**Journal of Emerging Markets and Management**

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ARTICLE

# Patterns of Employment and Their Spatial Constraints: Resilience to Climate and Market Crises in Nigeria

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## ABSTRACT

This research examines the sectoral structure of employment in Nigeria and the way that structure shapes spatial constraints on the economy's resilience to climate and market crises. Rather than treating social capital as a measured variable, the study frames it as contextual background and instead analyses observable sectoral employment, value added, and land-cover dynamics. A gap identified in the literature is the limited treatment of the top-down mechanisms through which capital is channelled into or out of economic sectors, and the spatial consequences that follow. Sectoral data on employment and productivity for Africa, Asia, and Latin America were drawn from the Economic Transformation Database (ETD) and analysed together with data on forest cover, GDP, agricultural land, export revenues, and foreign direct investment across a 1990–2018 time series. The analysis applied multiple linear regression and correlation, with variables for employment and sector value added (% GDP) in Mining, Real Estate, and Agriculture. Forest area is strongly and negatively associated with Agriculture gross value added (r = −0.872) and with combined Mining and Real Estate value added (r = −0.816); the regression of sectoral value added on forest area returns $R^2 = 0.997$, with Agriculture ($p < 0.001$) and Real Estate ($p < 0.001$) significant and Mining not significant ($p = 0.101$). Results indicate a pattern of employment and industrialisation that prioritises extractives for state revenues while the majority of the working population depends on low-wage agriculture under increasingly complicated spatial constraints. The associations reported here are interpreted as structural patterns rather than causal effects. The data suggest that a climate-conscious strategy of sectoral organisation would support progress toward Sustainable Development Goal 8 and the building of climate and economic resilience over the coming 25 years.

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ARTICLE INFO

Received: 8 June 2026 | Revised: 3 August 2026 | Accepted: 10 August 2026 | Published Online: 17 August 2026

DOI: https://doi.org/10.63385/jemm.v2i3.101164

CITATION

Mooney, H., 2026. Patterns of Employment and Their Spatial Constraints: Resilience to Climate and Market Crises in Nigeria. Journal of Emerging Markets and Management. 2(3): 25–39. DOI: https://doi.org/10.63385/jemm.v2i3.101164

***Keywords:*** Structural Transformation; African Economies; Employment; Climate Resilience; Deforestation; Climate Adaptation; Sustainable Development; Economic Diversification

# 1. Introduction

Even a brief examination of the increasing frequency of disasters, conflicts, and displacement within and beyond Sub-Saharan African (SSA) states illustrates the significance of the sectoral structure of employment in shaping resilience against shocks from both climate disruption and the complexities of international state machinery. Where a workforce is concentrated, and how value added is distributed across sectors, conditions a society's capacity for post-shock recovery and adaptation following a climate disaster or politically motivated conflict. A range of strategies for dealing with uncertainty has begun to acknowledge the malleability of spatially specific economic networks and their inherent capability to absorb and distribute pressures such as displacement, unemployment, or the tearing of social fabric. Social capital is invoked in this paper as contextual background for these dynamics rather than as a measured variable; the empirical analysis concerns observable sectoral employment, value added, and land-cover change.

Patterns of labour play a vital role in strengthening or weakening an economy's capacity to absorb exogenous climate and market shocks. A substantial literature documents the volatility of state economies that overrely on extractives or exhibit general resource path dependency and that prove unwilling or unable to diversify and hedge their portfolios against today's economic and ecological polycrises. United Nations Sustainable Development Goal (SDG) 8, Decent Work and Economic Growth, sets out several labour-related targets aimed at creating decent jobs and improving living standards for all [1]. Among them are achieving "higher levels of economic productivity through diversification, technological upgrading and innovation," devising and implementing "policies to promote sustainable tourism that creates jobs and promotes local culture and products," and achieving "full and productive employment and decent work for all women and men" by 2030 [1]. Against the backdrop of climate change, the past three decades of geopolitical alliances directed toward SSA have either purported to prioritise so-called sustainable industrialisation, as in the 2021 Leaders' Summit on Climate [2] and COP 26 in Glasgow [3], or committed simply to boosting aggregate productivity, as in China's Belt-and-Road Initiative [4]. Whether 'green'-oriented or not, these promises of job creation and assisted structural transformation toward more highly productive emerging economies seldom account for the spatial requirements needed to keep them, and the benefits of either are rarely experienced evenly across sectoral distributions of employment. Together with a long history of violent political revolution, decolonisation, resource path dependency, corruption, and environmental crime, many SSA countries are more highly susceptible to both climate and economic shocks and will bear the largest brunt of climate-induced pressures exerted on any of the Earth's populations. Developing the necessary capacity to withstand these shocks requires sectoral patterns of employment that reflect industry diversification, decent remuneration, and meaningful work.

## 1.1. Novel Contribution and Research Gap

Existing scholarship on Nigeria treats structural transformation, climate vulnerability, and employment largely in parallel. Studies of structural transformation document the slow movement of labour out of agriculture but rarely connect sectoral value-added dynamics to land-cover change. Climate-vulnerability research maps the spatial distribution of drought, flood, and sea-level exposure but seldom ties that exposure to the sectoral composition of the labour force. Employment studies, in turn, emphasise informality and underemployment without locating them within a biophysical, land-constrained frame. The novel contribution of this study is to join these three strands empirically: it pairs long-run sectoral employment and value-added series from the Economic Transformation Database with national land-cover, export, and investment data, and reports the association between sectoral economic structure and forest-area change across a 1990–2018 series. The aim is not to estimate causal effects but to characterise a structural pattern—the coexistence of an extractives-oriented revenue base, an agrarian employment majority, and a contracting forest frontier—and to assess what that pattern implies for resilience to climate and market crises. The contribution is therefore integrative and descriptive rather than causal-inferential, and it is framed accordingly throughout.

## 1.2. Conceptual Framework

The study is organised around a simple structural framework with three linked elements. First, the sectoral allocation of employment and value added describes how an economy distributes labour and income across activities; in Nigeria, this allocation is markedly uneven, concentrating value in extractives while concentrating labour in agriculture. Second, this allocation interacts with the biophysical land base: agriculture is spatially extensive and climate-sensitive, so a large agrarian workforce operating under capital and technology constraints exerts pressure on forest and arable land. Third, the resulting land-cover change feeds back into exposure, because deforestation and the contraction of the arable frontier reduce the natural-capital buffer on which a climate-sensitive workforce depends. Resilience, in this framework, is treated as the capacity of this sectoral-spatial configuration to absorb climate and market shocks without large welfare losses; it is approached through proxies—employment concentration, value-added disparity, Foreign Direct Investment (FDI) dependence, and forest-area trend—rather than through a single composite index. Social capital is positioned as a contextual conditioner of this capacity, not as a quantified term in the model. This framing makes explicit which constructs are measured (employment, value added, land cover, exports, FDI) and which are interpretive (resilience, social capital), and it disciplines the interpretation of results toward association rather than mechanism.

## 1.3. The Nigerian Context

Of Nigeria's remaining land surface area, nearly 76% has been converted to agricultural land [5]. The state's rate of urbanisation is rapid [6], which, beyond redefining urban and peri-urban areas, suggests that the construction of new infrastructure leaves even less available space and budgetary allocation for the agricultural jobs the country has prioritised. A diversification of a state's economic portfolio, particularly one that is climate-conscious, correlates positively with progress toward SDG 8. This is especially the case given that, over the next fifteen years, job-seeking youth will account for nearly 42% of Africa's total population, a figure projected to nearly double by 2055 [7]. Drivers of conflict in the region, even in the 'green' space, have been linked primarily to predatory resource grabbing [8], top-down spatial decision-making [9], and involuntary resettlement without compensation [10]. These symptoms of development-as-usual manifest alongside climate-related catastrophes such as drought [11], flood [12], invasive species [13], and the spread of disease [14], which render the country's share of impoverished subsistence living spatially unsustainable and more susceptible to climate and economic shocks.

The 1969 Petroleum Act of Nigeria asserts unilaterally that all petroleum resources in the state belong to the Nigerian federal government, arguably the most consequential statute pertaining to fossil-fuel ownership and management in Nigeria today. The Act laid the groundwork on which a political and economic arena could be moulded under the purported aim of lifting Nigerians out of post-colonial poverty through market imperatives on the global stage [15]. Today, joint ventures comprise 95% of oil and gas production [16]. As local ecological, transboundary climate, and international market pressures exert shocks on Nigeria's poorest and most rural communities, disaster recovery places additional strain on the limited resources with which communities resist exploitation, land grabbing, and economic marginalisation [17].

International monetary structures that peg the sale of Nigeria's petroleum against foreign and more valuable currencies can hinder the state's ability to diversify the trade of the commodities on which its trajectory rests. Sebastian and Warner (2014) maintain that, to assure self-sustaining development in the long term, developing states must have resources to begin with, control of those resources, and a tax base to reinvest in local and national economies [18]. Internal sources of state conflict, such as warlords and militia in the Niger Delta, periodically jeopardise the integrity of the entire energy system. States with a history of conflict in turn appear higher-risk to foreign investment that could otherwise be diverted into the sectoral diversification they may urgently need, a potential reason why Nigeria's rate of Foreign Direct Investment (FDI) has historically been so low (see Results). With a number of SSA states lacking the financial means to meet sustainable development agendas on their own [19], predatory opportunities for exploiting the extractives sector become simpler to capitalise on where tenuous land-tenure structures guard petroleum blocs around the country [20].

Despite the magnitude of its GDP, Nigeria's federal government consistently receives some of the lowest ratings for governance and corruption [21]. An oil economy characterised by extensive added wealth without reciprocal contribution to overall productivity recurs into distributive conflicts on a regular basis. Because the state apparatus holds embedded interests in the oil economy for private gain, efforts at reorganising the oil industry, or even promoting sectoral diversity, have largely failed. Reliance on oil and gas means other economic sectors are persistently hindered from establishing more durable portfolio variety against financial and climate disasters, a largely structural problem rooted in post-colonial mineral and surface rights [22].

## 1.4. Spatial Conflict and Climate Vulnerability

Agriculture provides the majority of employment for a large portion of the developing world, particularly across much of the Global South, and especially in SSA states. It is also a sector conspicuously sensitive to fluctuations in climate disasters, drought, heat, and precipitation. Because low-wage agriculture comprises a large proportion of the SSA labour force, the respective employment structures denote considerable exposure to which climate and market shocks are expected to be disproportionately absorbed [23]. The scarcity of adequate agricultural infrastructure, refrigeration, suitable transport routes, and irrigation equipment in many SSA countries, and in Nigeria as a percentage of its total labour force, leaves an increasingly spatially intensive agriculture sector vulnerable to the outputs of climate change [24]. Where the majority of earnings and sustenance derive from highly climate-dependent agricultural practices, a longer-than-usual drought can cause nourishment scarcity for large segments of the rural population, alongside lost state revenues and household incomes. The implications can include political unrest, food shortages [25], climate-induced migration due to lower annual yields [26], and, importantly for this research, deforestation in search of new untapped farmable land [27].

The Intergovernmental Panel on Climate Change (IPCC) projects that the percentage of arid and semi-arid lands will rise by 5–8% by the 2080s, in large part due to limited water supplies and severe fluctuations in precipitation and the Earth's water cycle. While the distribution of vulnerability varies both across and within SSA states, small-scale farmers are consistently found to be the most vulnerable to climatic shocks of this nature [28]. Research by Ogunrinde et al. (2020) on the spatial distribution of climate vulnerability within Nigeria suggests that a high degree of rurality and low socioeconomic development in northern communities are characteristics shared by households which frequently experience drought [29]. That research suggests at least a correlational link between the spatial distribution of atypical drought and the susceptibility of categorically distinct households to more severely experience the economic consequences of climate-related shocks within an increasingly large agriculture-dependent labour pool (**Figures 1** and **2**) [30].

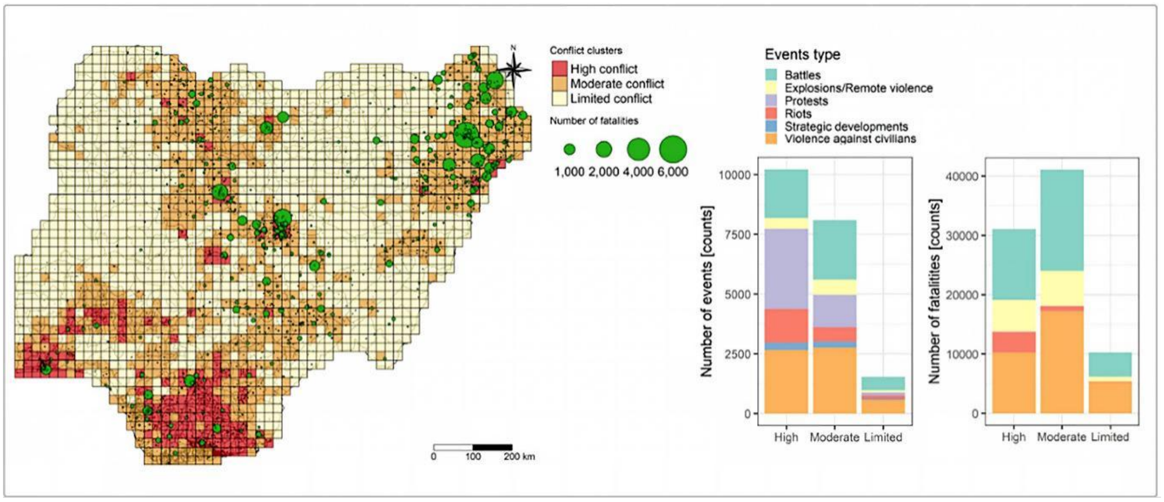


**Figure 1.** Conflict distribution: geographical location and distribution per type of conflict, Nigeria [31].

Source: Reproduced with permission; see the Data Availability Statement section.

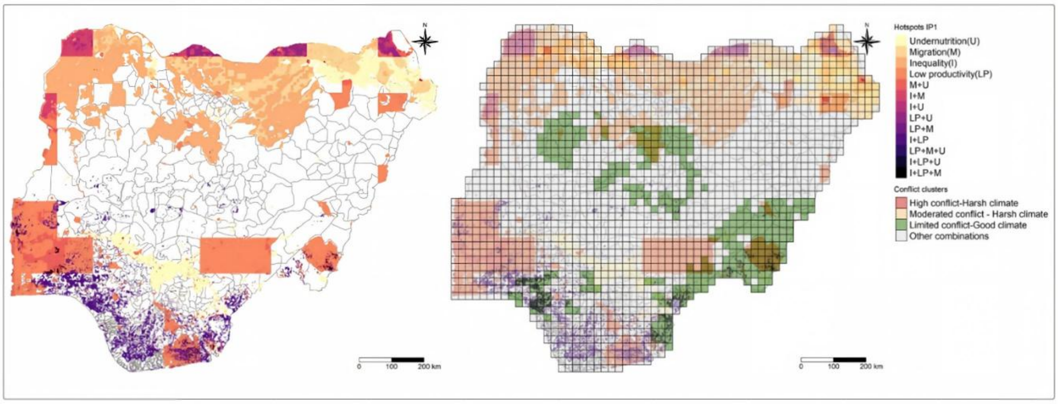


**Figure 2.** Spatial hotspots of conflict, Nigeria [31].

Source: Reproduced with permission; see the Data Availability Statement section.

Nigeria also faces spatial constraints from sea-level rise at its coast, which threaten to reduce the total land area available to its steadily growing population employed in the agriculture sector (**Figure 3**). When fisheries activity is included within the economic umbrella of the agriculture sector's definition, this carries further implications for coastal small-scale ocean users and artisanal fisherfolk who face land-based spatial constraints in residence and small-business infrastructure progressively threatened by rising seas.

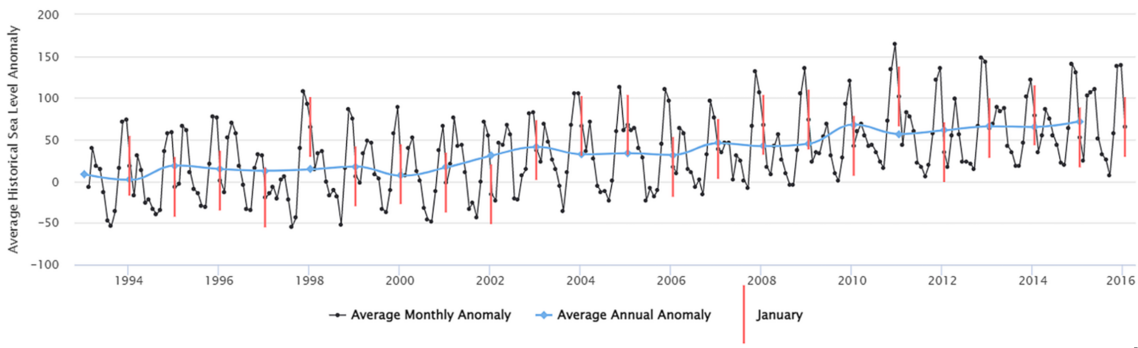


**Figure 3.** Historical sea level (mm) for coastal Nigeria, 1993–2015: Observed anomalies relative to mean of 1993–2012 [32].

Source: World Bank Climate Change Knowledge Portal; see the Data Availability Statement section.

The available modes of agricultural production in Nigeria play a fundamental role in creating the spatial constraints to which the large agrarian labour force is subject, for the purposes of this paper primarily through deforestation and slash-and-burn practices. Capital and technology constraints imposed on Nigeria's rural workforce can drive high-volume and spatially self-destructive farming methods with a disproportionate reliance on forest resources that encourages soil erosion and deforestation. Both outcomes are associated with decreased water retention, increased flooding after storms, and decreased water flow between downpours, with cascading implications downstream in the agriculture sector. Beyond removing a potential commercial safety net in forestry and logging, deforestation contributes to runoff, flooding, and soil erosion during rainy seasons and to the intensification of water scarcity during dry seasons, with harmful feedback for raising cattle, irrigating crops, and replenishing drinking-water reserves [33].

Land degradation for agriculture through deforestation is, in turn, a crucial source of agroecological concern in SSA. The lives and food security of millions are at risk from the direct and indirect pressures exerted by population growth under current modes of production, resource demands, poverty, and ineffective governance, all of which climate change is expected to exacerbate. Nigeria's agriculture sector is particularly susceptible to changes in rainfall and temperature because of the country's strong reliance on rain-fed crops for state revenues and food security amid the scarcity of irrigation and water-distribution infrastructure throughout rural areas [16]. Other industries whose sociometabolic relationships to natural capital do not depend as tangibly on its direct harvest, are also subject to volatility when disasters over longer horizons compound into the inability of, for example, Nigeria's hydropower sector to produce electricity at a rate that keeps pace with demand and rising energy costs [34].

Even outside an SSA context, forest-cover reduction is associated with a loss of resilience to climate shocks. The IPCC is particularly concerned about climate change in regions such as the Amazon basin and about the variation in regional impacts posed by climate risks when aggregated to reflect changes in global biodiversity and the global economy [28]. Biodiversity loss from deforestation for agriculture, and the consequent loss of ecosystem services, poses higher risks at higher global average temperature increases, particularly in fragile ecosystems such as the Amazon basin and the fringes of the Congo basin, which partially reach into Nigeria. The likelihood of extinction in these ecoregions is heightened by the fact that many areas where climate pressures are anticipated to hit hardest are also areas expected to experience rapid deforestation in the near future [35].

### 1.5. Structural Transformation

Structural transformation, the process by which an economy shifts from mostly low-productivity sectors toward higher-productivity ones, is a crucial component of economic progress, and recent evidence links it directly to sustainable development across sub-Saharan Africa [36]. The transition typically involves the emergence and development of new industries, which can produce better job prospects and a higher standard of living. The Groningen Growth and Development Centre (GGDC) of the University of Groningen and the United Nations University World Institute for Development Economics Research (UNU-WIDER) collaborated to create the GGDC/UNU-WIDER Economic Transformation Database (ETD), first launched in February 2021 to examine the patterns and causes of structural change and productivity development at national, regional, and international levels in developing countries. The literature has clarified the relationships among agriculture, climate resilience, and forest cover.

A major gap identified in the literature, however, is the limited consideration given to the top-down means by which capital is funnelled into or out of various economic sectors as those means pertain to the spatial consequences of their objectives. Newly released ETD data reveal patterns in state priorities of employment regarding where to develop human capital within and across state contexts and, in combination with other data and literature, suggest a paradigm in which structural development in Nigeria is more favourably catered to a smaller pool of those employed in extractives. This research therefore attempts to clarify how the sectoral structure of Nigerian labour markets shapes the spatial constraints on the economy's ability to adapt to a changing climate system, the shocks of which will be felt by the very pastoralists and agriculturalists who make up a large portion of the country's population.

## 2. Materials and Methods

Comprehensive, long-term, and globally comparable sectoral data on employment and productivity for Africa, Asia, and Latin America are available from the GGDC/UNU-WIDER ETD [37], and cross-sectoral data from selected employment sectors were analysed alongside data on forest cover, GDP, agricultural land, export revenues, and FDI over the same time series, FY1990 to FY2018. Among the countries available in the database, Nigeria was selected for analysis because it now ranks among the continent's states with the fastest population and GDP growth, surpassing South Africa on these metrics, while a large portion of its economic development is precariously dependent on externally set oil prices. Poverty nonetheless remains a major challenge, and income disparity has increased dramatically over the past 30 years [38]. Much of the data was sourced from the World Bank and the Organisation for Economic Cooperation and Development (OECD).

### 2.1. Sector Selection

Three sectors—Agriculture, Mining, and Real Estate—were selected for the regression and correlation analysis, and Manufacturing, Services, Energy, and Construction were excluded. The selection follows the analytical question rather than an attempt to model the whole economy. The argument of the paper concerns the coexistence of a labour-heavy, land-extensive sector (Agriculture) and capital-heavy, value-concentrated sectors that draw revenue and policy attention away from it. Agriculture is included because it employs roughly half the labour force and is the most spatially extensive and climate-sensitive sector. Mining is included because it is the revenue and export anchor of the economy and the clearest expression of the extractive orientation under study. Real Estate is included as a contrasting capital-intensive, high-value-added, low-employment sector whose value-added series in the ETD is directly comparable to Mining. Manufacturing and Construction were excluded because, in the Nigerian series, their employment and value-added shares are small and erratic and do not bear on the agriculture–extractives contrast that motivates the study; Services were excluded because the category is heterogeneous and dominated by informal activity that the ETD does not disaggregate in a way suited to the land-cover question; and Energy is largely subsumed within the petroleum (Mining) accounts in the source data, so treating it separately would double-count. The narrowed selection is therefore a deliberate analytical choice to isolate the agriculture–extractives–land nexus, not a claim that the excluded sectors are unimportant to structural transformation; this scope condition is revisited in the Limitations subsection.

## 2.2. Definitions

The ETD's definition of Agriculture is consistent with that of the World Bank, which "includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources"[39].

Arable land includes "land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded"[40].

Mining (and Quarrying) includes the "extraction of minerals occurring naturally as solids (coal and ores), liquids (petroleum) or gases (natural gas)"[41].

The ETD's definition of Real Estate is limited to "real estate activities"; for this analysis, the Black's Law Dictionary definition is used. Real estate "includes the land and anything fixed, immovable, or permanently attached to it such as buildings, walls, fixtures, improvements, roads, trees, shrubs, fences, sewers, structures, and utility systems"[42].

Forest area is "land under natural or planted stands of trees of at least 5 metres in situ, whether productive or not"[43].

Value added is the "net output of a sector after adding up all outputs and subtracting intermediate inputs"[39].

## 2.3. Analysis and Model Specification

Analysis applied multiple linear regression and correlation to identify trends over the chosen time series from available ETD data between 1990 and 2018, with variables for sectoral employment and value added (% GDP) in Mining, Real Estate, and Agriculture. Additional data from the World Bank, OECD, and the Nigerian Bureau of Statistics were selected for state export revenues, extractive production and value added, forest area, and agricultural land area. GDP per capita for the three selected sectors was calculated using a local-currency-to-USD coefficient in 2018 US dollars, adjusted for exchange-rate variability over the time series.

The regression model is specified with national forest area ($10^3$ km²) as the dependent variable and the gross value added of the three selected sectors as independent variables, estimated by ordinary least squares over the annual series $t$ = 1990, …, 2018 (n = 29):

$$\begin{gathered} Forest_t = \beta_0 + \beta_1 Agric_t + \\ \beta_2 Mining_t + \beta_3 RealEstate_t + \varepsilon_t \end{gathered} \tag{1}$$

Correlation coefficients were also computed between forest area and each sector's value added. The overall model fit and the per-coefficient significance levels are reported in the Results section. The analysis is interpretive in intent: the coefficients and correlations are read as descriptions of structural co-movement across the period, not as estimates of a causal effect of any sector on forest loss.

Data were drawn from several repositories (ETD, World Bank, OECD, OPEC, and the Nigerian Bureau of Statistics). Where series overlapped, the ETD and World Bank values were treated as primary for employment, value added, and land cover, with OECD and OPEC used for cross-checking export and production magnitudes. Series were aligned to a common annual frequency and to constant 2018 US dollars where monetary. The annual ETD and World Bank series used here contained no internal gaps over 1990–2018; no imputation was therefore required, and no observations were dropped. Minor discrepancies in reported totals across sources (for example, between OPEC export values and World Bank balance-of-payments figures) were retained as reported and flagged in the narrative rather than reconciled to a single figure, since the analysis depends on trends and relative magnitudes rather than on exact point values.

Because of the complexities inherent in socio-ecological systems and SSA structural transformations, causal conclusions are difficult to draw from fragmented and multi-purpose data. Beyond agricultural activity, other forms of infrastructural development in logging, urbanisation, and FDI also influence the rate at which Nigeria's forest cover continues to vanish. Sourcing data on total farmable land not yet developed throughout Nigeria's territory presents challenges of its own.

# 3. Results

According to the ETD, Agriculture accounted for nearly half of all employed Nigerians in FY2018 and over a fifth of all national productive sectoral value. Yet just 0.3% of the ETD's labour pool, in Mining and Real Estate, accounted for nearly the same value (**Figure 4**).

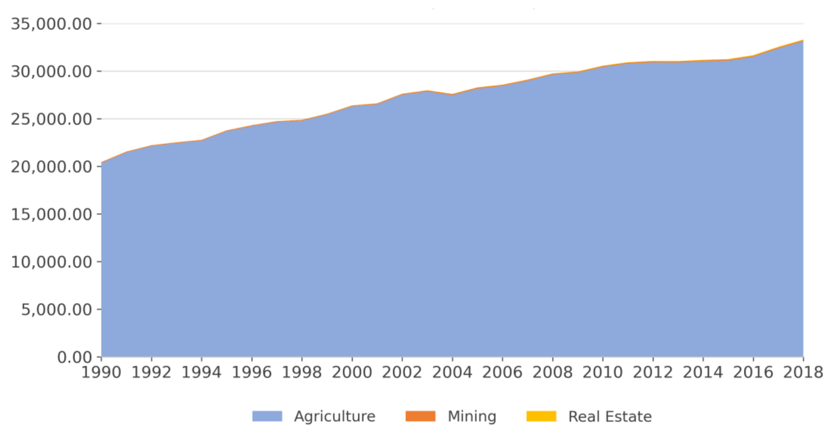


**Figure 4.** Total employment in Nigerian Agriculture, Mining, and Real Estate sectors (thousands), 1990–2018 [37].

As one of the continent's primary productivity powerhouses, Nigeria's total employed force in Q3 2018 stood at roughly 36% of the total labour force [5], with average incomes around USD 2,000, while the value of Nigeria's petroleum exports amounted to roughly USD 54.5 billion that year, accounting for nearly 87% of all state export revenues [44].

Relatively uniquely within an SSA context, Nigeria does not receive a significant portion of its state revenue through returns from FDI (**Figure 5**). Instead, the data show that while exports comprised roughly 11% of total GDP at market prices in 2021, petroleum exports comprised roughly 88% of that figure [44] (**Figure 6**).

The data also show that the total value added for Agriculture was approximately at parity with the combined contribution of Mining and Real Estate over the 30-year period, roughly USD 61,368 million for Mining and Real Estate and roughly USD 75,299 million for Agriculture (**Figure 7**). These figures are taken at 2018 value, calculated retrospectively at an October 2018 exchange rate.

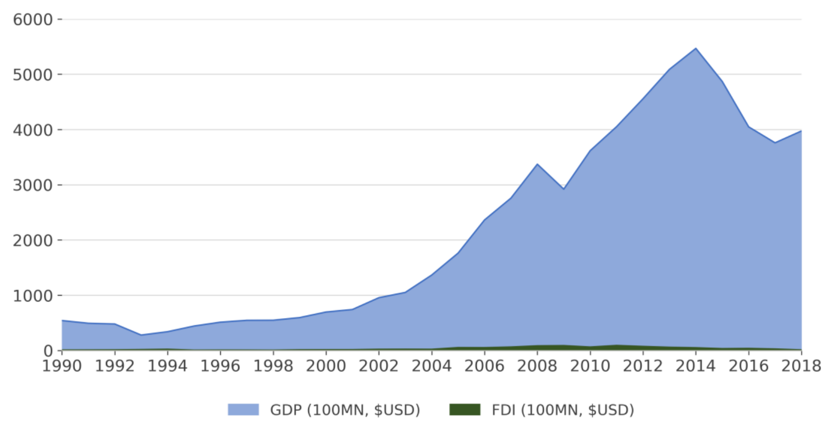


**Figure 5.** Nigeria GDP vs. FDI (USD 100 million), 1990–2018 [37,45].

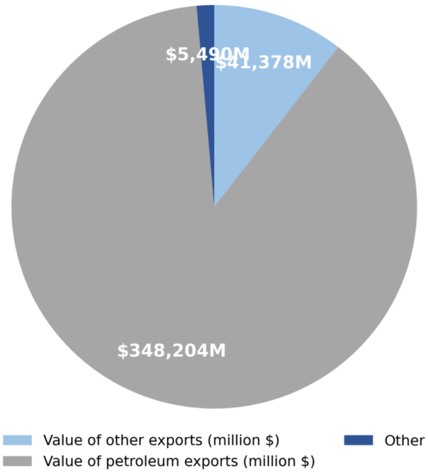


**Figure 6.** GDP, value of petroleum exports, and value of other exports, Nigeria FY2021 [32].

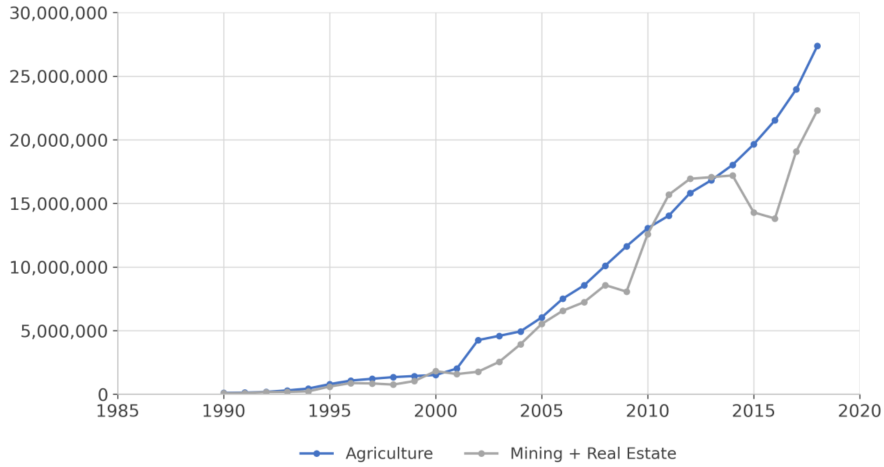


**Figure 7.** Gross value added at current basic prices (millions, local currency) for Agriculture and (Mining + Real Estate) in Nigeria, 1990–2018 [37].

Only a very small proportion of the labour force generated the gross value added by Mining and Real Estate compared with the proportion employed in Agriculture, to the point where Agricultural employment scarcely appears visible in **Figure 8**. Accordingly, GDP per capita across the two groups of sectors is vastly disparate. As of 2018, GDP per capita was USD 2,701 for Agriculture, USD 383,194 for Mining, and USD 404,117 for real estate. These figures were calculated from local currency [37] into USD using historical average exchange rates [46].

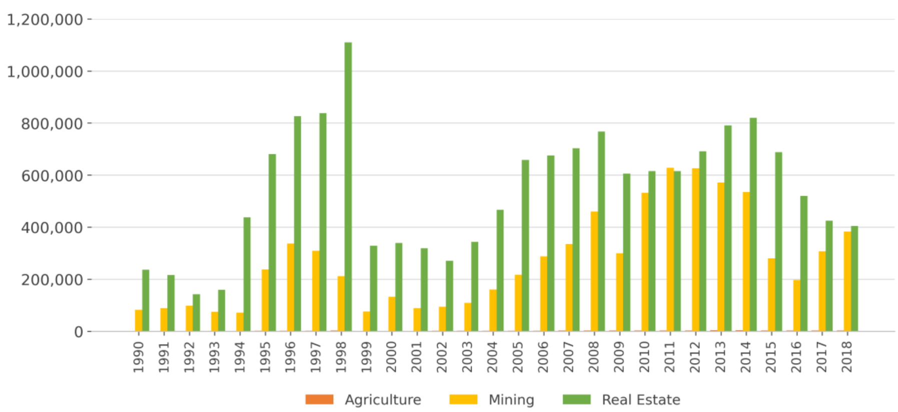


**Figure 8.** GDP per capita (USD) in Nigerian Agriculture, Mining, and Real Estate sectors, 1990–2018 [37].

Finally, forest area shows a stronger negative correlation with the gross value added (GVA) of Agriculture than with the combined value added of Mining and Real Estate (**Tables 1** and **2**). These coefficients describe co-movement across the period and are not interpreted as evidence that any one sector causes forest loss.

**Table 1.** Correlational statistics on sectoral value added and forest cover ($10^3$ $km^2$), 1990–2018 [37,43].

| Sector | Correlation with Forest Area ($10^3$ $km^2$) |
|---|---|
| Mining & Real Estate GVA | −0.816 |
| Agriculture GVA | −0.872 |

**Table 2.** Regression output for model (1): sectoral value added on forest cover ($10^3$ $km^2$), 1990–2018 [37,43].

| Term | *p*-Value |
|---|---|
| Intercept | $8.19 \times 10^{-35}$ |
| Agriculture GVA | $1.08 \times 10^{-15}$ |
| Mining GVA | 0.101 |
| Real Estate GVA | $2.72 \times 10^{-11}$ |
| Multiple R | 0.998 |
| $R^2$/Adjusted $R^2$ | 0.997/0.996 |
| Standard Error (model) | 0.853 |
| Observations (years) | 29 |

Note: the analysis reports per-term significance levels and overall model fit; coefficient point estimates and standard errors are not reported because the model is interpreted as describing structural association across the 1990–2018 series rather than estimating causal effects, consistent with the framing in Section 2.3 and the Limitations.

# 4. Discussion

The pattern of industrialisation observable across the past 30 years of data prioritises mining and extractives for state revenues that accrue to very few in terms of both income and employment, while the majority of the working population relies on subsistence or low-wage agriculture under increasingly complicated spatial constraints. Although overall structural transformation from low to high productivity is evident in singular descriptive statistics such as GDP, the data on Nigeria's experience indicate that this productivity is far from evenly distributed by sector, and that changes in relative productivity are less pronounced than one might expect; the share of agricultural employment, for instance, is nearly the same as it was 30 years ago.

These findings are consistent with, and extend, prior scholarship. The persistence of an agrarian employment majority alongside an extractives-dominated revenue base echoes the structural-transformation accounts that motivated the ETD itself, but the present study adds the land-cover dimension that those accounts generally omit. The strong negative association between Agriculture value added and forest area aligns with the deforestation-for-farmland mechanism described in the SSA conflict and land-use literature, while differing from studies that foreground logging or urbanisation as the primary driver; here, agriculture co-moves more strongly with forest loss than the capital-intensive sectors do. Where earlier Nigeria-specific work emphasised drought exposure and rurality as vulnerability markers, the present results situate that vulnerability within a sectoral-economic structure, suggesting that exposure is not only climatic but also a function of how labour and value added are distributed. The divergence between the near-significant Mining coefficient and the highly significant Agriculture and Real Estate terms also indicates that the extractives–forest relationship is weaker in the aggregate series than the agriculture–forest relationship, a nuance worth testing in disaggregated future work.

The analysis demonstrates that, while Mining and Real Estate are both associated with the loss of forest area ($r = -0.816$), Agriculture is more strongly associated ($r = -0.872$) with deforestation than the other two sectors combined. This is consistent with a structural pattern in which, where finance is directed away from sustainable agriculture and toward Mining and Real Estate, spatial impacts are distributed across an increasingly dwindling supply of remaining forests. The 1969 Petroleum Act's declaration that all petroleum resources belong to the federal government also functions as a legal framework shaping where the government deems development investment will see the largest return. Implications of this research include insight into how developing economies can pursue sustainable, inclusive development in the face of transboundary climate pressures and the globalised production of commodities, many of which rely heavily on developing countries that depend on raw-resource exports for state revenues, as Nigeria does.

## 4.1. Generalizability beyond Nigeria

The findings are specific to Nigeria's configuration of a large agrarian workforce, an extractives-anchored revenue base, low FDI dependence, and a contracting forest frontier. They are most likely to transfer to other SSA economies that share this configuration—for example, oil- or mineral-dependent states with a climate-sensitive agricultural majority and active deforestation fronts. They are less likely to describe economies whose structural transformation has proceeded further into manufacturing or services, or whose revenue base is more diversified. The study should therefore be read as a structural case rather than a continent-wide generalisation, and the same metrics could be applied comparatively across ETD countries to test whether the agriculture–extractives–forest pattern recurs where the underlying sectoral structure is similar.

The structural inequality documented here, in which value generation concentrates in an extractive sector that employs almost no one while the labour majority remains in a low-value, climate-exposed activity, is not unique to Nigeria. It recurs across several resource-dependent economies and is the empirical signature of the resource-curse and Dutch-disease mechanisms [15,47]. In other oil-rich Sub-Saharan African states, notably Angola and the CEMAC producers (Congo, Equatorial Guinea, Gabon, Cameroon, and Chad), the surge in petroleum revenues has coincided with the erosion of a once-competitive agricultural export base, so that oil-exporting economies with a comparative advantage in agriculture became net agricultural importers even as farming continued to occupy much of the workforce [47]. The same divergence between where value is generated and where labour is concentrated appears in mineral-dependent and hydrocarbon-dependent economies more broadly, where export concentration in a single high-rent sector suppresses the tradable sectors that would otherwise absorb labour at higher productivity [47].

What distinguishes cases that have moderated the pattern is the presence of deliberate diversification and revenue-management institutions rather than any weakening of resource dependence itself. Comparative work on resource-dependent economies associates better outcomes with stabilisation and sovereign-wealth arrangements, investment in human capital, and reinvestment of resource rents into tradable, employment-generating sectors [15,47]. Placed against these comparators, Nigeria sits at the more acute end of the spectrum: its revenue base is heavily petroleum-concentrated, its FDI dependence is low, and its extractive rents have not been channelled into the sectoral diversification that would broaden the employment foundation for resilience. The Nigerian case is therefore best read not as an isolated anomaly but as a particularly sharp instance of a wider structural condition, which strengthens rather than limits the relevance of the findings for other resource-dependent economies confronting climate and market shocks.

## 4.2. Policy Implications

Four specific directions follow from the structural pattern documented here. On agricultural modernisation, targeted investment in irrigation, cold-chain and storage infrastructure, and extension services would reduce the land-extensive, rain-fed character of production that ties the agrarian majority so tightly to climate variability, lowering the incentive to clear new forest for marginal yield. On forest conservation, conditioning agricultural support and land-tenure formalisation on retention of forest cover—for instance through payments for ecosystem services and enforceable tenure for smallholders—would address the deforestation frontier directly rather than through aggregate growth. On employment diversification, redirecting a share of extractive rents into labour-intensive, higher-value-added activity (agro-processing, light manufacturing, and services linked to agricultural value chains) would begin to close the value-added-per-worker gap documented in **Figure 8**. On climate adaptation, integrating sectoral employment data with the spatial vulnerability mapping discussed in Section 1.4 would let planners target adaptation resources to the northern, rural, drought-exposed communities that the data identify as most exposed. These measures are mutually reinforcing: each reduces the pressure that the current sectoral structure places on the land base while broadening the employment foundation for resilience.

These directions are not abstract; each maps onto development and climate-adaptation frameworks already operating across Sub-Saharan Africa, and the contribution of this study is to indicate where such frameworks could be targeted more precisely in the Nigerian case. Agricultural modernisation aligns with the African Union's Comprehensive Africa Agriculture Development Programme (CAADP), whose successor strategy for 2026–2035 continues to channel National Agricultural Investment Plans toward productivity, irrigation, and value-chain development [48]. The evidence here suggests that CAADP-aligned investment in Nigeria would yield the greatest resilience return where it reduces the land-extensive, rain-fed character of production that binds the agrarian majority to climate variability. Forest conservation aligns with the African Union Great Green Wall Initiative, whose 2024–2034 strategy foregrounds land restoration, climate-smart agriculture, and livelihood resilience across the Sahel [49]; the strong negative association between agricultural value added and forest area reported here implies that such restoration efforts in Nigeria should be coupled with tenure and support instruments that remove the incentive to clear new forest for marginal yield.

Employment diversification and climate adaptation likewise connect to instruments already in place. Nigeria's Climate Change Act (2021) and its Nationally Determined Contributions provide a domestic legal and planning architecture into which the sectoral evidence presented here could feed, while continental initiatives on green growth and economic diversification point toward the agro-processing and value-chain activity that would begin to close the value-added-per-worker gap [24,34]. The practical implication is that the reallocation of extractive rents toward labour-intensive, higher-value sectors is most credible when pursued through these existing adaptation and diversification vehicles rather than as stand-alone measures. Integrating the sectoral employment data used in this study with the spatial vulnerability mapping discussed in Section 1.4 would, in turn, allow adaptation resources under these frameworks to be directed to the northern, rural, drought-exposed communities that the analysis identifies as most exposed. Situated in this way, the study's recommendations reinforce, rather than duplicate, the development and climate-adaptation agendas already underway in the region.

# 5. Conclusions

This study integrates long-run sectoral employment and value-added data with national land-cover, export, and investment series to characterise the structural basis of Nigeria's resilience to climate and market crises. Its theoretical contribution is to bring structural transformation, climate vulnerability, and employment perspectives into a single descriptive frame and to show that they are empirically linked through the land base. Its practical contribution is to identify where intervention would matter most: an extractives-oriented revenue structure concentrates value in a sector that employs almost no one, while the agrarian majority absorbs climate and market shocks across a shrinking spatial frontier. The principal empirical results—a near-parity of Agriculture and combined Mining–Real Estate value added over the period, a vast GDP-per-worker gap across these groups, and a strong negative association between sectoral value added and forest area ($r = -0.872$ for Agriculture; $r = -0.816$ for Mining and Real Estate; model $R^2 = 0.997$)—are interpreted as structural associations, not causal effects.

From the data, a climate-conscious strategy of sectoral organisation appears advisable if Nigeria is to move closer to meeting SDG 8, among other SDGs, and to develop both climate and economic resilience over the coming 25 years [50]. Future research could extend the analysis in three directions: disaggregating the sectoral series and applying time-series econometrics suited to short annual panels to test the robustness of the associations reported here; widening the sector set to incorporate Manufacturing, Services, Energy, and Construction; and applying the same framework comparatively across other Sub-Saharan economies to establish how far the pattern generalises.

### Limitations

Several limitations bound the interpretation of these results. First, on data constraints, the analysis combines several repositories (ETD, World Bank, OECD, OPEC) whose definitions and vintages are not perfectly aligned; trends and relative magnitudes are reliable, but exact point values should be treated with caution, and data on undeveloped farmable land were not available at the needed resolution. Second, on sector selection, the deliberate focus on Agriculture, Mining, and Real Estate isolates the agriculture–extractives–land nexus but omits Manufacturing, Services, Energy, and Construction, so the model does not describe structural transformation in full and may carry selection bias toward the contrast it was designed to examine. Third, on time-series properties, the series is short (29 annual observations) and was not subjected to unit-root or cointegration testing; the high $R^2$ should therefore be read as in-sample fit and co-movement rather than as evidence against spurious regression, and the relationships are reported as associations. Fourth, on generalizability, the findings reflect Nigeria's particular sectoral configuration and should not be assumed to hold for more diversified economies without separate testing. These limitations motivate the future research directions set out in the Conclusions.

## Funding

This work received no external funding.

## Institutional Review Board Statement

Not applicable. This study did not involve humans or animals; it relied solely on secondary, publicly available aggregate economic and environmental data.

## Informed Consent Statement

Not applicable. This study did not involve human participants.

## Data Availability Statement

The data analysed in this study are openly available from third-party sources. Sectoral employment and productivity data are available from the GGDC/UNU-WIDER Economic Transformation Database (https://www.wider.unu.edu/database/etd-economic-transformation-database). Forest area, agricultural land, GDP, and FDI data are available from the World Bank Open Data portal (https://data.worldbank.org). Petroleum export and production data are available from the OPEC Annual Statistical Bulletin (https://www.opec.org). No new primary data were created in this study. **Figures 4–8** are the author's own work, generated from the cited public datasets, and require no permission. **Figures 1** and **2** are reproduced from Achicanoy et al. (2021)[31]; **Figure 3** is reproduced from the World Bank Climate Change Knowledge Portal[32].

## Conflicts of Interest

The author declares no conflict of interest.

## AI Use Statement

The author declares that no artificial intelligence (AI) tools were used in the preparation of this manuscript.

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