on it to monitor sustainable development progress. The techniques suggested work well for nature related SDGs, e.g., clean energy etc. but do not find much use for humane goals such as inequality reduction. The paper [1] puts forth a very novel approach to the process of gauging sustainable development progress. It proposes the creation of a Progress Index of sorts, which also factors in circular economy. Unsupervised machine learning methods are used to assign weights to different SDGs as per their global relevance and an index is then assigned to each nation or region's performance upon the same. [6] also proposes a similar approach of using machine learning tools to classify sustainability levels in urban ecosystems. The approach taken is of a much more local, community-based level, and sustainable development is chalked out for smaller areas, making it pertinent in real world scenarios.

Paper [5] takes a different path and discusses the role of artificial intelligence in achieving sustainable development goals. It states that while AI can act as a catalyst in redirecting efforts for most goals, it could possibly hinder some as well. Similarly, paper [3] talks about how an AI driven circular economy can be a key enabler for sustainable development. Strategic solutions given by AI can be used to tackle a lot of the pressing problems at hand in today's world.

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A literature review of AI based business models for sustainable development is given in [2]. It also does a good job of explaining how technology is the way forward to attain targets set by the United Nations. The authors of [7] have taken a grassroots approach to integrate AI into a circular economy for product design which can pertain to sustainable targets. Such approaches are a roadmap for how future industries can be SDG compliant.

[8] and [9] are very interesting academic manuscripts prepared by the University of Pennsylvania and Stanford University as to how machine learning can be applied to sustainable decision-making processes. Despite having more of a theoretical basis, they give in depth insights for the world decision making bodies to follow. Finally, [10] and [13] are audit reports from McKinsey and another independent researcher which show the progress made so far, and the outlook for the future and try to attain correlations between the same.

III. GOALS AND PROGRESS ANALYSIS

As listed before, the United Nations have put forth no less than 17 Sustainable Development Goals. However, not each one of them has equal importance or relevance in the world community. Some are extremely pressing whereas others can be put on the backburners. In [11], a research survey has been carried out by experts in the respective fields to rank the SDGs by their importance. In this paper, we have picked up the top 5 most pressing SDGs according to this study and analyzed those for our research purposes.

A. Goal 1: End Poverty

The first sustainable development goal set forth by the United Nations is about world poverty. The official wording is 'To end poverty in all its forms, everywhere.' Member nations aim to uproot and do away with all forms of extreme poverty, including but not limited to lack of food, potable water and sanitation. Extreme forms of excessive poverty are very prevalent in low income, underdeveloped third world countries. The main means to eradicate the spread of poverty in such regions is primarily through establishing a set of resources which can facilitate upliftment of society.

The primary target for this goal is eradication of extreme poverty. The major indicator for the same is the proportion of population living below the international poverty line aggregated by sex, age, employment status, and geographical location (urban/rural). The widely accepted standard for the international poverty line division is a daily income of 1.9 US Dollars. Families with an income lesser than this figure are regarded as below the poverty line.

Fig. 1 shows the trend of the indicator across time in different regions. It can be seen that the red line, corresponding to the African region, has consistently had high proportions of population below the poverty line, more than 40%. The Asian region (green) had high values in the 1990s but has now reduced significantly, correlating perfectly with the astronomical developments in the region. The Americas region, shown in yellow, has had values of around 10% throughout. The best conditions can be found in Australia (black) and Europe (orange) which have extremely low, almost zero values, which shows great socio-economic progress. Overall, the world progress with regards to poverty management is shown via the blue line. The trend is constantly decreasing, which shows that efforts are giving results, currently around 10%, and that by 2030, the UN might well be able to meet its target of complete poverty eradication.

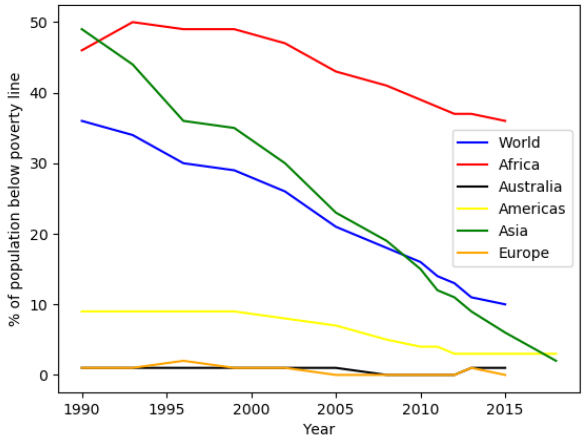

Fig. 1. SDG 1: End Poverty

B. Goal 2: Zero Hunger

SDG 2 is about zero hunger. Food is one of the primary resources a human being needs for survival and existence. However, it is no secret that a large portion of the world population is underfed and does not even get two square meals a day. The United Nations has noticed this and has therefore included this as a way towards a sustainable future. The official wording is: "End hunger, achieve food security and improved nutrition and promote sustainable agriculture".

The primary target is that by 2030, the problem of hunger should be ended and there should be equitable access to safe, nutritious and sufficient food by all people, in particular the poor and people in vulnerable situations including infants, all year round. The major indicator for this is the prevalence of undernourishment (%).

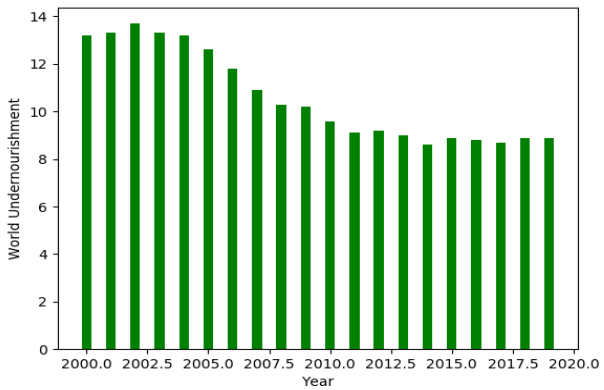

Fig. 2 SDG 2: Zero Hunger

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Fig 2 shows the world undernourishment % for the past 20 years. It can be inferred that there is a visible decrease in the undernourished numbers for the first 10 years, followed by a sort of consolidation for the later decade. Thus, we can conclude that though the overall outlook for this SDG is positive, efforts need to be made to bring it down to more sustainable levels.

C. Goal 7: Affordable and Clean Energy

The 7th SDG put forth by the United Nations is about affordable and clean energy. It aims to "Ensure access to affordable, reliable, sustainable and modern energy for all." Energy is one of the premium resources we need for day-to-day survival. It is used in various forms, ranging from electricity to cooking gas, fuel for vehicles and so on. Out of these, electricity alone is probably mankind's greatest discovery of the 19th century and is a great need now. Energy is needed for cooking food, another base activity. Fuel, whether renewable or not, is also energy at the very least. Hence, having access to regular energy sources is of paramount importance to human beings.

The main target is to provide universal access to modern energy by 2030. The indicator towards the same is the proportion of the population with access to electricity. It's a very straightforward metric to gauge progress towards the aforementioned targets.

Fig 3 shows the proportion of world population having access to electricity for a 30-year period from 1990 to 2020. Th green line corresponds to urban population, red to the rural population and yellow is the world average value. Overall, there are very positive trends with regards to electricity access. The average line has steadily risen from around 70% in 1990 to reach around 90% in 2020, which is a very substantial portion. Urban access has predictably always been high, in excess of 90%. Rural areas started off with barely half the population having electricity in the 1990s, but have climbed steadily to touch 80% now. To cap it up, substantial growth has been seen in this sector, but more of the same is needed in the next 10 years to meet the targets.

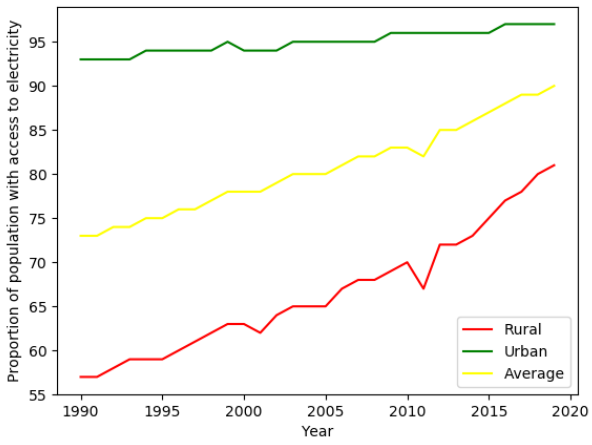

Fig 3. SDG 7: Affordable and Clean Energy

D. Goal 10: Reducing Inequality

The 10th sustainable development goal is about reduction of inequality. This has been rated as the single most pressing world issue by experts, and the SDG which needs maximum efforts. The official wording is 'Reducing inequality within and among countries.

Equality has long been a hotly debated topic in world politics. It is no secret that on an international scale, certain countries are able to dominate decision making processes more than others, often superseding opinions of other smaller states. Within a country too, there are vast discrepancies between various factions of society, primarily economics based, but in other social aspects as well. The United Nations has rightly determined that a sustainable future must entail removal of these inherent inequalities. This is important in today's political scenario and if not curbed, the gulf between rich and poor, the powerful and weak will keep widening and worsening.

The primary target of the most important SDG is to even out income inequalities. The exact wording is to progressively achieve and sustain economic growth of the bottom 40 per cent of the population at a rate higher than the national average by 2030. The major indicator for the same is the "Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population and the total population". Household expenditure or income per capita is a very accurate metric towards gauging financial and economic statuses prevailing in the country, as it gives a generic picture of inflation and the country's economic and Gross Domestic Product (GDP) trends.

Fig 4 plots out the national average income per capita (in blue) against the same for the lower 40% of the economy (in red) for 5 different countries for the year 2016. For China, a developed country, the lower section of the population is improving their financial status at 8%, higher than 7% national average, showing a reduction in inequality. For Palestine both the figures are -1%, showing a further worsening of economic situations, which corresponds to the unstable situation there. For Malaysia, a developing country, the national average of growth (8%) is higher than the lower population figure (6%), showing that there is good economic growth, but no particular movement towards reduction of lower strata inequality. In Uganda, a sub-Saharan nation, the numbers are frightening. The economic status of the lower strata is depreciating (-2%) and it is faster than the national average of -1%. This is the exact example of how reduction in inequality is the need of the hour. Finally in the USA, the world leading power, the lower strata is growing faster than national average, showing good reduction in socio economic inequalities.

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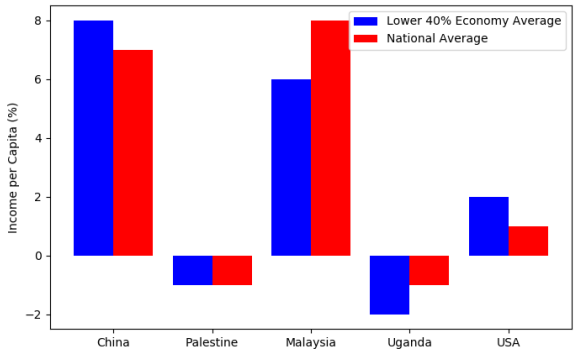

Fig 4. SDG 10: Reducing Inequalities

E. Goal 16: Peace, Justice and Strong Institutions

The penultimate Sustainable Development Goal pertains to promoting world peace. The official wording is "Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels". As this in itself is one of the core functionalities of the United Nations, it is inherently a very important objective.

History has shown that disruption of world peace has had catastrophic effects on human existence. The World Wars are testimony to the same, and the long-lasting outcomes are hurting people even to this date. The current political scenarios are also witnessing major conflicts, be it the Syrian war, the Israel-Palestine conflict or the very recent Taliban Afghanistan takeover. Millions of people around the globe are affected by such conflicts, people lose their lives, families get displaced, means of livelihood are lost and so much worse.

The primary target for this goal is to reduce violence everywhere. Albeit easy to understand, this is very difficult to realize in reality. The convoluted web of national and international politics is spun so thick that global peace is yet a distant dream. The main indicator is about the count of the number of victims of intentional homicide, a very serious matter.

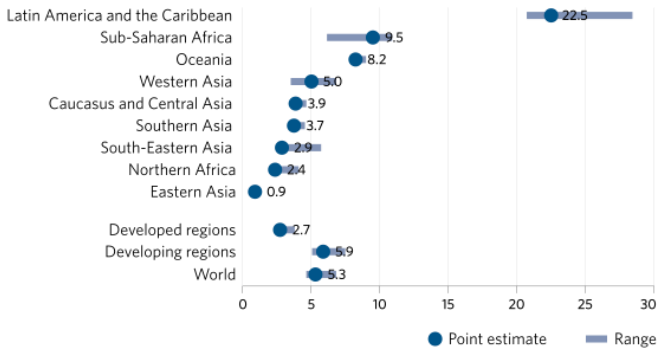

Fig 5. SDG 16: World Peace

Fig 5 shows the Number of victims of intentional homicide per 100,000 population, 2014, for different world regions. It is easily inferred that Latin and Central American countries have an extremely high homicide rate of 20-30 per 100000.It corresponds to the cartels, gangs and mafia system there. This is followed by the sub Saharan African region, which is also notorious for infighting and ceasefire violations (6-10 /100000). The Oceania and Asian regions are around the 5-10 /100000 mark, which is somewhat mediocre, but still needs improvement. Overall, developed regions are much safer in terms of violence than developing states. The world average is around 5.3 deaths per 100000. If we want the global community to always be truly safe, we need this figure to be as low as humanly possible.

IV. PANDEMIC EFFECT

The coronavirus pandemic has arguably been the largest setback to the prosperity of humanity since the world wars. The short-term effects in terms of loss of life are immense. However, there are some genuinely alarming underlying long-term outcomes which could hamper sustainability as a whole.

The greatest detrimental effect of the pandemic has undoubtedly been the jolt given to the global economy and the crashes which have ensued. Entire nations are teetering on the verge of bankruptcy. More and more people are losing means of livelihood and slipping into destitution. Almost every single field, ranging from hospitality, sales to tourism has been affected by the pandemic. This is a direct impediment to a plethora of sustainable development goals.

However, every cloud has a silver lining. There have been some positives to the pandemic as well. The health systems of almost every country have been scaled up and revamped significantly. This would certainly correspond to better quality healthcare worldwide. Also, a large section of the working population has experienced the benefits of working from home, a radical change in lifestyle, which would certainly improve the quality of life.

Keeping the discussion specific to sustainable development though, the bleak reality is that the pandemic has set us back quite some time and renewed vigor will be needed to put the world back on the fast track to sustainability.

V. CONCLUSION

This research work has aimed to put forth an estimate about the efficacy of the United Nations' Sustainable Development Project. On the whole, it can be said that substantial progress has been made in various sectors. However, the Covid pandemic posed and continues a pose a significant hurdle to such progress. Notwithstanding the pandemic too, certain domains and regions around the world are still a long way from compliance to the goals set forth. The larger picture clearly showcases that the world needs to act as a global community and if so, we can certainly be confident of a sustainable, safer future.

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