Sustainable Investment – Exploring the Linkage Between Alpha, ESG, and SDGs[1]

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Abstract

Environmental, Social and Governance (ESG) investing has attracted much attention in asset management this past decade. Asset managers who consider ESG issues when making investment decisions potentially face a trade off with their fiduciary duty to attempt to outperform investment benchmarks ("generate alpha"). We first analyze the relationship between alpha generation and ESG metrics. However, because there are no well-accepted ESG standards, we also measure the impact companies have on the U.N.'s Sustainable Development Goals (SDG´s). Our research consists of three steps. First, we construct a sector-neutral portfolio using MSCI ESG momentum scores from 2013 to 2018, and determine that it is feasible to generate positive alpha vis-à-vis the MSCI US index and other risk benchmarks. Second, we utilize structured and unstructured data to determine a company's net influence on the SDGs, which we call its SDG "footprint." We show that an ESG momentum portfolio both outperforms the MSCI US index and has a relatively better SDG footprint than that of the index. Third, we establish a positive contemporaneous connection between the portfolio's ESG ratings momentum and its SDG footprint. Thus, a positive linkage exists between ESG, alpha, and the SDGs for our sample.

Keywords: SDG, ESG, alpha, fiduciary duty, ESG momentum, sustainable investment

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I. Introduction

"ESG" investing has become all the rage. Trillions of dollars are now invested taking environmental (e.g., carbon emissions), social (e.g., fair labor practices) and governance (e.g., internal corruption) issues into account. ESG investing is now the most popular form of "sustainable" investing, growing simultaneously with companies focusing more on their long-term sustainability and the needs of all stakeholders. Yet, a 2019 survey of RBC Global Asset Management found that less than 25% of asset managers and asset owners "significantly" use ESG principles as part of their investment approach and decision making (RBC Global Assets, 2019). Kim and Yoon (2022) also question the asset management industry's commitment to ESG. This may not be surprising as ESG issues may well conflict with the fiduciary duties of asset owners and managers to act in the best interest of their beneficiaries. A recent Department of Labor (DOL) proposal regarding the use of ESG risk factors in Employee Retirement Incomes Security Act of 1974 (ERISA) accounts is consistent with this view of a conflict. The new proposal states that "private employer-sponsored retirement plans are not vehicles for furthering social goals or policy objectives that are not in the financial interest of the plan. Rather, ERISA plans should be managed with unwavering focus on a single, very important social goal: providing for the retirement security of American workers." (Department of Labor, 2020).

While some have suggested that investor preferences for ESG companies lowers expected returns (Cornell, 2021), others (e.g. Pedersen, Fitzgibbons, Pomorski, 2021, and Pastor, Stambaugh and Taylor, 2020) suggest ESG aware firms may occasionally outperform. Whether there is indeed a trade-off between ESG objectives and fiduciary duty is an empirical question. Extant research is still scarce, but growing rapidly. Sherwood and Pollard (2018) suggest that emerging market companies incorporating ESG considerations outperform; Manescu (2011) finds certain ESG attributes (such as community relations) to be associated with positive risk-adjusted returns in the US, but others to show a negative link; Jyoti and Khanna (2021) show most ESG factors to be negatively associated with value relevant factors such as return on assets and equity for Indian service sector firms; Antoniuk (2023) finds that Norwegian firms with a high score on carbon disclosure outperform the market, but only when energy firms are excluded. Our first contribution is to comprehensively investigate whether it is possible to reflect ESG considerations in an active portfolio of the US stocks in the US MSCI index, a well-known international benchmark, and generate alpha, relative to the market index and other risk benchmarks.

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Such an endeavor requires a systematic way to measure the relative ESG standing of various companies. However, there is a lack of generally accepted agreed-upon standards and reporting requirements. While corporations now largely self-report some ESG data, there are no agreed ESG standards and "green-washing" is rampant. Antoncic (2019) decries the lack of high-quality, firm-level ESG data to serve as key inputs in assessing, managing, and monitoring the ESG risks and opportunities that a company faces.[1]

As a result, major discrepancies exist across vendors who rate, rank and provide company ESG scores. In fact, comparing a company's ratings from the different raters and rankers shows a company's ESG rating and ranking varies substantially across the data providers, with the ratings showing little correlation (see Berg, Koelbel and Rigobon (2022); Dimson, March and Staunton (2020), and Kotsantonis and Serafeim (2019)). Apart from rating disagreements, ESG ratings are also plagued by thorny agency issues, with some rating services provided by data vendors, such as Bloomberg and Thomson Reuters, or major credit rating agencies, which may lead to conflicts of interest, given their business relations with many companies (see Walter, 2020). [2] In our work, we use the popular MSCI ESG ratings, and so our results only apply to ESG investing measured as such.

To broaden the scope of our results, we investigate alternatives to investing through a sustainability lens based on the United Nations Sustainable Development Goals (SDGs; United Nations (2020)). The U.N. SDGs represent a much broader set of sustainability issues than traditional ESG issues and focus on "good health and well-being, the elimination of poverty, zero hunger, quality education, clean water and sanitation, reduced inequity," as well as the environment and other issues encapsulated in ESGs. The SDGs have more factors and address the full spectrum of global macro systemic issues that matter to all stakeholders, all businesses and all countries. They were established in 2015 by 193 countries "to end poverty, protect the

[1] In fact, 63% of hedge funds polled by KPMG responded to a recent survey that ESG investing is "hampered by the lack of robust reliable data." (KPMG, 2020).

[2] Another important agency issue, mentioned in Walter's article, is that large asset management companies, such as Blackrock, effectively control a large fraction of voting rights and effectively impose their views regarding ESG on boards of directors, whether or not they reflect the views of the ultimate shareowners, which in itself has serious fiduciary implications.

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planet and ensure that all people enjoy peace and prosperity by the year 2030" (United Nations (2020)).

We use data from Global AI Corp., which uses state-of-the-art Big Data techniques to examine a comprehensive set of unstructured data, including news articles, self-reported company data, blogs, NGO reports and social media and then creates daily SDG scores at the company level. The scores are available at the individual SDG level, (i.e., company scores are available for each of the 17 SDGs as well as an overall SDG rating), and can be interpreted as z-scores reflecting sentiment regarding a particular SDG in recent information releases involving the company. The SDG scores contain relevant information made available at high frequencies, going beyond the information in unaudited, self-reported annual firm reports which are not designed to adequately report on SDGs (see also Antoncic, 2020; Arena et al. (2023)).

To sum up, this article explores the possibility of creating an active portfolio that achieves the goals associated with ESG investing but still generates alpha, consistent with fiduciary duties. In addition, we measure the SDG impact of the resulting active portfolio relative to the benchmark. Specifically, we consider the US MSCI Index as the benchmark to beat. Among the roughly 600 stocks in the index, we create an active portfolio of about 50 stocks using the MSCI ESG ratings to measure ESG performance. Specifically, we select stocks which show positive ESG momentum and track the resulting portfolio's performance relative to the index. We find that the portfolio significantly outperforms the index when relative momentum is used and this outperformance persists when controlling for the Fama French three- (Fama and French, 1993) or Fama and French five-factor models (Fama and French, 2015).[3] We then rely on data from Global AI Corp.[4] to measure the SDG impact of the active portfolio relative to the benchmark. Overall, the ESG portfolio shows better sustainability footprint than the benchmark, which persists for at least a year.

The remainder of the paper is organized as follows. Section II describes the ESG data, the methodology to create an active portfolio, and contains detailed portfolio results. Section III describes the SDG scores in some detail, and characterizes the SDG footprint of the selected portfolio. Section IV concludes.

[3] Importantly, firms exhibiting attractive relative momentum may not necessarily obtain the highest ESG scores; they show most improvement in their scores.

[4] Two of the authors work for Global AI, whereas the first is an external consultant to the company.

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II. ESG Investing and Asset Returns

In this section, we describe the ESG data, the active portfolio construction, and its performance.

ESG Database

MSCI ESG ratings are widely used by the investment community as a proxy for ESG performance. The MSCI coverage universe is based on major MSCI indices (such as the MSCI World Index), which include the world's largest and most liquid stocks. For a detailed description of the MSCI's methodology, see MSCI (2019) and Serafeim (2020); we provide a short summary here.

MSCI attempts to quantify the risk and opportunity exposure of each company on 37 so-called "Key Issues." These issues are divided into three pillars (environmental, social and governance) which correspond to one of ten macro themes identified by MSCI as a concern to investors, inter alia; climate change, pollution and waste, product liability, social opportunities, and corporate governance. For issues focusing on a firm's risk exposure, both the firm's exposure and risk management are taken into account. Specifically, a company is not penalized for minimal risk management strategies on a low exposure risk issue, however, must have strong risk management practices in place for large exposure issues. For issues quantifying opportunity, such as opportunities in renewable energy, 'risk exposure' indicates the relevance of this opportunity to a given company given its location and business focus, whereas 'risk management' means the capacity of the firm to seize the opportunity. The MSCI ESG scores use company-specific operations data from annual reports and financial and regulatory filings, coupled with information from a variety of other sources, including news media, and trade and academic journals. They also use relevant macro-level data associated with a key issue and related to a company's geography of operations and business segments. In addition, MSCI directly communicates with companies to verify the accuracy of company data for all MSCI ESG research reports.

MSCI aggregates the key issue data to an overall score where each key issue is weighted according to its assessed materiality in each industry. Given that ESG issues tend to vary systematically across industries, MSCI calculates an industry-adjusted score so that the actual ratings are industry specific and comparisons across industries are not meaningful.

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ESG Investing

Incorporating ESG into the investment process is not without challenges. If firms with high ESG scores manage to lower their cost of capital by their ESG actions and/or increase their future cash flows by avoiding certain risks, all else equal, firms with good ESG performance would be valued more highly than similar firms with less exemplary ESG performance.[5] If a lower cost of capital is the source of the valuation premium, it should be associated with lower returns going forward. Clearly, this might clash with the fiduciary duty of some institutional investors.

Several research papers written by MSCI show evidence that MSCI ESG rating changes ("ESG momentum") may be a useful financial indicator (Giese et al., 2019; Giese and Nagi, 2018). Companies with higher ESG ratings, on average, experienced fewer stock-specific risks and smaller drawdowns, suggesting ESG represents a "risk-mitigation premium." In this article, we focus on the return implications of investing in ESG momentum, which may not entail paying valuation premiums. ESG performance measurement is complex and uncertain, and in a world where capital may move slowly to eliminate mispricing (Duffie, 2010), active portfolios that incorporate ESG momentum may succeed in creating alpha while satisfying the goals of ESG investing. One caveat applies to all current research regarding ESG investing: the available sample periods are relatively short (our data go back to 2013), and ESG ratings have a much shorter history than traditional factors, rendering the statistical confidence regarding statements about ESG factors and investing rather limited. Moreover, as discussed above, the ESG data are far from perfect.

ESG Momentum Portfolio Construction Process

To test whether changes in a US stock's ESG score can be used to generate alpha, we construct two sector neutral portfolios – one on the basis of the relative percentage change in the industry-adjusted ESG score, and the other on the basis of the absolute change in industry-adjusted ESG scores. Using the 11 GICS (Global Industry Classification Standard) sectors stocks in each sector are ranked, at the end of each year, based on their absolute and relative ESG momentum, relative to the scores one year before. The 10% highest ranking stocks in each of the 11 GICS sectors based on their absolute and relative ESG momentum are then selected for inclusion in the

[5] Bennani, Le Guenedal, Lepetit, Ly, Mortier, Roncalli, Sekine (2019) suggest that ESG could become a risk factor itself, if most investors use ESG scores in their decision to over- or under-weight a company's stock in their portfolio.

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portfolios. These stocks are held for a full year, after which the portfolios are rebalanced. The stocks within each industry, and the industry -portfolios themselves are market value-weighted. Appendix A describes the portfolio construction in more detail. [6]

The portfolio's performance over the past 6 years is then analyzed relative to the MSCI US index. We chose the MSCI US index as a benchmark since it is more comprehensive than the S&P 500 Index, featuring close to 640 constituent stocks, and it provides the universe for our active stock selection.

Portfolio Results and Alpha Analysis

Our analysis tracks both the daily and monthly returns of the active ESG portfolio and the MSCI US index for the selected sample January 2013 - December 2018. Figure 1 plots the cumulative return performance over the sample period, showing the relative ESG momentum portfolio having the best performance followed by the absolute ESG momentum portfolio, and the benchmark index performing worst. For the purposes of this analysis, the most important test is whether the portfolio provides alpha with respect to the relevant benchmark. Our framework to do so is standard in finance; we run regressions of the excess returns on the active portfolio onto a constant and returns on the risk factors. The estimation is by Ordinary Least Squares, and the risk-free rate is proxied by the one-month Treasury Bill. The constant in the regression measures Jensen's alpha and when positive indicates that the active portfolio historically outperformed the benchmark. The slope coefficients ("betas") are also of interest as they measure the risk exposure of the ESG portfolios.

The first risk benchmark can be viewed as a version of the (domestic) market model, where the benchmark return is the (excess) return on the MSCI index itself. This model

[6] In this paper we use the United Nations joint Staff Pension Fund portfolio, which excludes the tobacco and weapons industries. ESG investing raises an important question of whether there is a "cost to being good, " which is particularly vexing because of the poor quality of the data and the fact that ESG funds frequently exclude companies based on various criteria, which can create conflicts with fiduciary duty. Folqué, Escrig-Olmedo and Santamaria (2021) show that sustainable investment funds which only apply negative filters achieve worse ESG scores. SDG investing does not seek to exclude any company but instead measures their impact to society across a variety of angles. This means that while the ESG approach may well reduce investment flows to certain sectors, an SDG-focused approach can be used as an objective investment tool for the assessment of non-financial risks and can help identify positive and negative spillover effects that go far beyond the narrow ESG lens. The fact that SDGs are applicable to investments at the corporate, infrastructure, and sovereign levels, makes it a powerful alternative to traditional ESG investing.

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is most important because the index reflects the benchmark that the active manager must outperform. The portfolio alphas are also shown relative to the Fama-French three- and five-factor models. In addition, we report the factor exposures to verify whether the ESG portfolios show particular tilts relative to existing factors. The Fama-French (1993) three-factor model adds two portfolios to the market model: the Small Minus Big (SMB) portfolio, representing the return difference between an index of small versus an index of large capitalization firms, and the High Minus Low (HML) portfolio, representing the difference between returns on portfolios of value and growth firms. The relatively new five-factor model (Fama and French, 2015) complements the three-factor model with the Conservative Minus Aggressive (CMA) and Robust Minus Weak (RMW) spread portfolios. CMA represents the return difference of a portfolio investing in firms with conservative investment strategies minus a portfolio investing in firms with aggressive investment strategies. RMW represents returns on firms with robust operating profitability minus returns on firms with weak operating profitability. The data for all benchmark returns are available from Kenneth French's website.

Table 1 (Panel A) reports the results for the relative momentum portfolio, showing alphas and betas. The beta with respect to the index is 0.96; not surprisingly, close to 1. Importantly, the relative momentum portfolio generates an alpha of 0.47 basis points (or 5.64% per year), with a standard error of less than 15 basis points. The alpha is thus positive and highly statistically significant. Relative to the Fama-French three-factor model, the ESG portfolio still generates an alpha of 0.47% per month, and the alpha remains statistically significant. Adding two additional factors does not change this conclusion.

The SMB and HML loadings are not statistically significantly different from zero, suggesting the ESG portfolio has neither a value nor a size bias. In the five-factor model, the CMA exposure is borderline statistically significant and negative. The negative CMA exposure suggests the ESG portfolio includes firms with aggressive investment strategies, which is typically associated with low future returns.

While the alphas for the relative momentum portfolio are significantly different from zero, the alphas for the absolute ESG momentum portfolios, reported in Panel B of Table 1, are positive but no longer statistically significant. The factor exposures of the absolute ESG momentum portfolio are very similar to those of the relative ESG momentum portfolio. One possible explanation for this result is that the relative measure has more chance of selecting firms that have low absolute ESG scores, i.e.,

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firms that may be less likely to be on investors' radar screens as potential ESG target firms. However, it also raises the possibility that the selected firms may not rank very high on ESG performance in an absolute sense. Indirect evidence addressing this issue is presented in the next section.

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Table 1. Alphas Relative to the Market Model and Fama-French Factors

Panel A: Relative Returns

		Market Model	Fama-French 3 Factor Model	Fama-French 5 Factor Model
Alpha	*Estimate*	0.0047	0.0047	0.0047
	(Standard Error)	(0.0014)	(0.0015)	(0.0014)
Market	*Estimate*	0.9594	0.9628	0.9502
	(Standard Error)	(0.0451)	(0.0473)	(0.0465)
SMB	*Estimate*		-0.0175	-0.0566
	(Standard Error)		(0.0580)	(0.0642)
HML	*Estimate*		-0.0063	0.0984
	(Standard Error)		(0.0613)	(0.0794)
RMW	*Estimate*			-0.1086
	(Standard Error)			(0.1047)
CMA	*Estimate*			-0.2307
	(Standard Error)			(0.1249)

Panel B: Absolute Returns

		Market Model	Fama-French 3 Factor Model	Fama-French 5 Factor Model
Alpha	*Estimate*	0.0023	0.0022	0.0021
	(Standard Error)	(0.0014)	(0.0014)	(0.0014)
Market	*Estimate*	0.9786	0.9879	0.9771
	(Standard Error)	(0.0435)	(0.0454)	(0.0450)
SMB	*Estimate*		-0.0471	-0.0492
	(Standard Error)		(0.0557)	(0.0621)

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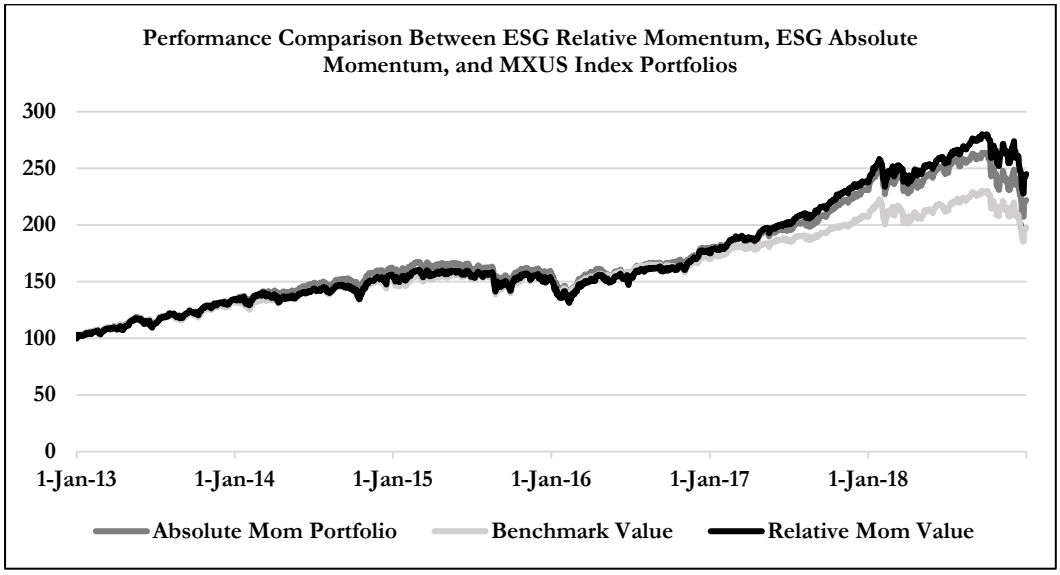
HML	*Estimate (Standard Error)*		-0.0050 (0.0589)	0.0986 (0.0767)
RMW	*Estimate (Standard Error)*			0.0193 (0.101406)
CMA	*Estimate (Standard Error)*			-0.2472 (0.120968)

Note: The analysis uses monthly returns. Standard errors are reported in parentheses. The market model uses the MSCI index as the benchmark.

Figure 1. Cumulative Return Performance



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III. Measuring the SDG Footprint of an Investment Portfolio

In this article, we broaden the dialogue of sustainable investing beyond just ESGs to measuring the societal impact of a portfolio on the UN Sustainable Development Goals (SDGs). From a societal perspective, building a framework which measures the net SDG contribution of entities can potentially incentivize public corporations and investors to mobilize capital towards achieving the SDGs.

The SDGs are a much broader measure of sustainability risks and opportunities than the ESGs. The SDGs have more factors and address the full spectrum of global macro systemic issues that matter to all stakeholders, all businesses and all countries.

We propose to measure a company's SDG 'footprint,' as its 'reputational footprint' in publicly available information regarding SDG. Such a footprint may reveal hidden risks that can impact its long-term performance and global perception across the world. This creates incentives for corporations to quantify and increase their net SDG contributions and SDG score in order to become more attractive to investors controlling trillions in assets under management and concerned with sustainable investments. It can also provide increased transparency for investor engagement strategies.

Asset owners can thus potentially contribute to more long-term centric practices among corporations through the lens of an SDG investment strategy, going beyond the sustainability goals embedded in ESGs.

Measuring the SDG Footprint of Companies

While corporations now largely self-report some sustainability data, due to the lack of standards and metrics, significant 'green-washing' and self-reporting data biases, ESG scores contain a significant amount of noise and thus are of limited use for investment purposes. In fact, typically, companies carry out voluntary reporting on their sustainability performance in order to assure their shareholders and investors of their compliance to regulations (Braam and Peeters, 2017). However, as more companies are wary of the adverse impact of negative sustainability performance on investor decisions, they may fail to disclose negative information (Reimsbach and Hahn, 2013).

A useful complement to the reported sustainability data, is Big Data leveraging Artificial Intelligence technologies to extract, process, and analyze large-scale structured and unstructured data on ESG and SDG-related factors, which can then

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enable the integration of these sustainability factors into the decision-making of global investors. The data could include news items, social media, and reports in dozens of languages, providing up-to-date information beyond what is in unaudited annual firm reports or firms' marketing efforts. Moreover, Big Data can make this information available daily for investors, governments, and all stakeholders – not just annually when a firm generates an unaudited sustainability report. Thus, a Big Data approach significantly reduces self-reporting bias and 'greenwashing' and can show which firms are effectively having a positive or a negative SDG footprint.

There are scenarios in which the technology can go wrong or provide imperfect information; relying on publicly available information such as newspaper articles, may lead to false or biased scores, for example. Other issues include fake news, articles that commemorate negative events from the past, major discrepancies between reported and third-party data, etc. For these reasons, it is necessary to perform extensive manual verification of data to evaluate if the analysis corresponds to reality. Extreme scores should be further examined using the underlying data sources.

In this paper, we use Global AI Corp.'s (GAI) SDG scores. The company extracts, filters, and cleans massive amounts of structured and unstructured data, including self-reported company data, news articles, blogs, NGO reports, social media, etc. to provide "raw," short-term and long-term scores. The full data set covers information across 60 languages from more than 100 countries. Specialized algorithms map the raw data to specific companies and associated entities, such as subsidiaries, using different combinations of company names, abbreviations, tickers, and ISINs. Proprietary technology then ranks and filters content by relevance using domain-specific taxonomies based on the SDGs.

The algorithms analyze the filtered content at a daily level: recording the number of relevant news items, providing a sentiment score per news item, and tracking volume and dispersion of sentiment across news items. This information is aggregated into daily, company-specific "raw" scores, which represent aggregate sentiment of the SDG data. GAI then aggregates data from 7 days of information, using statistics on the precision of the scores and the volume of the news sources, accommodating sparsity in the data while weighting recent information more heavily. That is, a particular adverse firm event with respect to an SDG (e.g. Nestle is sued over child slavery in African cocoa fields) would receive a more negative score, if more articles cover it and the negative sentiment is closely aligned, rather than dispersed. For each company scores

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are available for all 17 SDGs, and the system also provides an overall company score measuring the overall SDG footprint of a company. The scores can be interpreted roughly as "z-scores," varying mostly between -1 and +1, and having a standard deviation of roughly 1. While we use the short-term scores in our current analysis, longer-term scores are also available.

The higher the score, the more positive the news is in relationship to each SDG, and vice versa. For example, for SDG 13 (climate action), a company would get a more negative score after a chemical spill that pollutes the ecosystem than a company that increases its carbon emissions by 5%. The combination of positive and negative SDG scores can be used to better assess non-financial risks and calculate a 'net' SDG footprint that measures the effect of positive and negative externalities at both long- and short-term frequencies.

SDG Footprint of the ESG momentum Portfolio

We use GAI's data across the MSCI US index universe over the Jan-2015-Dec. 2019 period to measure the SDG footprint of the active portfolio relative to the benchmark. For this purpose, we apply the portfolio and benchmark weights to the company SDG scores, averaged for each year. There are no SDG data available for 2013 and 2014.

Our analysis addresses two different questions. First, we verify whether ESG momentum relative to the benchmark coincides with a positive SDG footprint in the year the ESG momentum was detected for the active portfolio constituents. In other words, we test whether an ESG momentum strategy selects firms with an SDG footprint that is better than that of the benchmark. Second, we investigate the SDG footprint of the selected companies in the investment year (the year after ESG momentum was observed). This exercise measures whether firms with ESG momentum continue to relatively improve their SDG footprint in the year after their ESG scores increased and whether ESG momentum is associated with a persistent (relative) positive SDG footprint. Neither question needs to necessarily receive a positive answer. Because the SDG scores are relatively fast moving, it is conceivable that they pick up certain ESG issues even before the MSCI ESG rating change occurs. Unless companies continue to generate (relatively) positive SDG contributions for a few years, it may not show up in our measurement.

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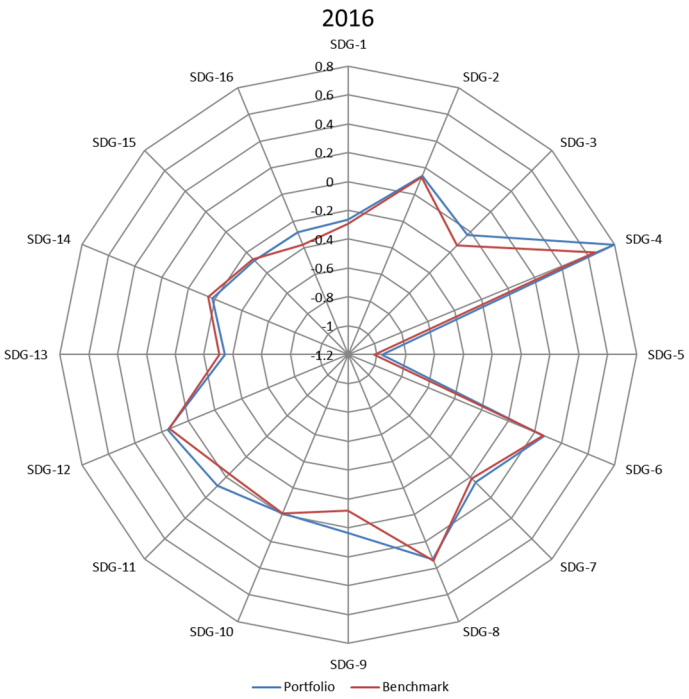
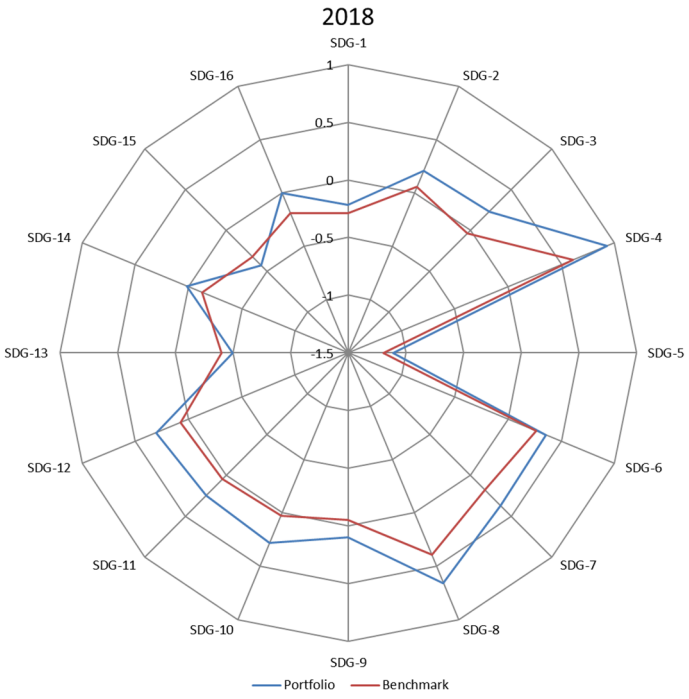
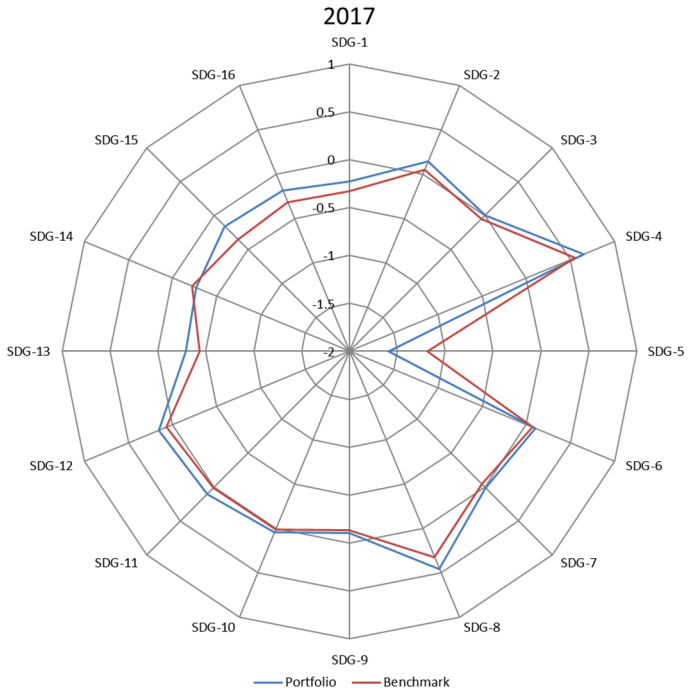
Figure 2: SDG Footprints of Momentum Portfolio

Contemporaneous Raw SDG Scores







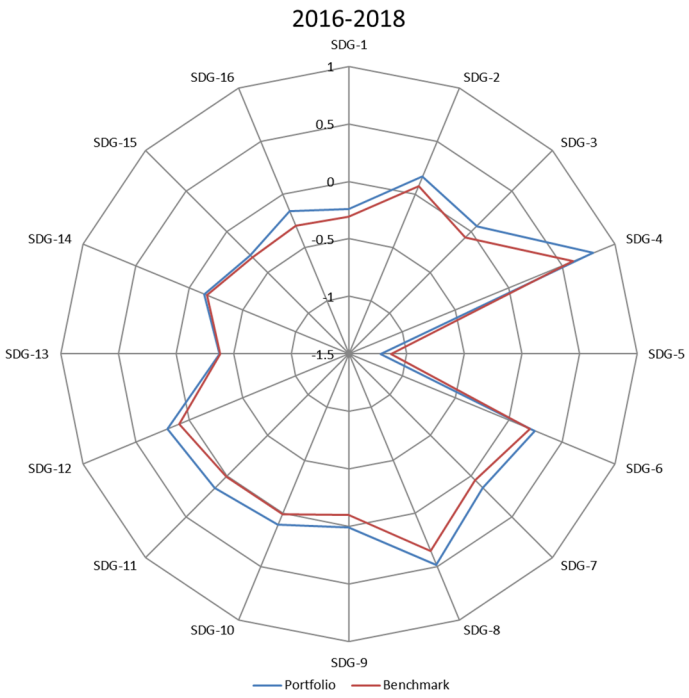


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Figure 2 shows "contemporaneous" sentiment scores of SDG content for the portfolio and the benchmark. The years indicated are the investment years, while as indicated above the scores are contemporaneous with the time ESG momentum was measured and which was one year before the investment year recorded. Thus, the scores for 2016 are actually recorded in 2015. The so-called polar plots arrange the scores for the first 16 of 17 SDGs, around a circle. Appendix B contains a list of the 17 SDGs, taken from "United Nations Sustainable Development Goals" (UN, 2020). Each SDG is on a radius from the center, with the center representing a negative score of between -2.0 or -1.5 depending on the year analyzed. Moving away from the center outward represents an improvement in SDG scores. Thus, for example in 2017, one can see in the polar plot SDG scores range from a low of -2.0 to a high of 1.0. The portfolio's scores are in blue, the benchmark portfolio scores are in red. Thus, if the portfolio has better SDG footprint than the benchmark, the red lines should be inside the blue lines. Note that in any particular year, this is true for the majority of SDGs. For SDGs 1 through 4, 7, 11, 12 and 16 this is true for all three years. The first four SDGs, represent "End poverty in all its forms everywhere" (Goal 1), "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" (Goal 2), "Ensure healthy lives and promote well-being for all at all ages" (Goal 3), and "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (Goal 4). Goal 7 is to "Ensure access to affordable, reliable, sustainable and modern energy for all;" Goal 11 is to "Make cities and human settlements inclusive, safe, resilient and sustainable;" and Goal 12 to "Ensure sustainable consumption and production patterns." Finally, Goal 16 aims to "Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels." The portfolio does not do as well on environmental issues, with its footprint with regard to Goal 13 "Take urgent action to combat climate change and its impacts," Goal 14 "Conserve and sustainably use the oceans, seas and marine resources for sustainable development" and Goal 15 "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss" only being better than the benchmark in one of the three years.

The last plot in Figure 2 averages the scores over the three years. Averaged over all three years, the SDG footprint of the portfolio is better than the footprint of the benchmark for all SDGs except for Gender Equality, SDG 5. The differences are

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relatively small, however, and most of the scores (14 out of 17) are negative. This is not surprising as companies on average have not yet fully internalized SDG goals with many companies still on their journey of understanding the role of the private sector in delivering on the SDGs by 2030.

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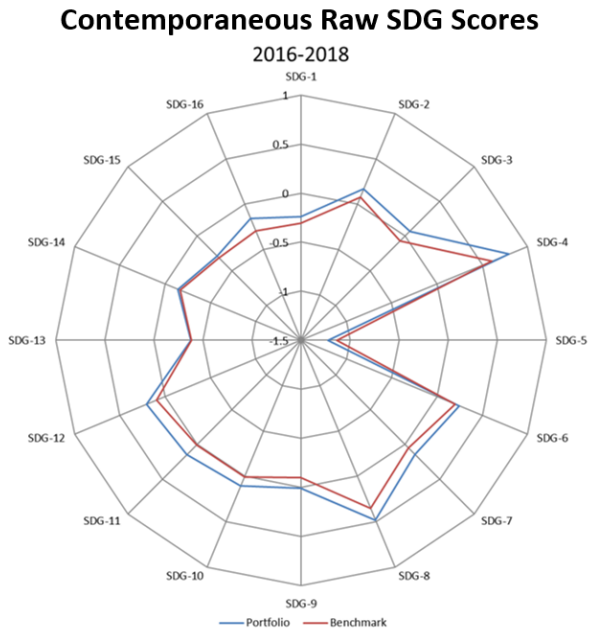
Figure 3:



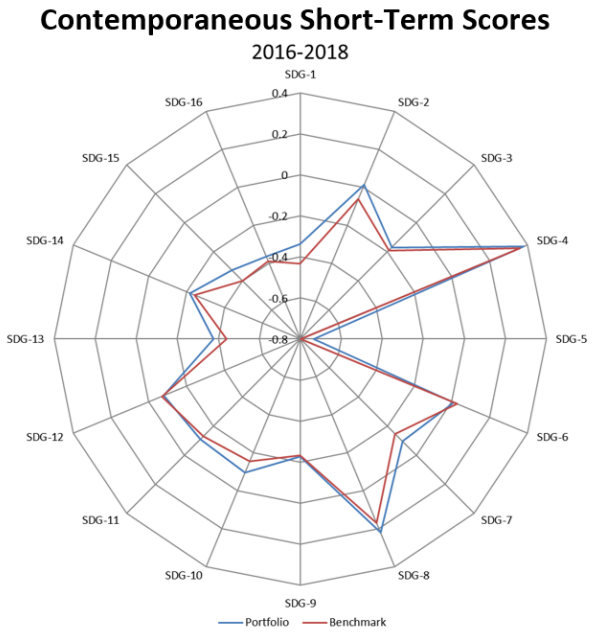
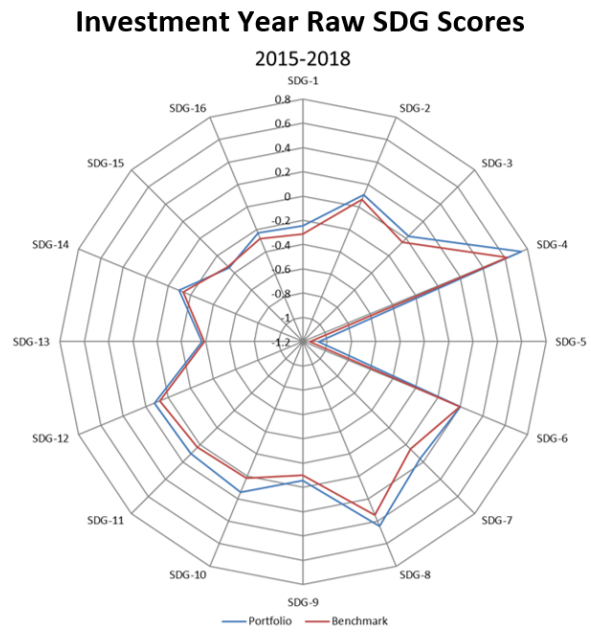
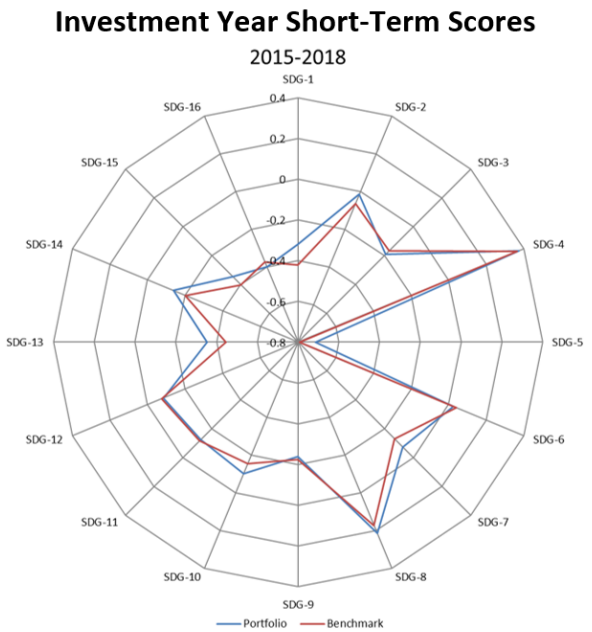


Figure 4:





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In Figure 3, we juxtapose the 2016-2018 scores using "raw" SDG scores from Figure 1 with the same results for GAI's actual 7-day scores. These scores use the last 7 days of SDG information, using a weighting scheme to weight the most recent data with older information downweighed, and adjust the sentiment of the daily information source for accuracy. The results are largely the same with some small differences, e.g. the portfolio performs slightly better on Gender Equality (SDG 5), but worse on Clean Water and Sanitation (SDG 6), and Responsible Consumption and Production (SDG 12), relative to the benchmark.

In Figure 4, we focus on the persistence of the outperformance of the portfolio in terms of SDG footprint, by looking at the SDG footprint of the portfolio relative to the benchmark in the investment year. We can now use SDG scores from 2015 to 2018, where the years are matched with the investment years for the active ESG portfolio. We show the same summary graphs over all years for the raw scores and the 7-day scores. The SDG footprint of the portfolio is again better than that of the benchmark, but the differences are often small. An exception for the raw scores is SDG 15, an environmental goal regarding life on land, where the benchmark performs better. For the 7-day scores, there are 6 SDGs (3, 6, 9, 11, 12 and 16) for which the benchmark has slightly better scores than the portfolio, suggesting the better SDG footprint may not always do better over a period of several years.

Statistical Significance

The polar plots show that the SDG footprint of the ESG portfolio is better both in the year ESG momentum was observed ("contemporaneous") and the subsequent investment year. We now verify whether the differences are statistically significant. The lack of observations prompts us to increase statistical power by comparing SDG footprints on a monthly basis. For the contemporaneous comparison we have 3 years of data, or 36 monthly observations; for the investment year we have 4 years, or 48 monthly observations. A simple t-test is performed to address whether the average difference between the monthly SDG footprint of the portfolio and the benchmark is statistically significantly different from zero. These observations may be serially correlated which we control for by using 6 Newey-West (1987) lags in the creation of our standard errors.

Table 2 reports the results, both for the raw scores and the short-term SDG scores. The actual difference is reported with the standard error in parentheses below it. The ratio of the two is the t-statistic. As observed from the polar plots, all differences are

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positive, indicating that the SDG footprint of the portfolio is better than that of the benchmark. Moreover, these differences are larger in the year ESG momentum was established relative to the investment year, which is consistent with the idea that relatively greater SDG footprint persists, but the differences may not be permanent. Finally, the differences are not statistically significant for the 7-day scores, but they are statistically significant for the raw scores in both reported cases. The statistical significance is highest for the contemporaneous case, with a t-statistic of 3.38 (that is, 0.1411 divided by 0.0417).

Table 2: SDG Footprint of the ESG Portfolio Relative to the Benchmark

		Raw Scores	**Short-Term Scores**
Contemporaneous	*Coefficient*	0.1411	0.0438
	(Standard Error)	(0.0417)	(0.0408)
Investment Year	*Coefficient*	0.1138	0.0295
	(Standard Error)	(0.0593)	(0.0480)

Note: The table reports the difference in SDG scores between the ESG momentum portfolio and the MSCI benchmark portfolio. The number in parentheses is the standard error of the difference, which accounts for serial correlation with 6 Newey-West (1987) lags.

IV. Conclusion

Assessing a company's performance regarding ESG issues and its SDG footprint is challenging for investors, academia, and NGOs. Because companies with good ESG performance may enjoy a valuation premium, ESG investing has been thought to create a potential conflict for asset owners who have a fiduciary duty not to sacrifice long-term return opportunities. In this paper we dispel that view, at least for an equity mandate benchmarked by the well-known US MSCI equity index. We show it is feasible for an asset owner to both uphold his/her fiduciary duty and have a positive impact on achieving the SDGs.

Concretely, we explore the possibility of creating an active ESG portfolio to consistently generate alpha, considering the MSCI US Index as the benchmark to beat.

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Our research shows that the active ESG portfolio significantly outperforms the index when relative ESG momentum is used, and this outperformance persists when controlling for the Fama-French three- and five-factor models. In the next step, we verify the ESG portfolio's congruence with the SDGs, utilizing SDG scores from Global AI Corp. relative to the benchmark. These daily SDG scores at the company level reflect a comprehensive set of unstructured data, including news articles, self-reported company data, blogs, NGO reports, and social media regarding SDG-related issues. The scores can be interpreted as z-scores reflecting sentiment, or SDG fitness, regarding an SDG in recent information releases involving the company. We find that the active ESG portfolio shows a higher SDG footprint than the benchmark over the full period, but this is not true for every SDG and every sub-period.

For our data and application, we find a positive linkage between ESG, alpha, and SDG footprint. Thus, there need not be a trade-off between an asset owners' fiduciary duty to generate financial returns and a positive societal footprint. Of course, such results need not extend to other countries or other time periods. Importantly, they do not apply to the *level* of the ESG scores. [7]

In future work, it maybe useful to verify the relationship between financial returns and SDG footprint directly, rather than through the narrower ESG lens. Further analyzing objective data on the SDG footprint of companies may lead to a better understanding of the underlying risks in corporate behavior, and ultimately lead to more sustainable investment decisions.

[7] Brandon, Krueger and Schmidt (2021) show that ESG *disagreement*, across different ratings, comes with higher returns.

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Appendix A – Portfolio Construction

1. Universe: Determining the customized benchmark

    a. MXUS Index members stocks list for each Dec 31st of 2012, 2013, 2014, 2015, 2016, and 2017.

    b. Remove the stocks that either did not have MSCI industry adjusted ESG scores or were no longer listed or were acquired since then.

    c. Remove the stocks belonging to the tobacco and weapons industries.

2. Security Selection from the customized benchmark: Determining portfolio stocks for each year

    a. Determine the number of stocks to be used in the investment strategy portfolio as 1/10th of the number of stocks in each sector in the customized benchmark on a particular rebalancing date. For e.g., If IT sector had 62 stocks in the customized benchmark on a particular rebalancing date, it would have 6 stocks in the strategy portfolio.

    b. Relative Momentum: Calculate the ESG 1 year Momentum for each stock in the customized benchmark. Formula used: ESG_MOM_1Y = ESG_Score(t)/ ESG_Score(t-1) – 1 {Here ESG_Score is the MSCI published Industry Adjusted ESG Score}

    c. Absolute Momentum: using the following formula: ESG_MOM_1Y = ESG_Score (t) - ESG_Score (t-1)

    d. Remove the stocks that had infinite calculated 1-year ESG Momentum as such companies had only recently started disclosing their ESG metrics and this infinite momentum was not an accurate representation of improvement in their ESG practices.

    e. Within each sector group, rank the stocks in the descending order of their ESG Momentum values.

    f. For each sector, select the highest ranked stocks (number of stocks to be selected is determined using Step 2.a.). E.g.: 9 stocks selected in Information Technology sector on 31 Dec 17 will have the highest 1-year ESG momentum in the IT sector on that particular day.

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g. The same logic would be applied to all the other sectors to select the top ranked stocks. Finally, we end with the total number of stocks for a particular year. E.g. 46 stocks selected on Dec 31, 2012, will be held in the portfolio till Dec 30, 2013.

3. Portfolio Allocation: The stock weights are determined such that the final portfolio stays sector-neutral with respect to the custom benchmark at the different rebalancing dates. This step is implemented through the following steps:

   a. Calculate the sector weights % (Si) for all 11 sectors in the customized benchmark for each of the 6 rebalancing dates (i.e. 31 Dec of each year from 2012 to 2017).

   b. Determine the market cap value (Ms) of each stock on the corresponding rebalancing date when the stock was selected.

   c. Calculate the total market cap (MT) of the selected stocks for each year as the sum of market cap values of all stocks selected in that year.

   d. Calculate the sector weight value (Sa) to be allocated to each sector each year as

      $Sa = Si * (MT)$

   e. Calculate the annual sector weight value (Sv) of selected stocks by summing up the market cap values of all stocks in each sector each year.

   f. Calculate the stocks' final value weight (Sf) to be allocated each year as –

      $(Sf) = ((Ms) /(Sv)) * (Sa)$

   g. Determine the stocks' final % portfolio weight (Ws) as –

      $(Ws) = (Sf)/ (MT)$

4. Portfolio Rebalancing:

   a. The selected stocks will remain in the portfolio for 1 year until the next rebalancing date (i.e. 31 Dec of next year).

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Appendix B: List of SDGs

For ease of reference, we copy the UN's list of SDGs here (see "Sustainable Development Goals," available at https://www.un.org/sustainabledevelopment/sustainable-development-goals/)

- Goal 1. End poverty in all its forms everywhere
- Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- Goal 3. Ensure healthy lives and promote well-being for all at all ages
- Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- Goal 5. Achieve gender equality and empower all women and girls
- Goal 6. Ensure availability and sustainable management of water and sanitation for all
- Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all
- Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
- Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
- Goal 10. Reduce inequality within and among countries
- Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
- Goal 12. Ensure sustainable consumption and production patterns
- Goal 13. Take urgent action to combat climate change and its impacts
- Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

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- Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
- Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
- Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development

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