UN Sustainable Development Goal 8
Introduction To Data Science
Group Assignment Report

Group Kensington 3
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Introduction

The Sustainable Development Goals (SDGs) are a set of 17 objectives, forming a framework that advocates for economic, environmental, and social progress internationally. This report examines SDG 8, which aims to foster sustained economic growth and improve access to 'decent work' and more productive employment. We focus on two targets. Target 8.1 assesses whether countries have achieved sustainable per-capita GDP growth, which is evaluated using geometric growth rates, long-run β-coefficients from log-GDP regressions and volatility metrics to capture the stability of growth. Target 8.6 analyses global progress in reducing the share of youth not in employment, education, or training (NEET) by 2020, using absolute, relative, and trend-based indicators.

Both analyses rely on data from the World Bank, the UN, and supplementary resources for data categorisation, which we process using R. The findings reveal significant cross-regional variation across both targets. Only two of the six continents, Europe and Asia, showed meaningful reductions in NEET rates by 2020, and very few economies demonstrate both stable and sustained economic growth. Our results demonstrate that economic expansion does not guarantee better youth outcomes. This underscores the importance of complementary elements of SDG 8, which address productivity upgrades (Target 8.2), financial inclusion (Target 8.10) and youth-focused labour market programmes (Target 8.6) – all of which play a role in translating growth into improved employment and inclusive outcomes.

1 Assessing Global Progress in Per Capita GDP Growth Rates

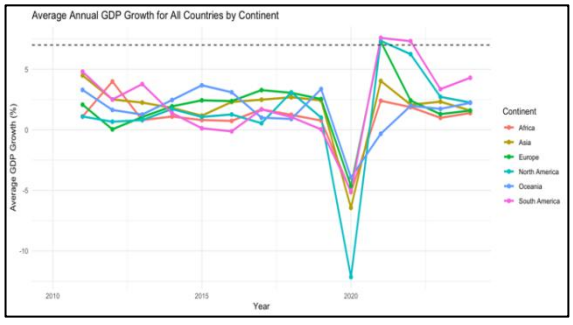
1.1 Methodology

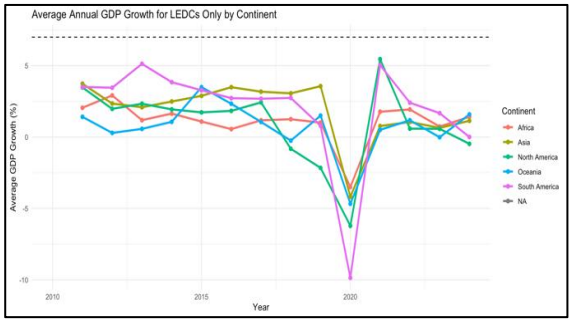
The dataset used is constructed by combining real GDP per capita data with country-level continent identifiers and World Bank income classifications. This allowed us to conduct cross-continental analyses and isolate Low-Income and Lower-Middle-Income economies, which we treat as LEDCs in line with the focus of SDG 8.1.

To assess progress towards SDG 8.1, we decompose the target into measurable indicators. We measure per capita growth using the geometric mean of annual growth factors, reflecting the compounding nature of GDP per capita. Stable growth is evaluated using the coefficient of variation (CV), which measures volatility relative to average growth. This standardisation enables us to compare countries even with very different growth levels. Addressing the core of SDG 8.1, we estimate a time trend for each country by regressing log GDP per capita on time. The resulting coefficient represents the average proportional growth trend from 2010 to 2024.

1.2 Evaluating Cross-continental Per Capita Economic Growth

Before assessing sustainability or long-run trajectories, we must first identify whether economies are growing at all. To provide a broad yet comparable cross-continental perspective, we construct continent-level indicators of annual per-capita GDP growth by aggregating countries' geometric mean growth factors within each region.



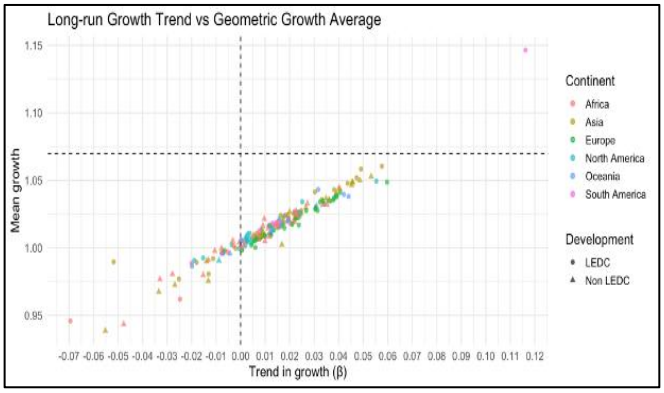


Across all continents, pre-2020 growth is relatively steady, with Europe consistently expanding at only 1–2% per year—consistent with SDG 8.1's principle that mature economies grow more slowly than developing ones. LEDCs generally grow faster than their continental averages, reflecting catch-up dynamics, but none approach the 7% SDG benchmark, and their year-to-year growth is far more volatile, signalling greater vulnerability to shocks.

After 2020, all continents contracted sharply due to the COVID-19 shock, with Oceania and South America hit hardest. Although 2021 brings a strong rebound, it proves short-lived: by 2022, growth returns to pre-pandemic levels, indicating a cyclical correction rather than structural improvement. For LEDCs, the post-2020 period is even more unstable, marked by deeper contractions and larger—but highly volatile—recoveries, highlighting their limited economic resilience.

Although averages are informative, they do not capture the full dynamics of growth. Specifically, they fail to differentiate between genuine, structural growth and irregular high-growth episodes, an important distinction for developing economies. As SDG 8 emphasises sustained growth, we also look at each country's long-run trajectory. We regress log GDP per capita

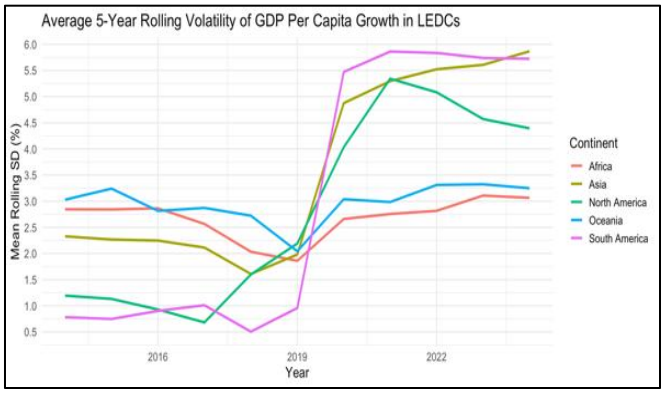
on time to obtain β, which represents the average annual proportional change in GDP per capita. Since β represents the long-run trend, we use it to isolate structural performance, filtering out the short-term fluctuations highlighted earlier.



The plot reveals a strong linear relationship between geometric mean growth and β: countries with higher average per-capita growth also show steeper long-run trends, while those with low or negative averages consistently show declining trajectories. This indicates that higher growth rates are, in part, driven by consistent increases rather than isolated boom periods. Most countries cluster within $\beta \in [-0.01, 0.03]$, which, while modestly positive, falls short of the 7% annual growth benchmark. Most LEDCs fall to the right of zero, signalling positive structural growth, but their β values remain well below the threshold, showing the challenge of achieving the magnitude of per-capita growth required.

1.3 Evaluating the Sustainability of Economic Growth

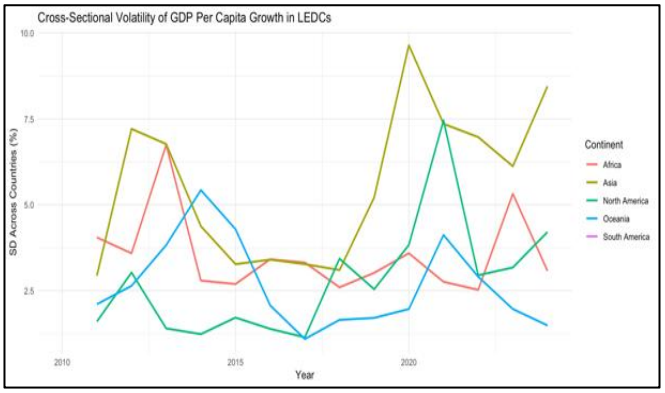
To assess sustainable growth, we examine short-term volatility using a 5-year rolling standard deviation of per-capita GDP growth for LEDCs. This measure captures within-country volatility growth and illustrates the impact external shocks have on sustained growth efforts.



All continents show a spike in volatility from 2019 to 2020, driven by the COVID-19 pandemic. There is a more pronounced jump for South America, Asia, and North America, reflecting the collapse in tourism, commodity price shocks and national fiscal instability. This highlights how global shocks can disproportionately destabilise LEDCs [1] and suggests current structural hurdles like fragmenting global trade, rising interest rates and climate change may further undermine progress towards SDG 8.

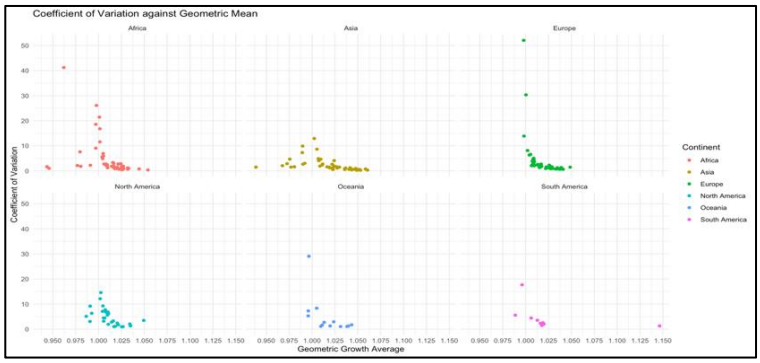
Interestingly, Africa exhibits the lowest volatility. Pre-COVID, its volatility curve is relatively flat, and its peak remains far below the global average [2][3]. This is not due to economic resilience but rather stems from low exposure to the underlying factors responsible for the volatility. Limited integration into global trade, low industrial diversification and reliance on population-driven growth mean Africa suffers from relatively low and slow-moving growth. While GDP appears more 'stable', it masks the continent's unique combination of low volatility and slower economic development.

The adjacent figure tracks the standard deviation of GDP per capita growth across countries within each continent from 2010 to 2024. Whereas rolling volatility captures within-country fluctuations, this measure assesses how evenly economies develop relative to neighbours operating under similar macroeconomic conditions.



The results show substantial divergence within Asia consistently showing the highest cross-sectional volatility. The juxtaposition of fast-growing economies like Vietnam, India and China alongside structurally stagnant or conflict-affected nations amplifies overall regional volatility. Consequently, Asia's otherwise strong growth figures conceal deep regional inequalities, posing a challenge to achieving inclusive and sustained growth.

South America also displays large fluctuations, driven by recurrent macroeconomic crises, debt pressures, and commodity-price swings that affect countries asymmetrically. In contrast, Africa shows moderate and stable dispersion. The appropriate interpretation, again, is not better performance, but evidence of shared structural constraints across Africa, yielding uniformly modest rather than diverging growth outcomes.



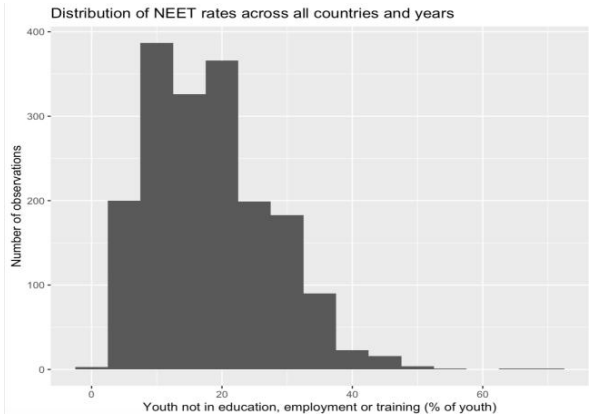
The adjacent figure plots each country's geometric mean GDP per capita growth rate against the coefficient of variation (CV) of its annual growth, faceted by continent. The plot measures within-country volatility over the full 15-year period, capturing the relationship between stability and growth more concretely. All continents show a clear inverse relationship: stronger long-run growth is associated with lower volatility, while highly volatile economies tend to record weak or negative growth. Asia displays the most compressed distribution, with the lowest CV range. This reflects greater diversification into manufacturing and services, deeper integration into GVCs and productivity gains. These results may provide a potential blueprint for LEDCs, highlighting the key determinants of both high and robust growth.

Africa, by contrast, shows the widest CV dispersion, being nearly three times that of Asia. Short-run volatility appeared low because African economies typically grow more slowly and change little year-to-year, hence the flatter volatility curve. Over longer horizons, however, Africa is more susceptible to civil conflicts, climate-related disasters, political instability, and currency challenges, all of which threaten stability. These shocks have large proportional effects relative to Africa's low trend growth and, though less frequent, can severely disrupt compounding and eliminate periods of improvement. Overall, the figure highlights how sustained growth and highly volatile growth are fundamentally incompatible, and the lack of any high-growth, high-volatility anomalies corroborates this.

2. Assessing Global Progress in Reducing Youth NEET Rates

2.1 Overview of Objective and Data

This section examines global progress toward Target 8.6 of SDG 8, which seeks to "by 2020, substantially reduce the proportion of youth not in employment, education or training." The analysis utilises the data extracted from the World Bank to identify trends in youth unemployment and classify countries by continent. Once the data were tidied and merged using R, we conducted exploratory analyses to evaluate how NEET rates evolved from 2000 to 2020 across 171 countries.



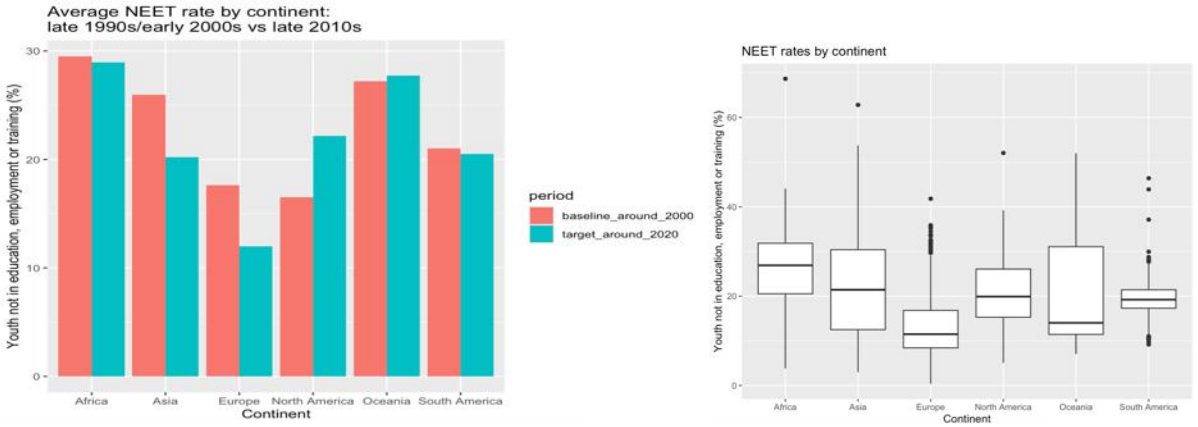
To determine whether a country achieved a "substantial reduction", despite no universal definition, we adopted a three-part criterion consistent with UN and OECD monitoring frameworks: an absolute decline of $\geq 5\%$, a relative decline of $\geq 20\%$, and a negative long-run trend ($\beta_1 < 0$) from a linaer regression $x_t = \beta_0 + \beta_1 t + \varepsilon_t$, where x_t represents the NEET rate in year t. The baseline is defined for the year 2000, and the target year is 2020 (or the latest available year if data for 2020 is missing). The result is that any reductions observed will be statistically meaningful and evidence of sustained improvement.

2.2 Continental Pattern

Averaging across countries, Europe and Asia recorded the largest declines in NEET rates between 2000 and 2020 (Table 1). Europe's mean NEET rate fell from 17.6% to 12.0% (−5.6 p.p., −32%), while Asia's declined from 25.9% to 20.2% (−5.7 p.p., −22%). These improvements are consistent with post-crisis labour-market reforms, rising tertiary enrolment, and targeted youth-employment programmes. By contrast, North America, Oceania, Africa, and South America experienced limited or adverse progress: North America's NEET rate increased by 5.6 points (+34%), and Africa and South America recorded reductions of less than 3 percentage points. This regional divergence suggests that global progress toward the Target 8.6 was uneven.

Continent	Baseline (≈2000)	Target (≈2020)	Absolute Change	Percentage Change	Mean 2019-2020
Europe	17.6	12.0	-5.6	-32%	11.6
Asia	25.9	20.2	-5.7	-22%	20.6
South America	21.0	20.5	-0.5	-2.5%	22.5
North America	16.5	22.2	5.6	34%	22.0
Oceania	27.2	27.7	0.5	1.8%	32.8
Africa	29.5	28.9	-0.6	-1.9%	28.6

These results indicate that, globally, SDG 8.6 was only partially achieved: Europe and Asia met the "substantial reduction" definition, but other regions did not.



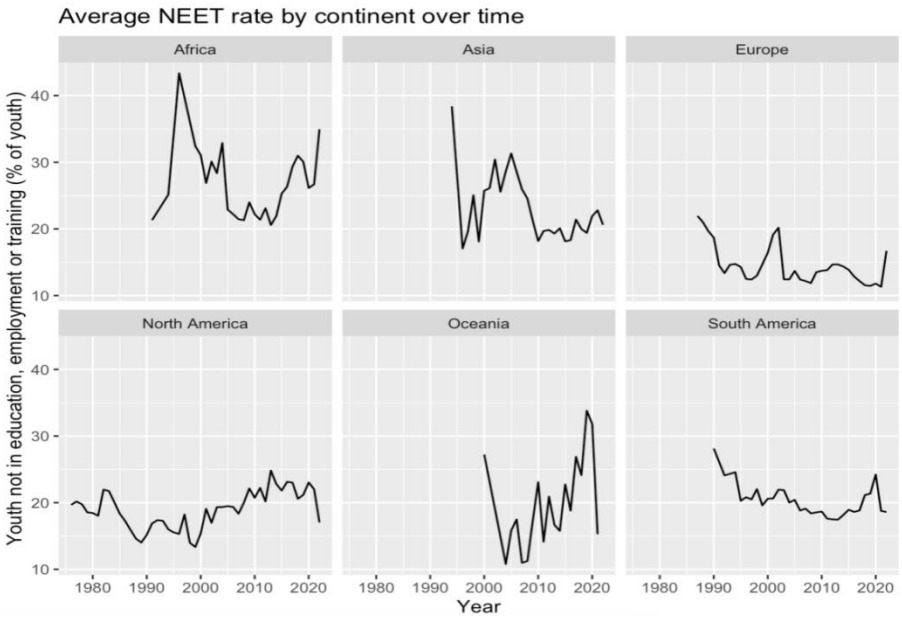
2.3 Country-Level Results

Applying the formal algorithm produced 171 country-level regressions. Roughly 38 % of countries achieved a substantial reduction. Prominent improvers include Germany, Poland, Japan, South Korea, and Vietnam, each recording reductions of more than 5 percentage points and 20%. Japan's NEET rate fell from 10.3% in 2000 to 6.2% in 2020 (−39%), consistent with OECD findings that link its "Freeter to Regular" reforms to stronger youth labour-market attachment. Vietnam's rate declined by over 8 points, reflecting rapid industrialisation and the expansion of vocational training.

By contrast, the US and Canada saw rising NEET rates ($\beta_1 > 0$), reflecting post-2008 labour-market weakness and COVID-19 disruptions. African economies recorded only modest gains, with NEET levels remaining above 25% due to structural unemployment, informality, and education–labour mismatches [6]. Oceania's apparent stagnation largely reflects limited and inconsistent data for Pacific Island states.

2.4 Trend and Regression Analysis

For each country, a linear model $x_t = \beta_0 + \beta_1 t + \varepsilon_t$ was fitted from 2000 to 2020 using at least 3 data points. The slope β_1 represents the annual rate of change in NEET percentage points. A negative and statistically significant β_1 indicates sustained improvement. Around 70 countries met this criterion, with the steepest declines in Central and Eastern Europe, East Asia, and parts of Latin America. The figure shows sharply falling NEET rates in Europe until 2008, a post-crisis plateau, and renewed improvement after 2015. Asia exhibits a steady downward trend, whereas Africa and the Americas remain relatively flat. Regression diagnostics highlight substantial heterogeneity: slope variance is far higher in developing regions, reflecting instability and data gaps. Where data were sparse, we validated results using three-year averages to dampen volatility.



2.5 Interpretation and Discussion

According to the ILO, countries with strong technical and vocational education and training (TVET) systems tend to have lower youth NEET rates, as these systems facilitate smoother school-to-work transitions. This aligns with our findings: Germany and the Netherlands maintained low NEET rates through robust vocational and apprenticeship systems, reinforced by post-2008 labour-market reforms and Youth Guarantee schemes.

Elsewhere, structural barriers slow progress. Sub-Saharan Africa's persistently high NEET rates reflect rapid demographic growth and weak formal-sector job creation [7]. In Latin America, early school leaving and gendered caregiving responsibilities keep NEET levels elevated, limiting the pace of improvement even during growth periods. North America's rising NEET rates—especially in the US—stem from youth-employment polarisation and growing "discouragement" as low-skilled young people exit the labour force amid shrinking middle-skill opportunities. These patterns show how continent-level averages mask the deeper drivers of youth inactivity: education quality, labour-market dualism, social-protection gaps, and gender norms.

Overall, the divergences highlight that growth alone is insufficient. Countries that paired inclusive education, youth-employment incentives, and strong safety nets with solid growth achieved the largest NEET reductions.

Conclusion

Overall, global progress toward SDG 8 remains uneven. For Target 8.1, many developing economies are growing, but only a minority achieve the sustained and robust performance to approach the 7% benchmark. Several Asian economies like Bangladesh and Cambodia show encouraging growth rates, but high volatility reduces their prospects for sustained and stable expansion, evidenced by the coefficient-of-variation-to-mean analysis. A similar pattern emerges for Target 8.6. Although 38% of countries achieved statistically meaningful reductions in youth NEET rates, exploration of the data reveals how unevenly distributed this progress is. Progress is heavily concentrated in Europe and East Asia, where labour market policies such as Germany's dual vocational system [4] and South Korea's youth-unemployment incentives enable better school-to-work transitions [5]. Simultaneously, countries such as Brazil, South Africa, and the US all experience stagnation and even reversals despite periods of economic expansion.

In conclusion, this pattern of mixed results highlights that progress towards SDG 8 is nuanced and complex. It is difficult to categorise any one country or continent as 'progressing' as it may succeed in some components of the framework but fail in others. For example, many developing economies are growing, but fail to complement this with the structural labour market reforms needed to encourage greater youth inclusion, or strategic government intervention to stabilise growth in the future. Countries that paired growth with the correct reforms made the clearest progress, suggesting that policy implementation and not just headline growth metrics should play a more decisive role in achieving SDG 8. This aligns with the point made in the introduction that by focusing on a narrow selection of SDG 8 targets, we will miss the institutional and financial mechanisms, like those captured in Target 8.10 and 8.6, which can provide a more holistic assessment of sustainable growth and inclusive employment.

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