Technology and the Nigerian Labour Market Output: Disruptive Innovation or Economic Opportunity?

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ABSTRACT

This study analyses the relationship between technological advancement and labour market performance in Nigeria, with the aim of determining whether innovation has enhanced employment outcomes. Using the Autoregressive Distributed Lag (ARDL) from 1985-2023 approach, the study examines both short-run and long-run dynamics while controlling for education, institutional quality, life expectancy, capital formation, and technological development. The short-run results show that education and previous labour market conditions significantly improve employment outcomes, whereas technological investment and capital formation have no immediate effect. In the long run, education, security, and life expectancy emerge as key drivers of labour market performance, while technology remains statistically insignificant despite its positive sign. The error correction result confirms a gradual adjustment toward long-run equilibrium. These findings suggest that Nigeria's labour market lacks the structural readiness required to translate technological progress into meaningful employment gains. The study therefore recommends educational reforms, expanded vocational and digital skills training, and sustained re-skilling programmes to ensure that technological advancement supports inclusive labour market growth.

Keywords: *Technological Advancement, Human Capital, Labour Market Performance, ARDL and Employment Outcomes*
JEL Codes: J21, J24, O33, O47

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INTRODUCTION

Technological advancement has emerged as a defining force of socioeconomic transformation in the twenty-first century, with profound implications for labour markets worldwide. Recent developments in artificial intelligence, automation, digital platforms, and data-driven production systems are reshaping how work is organised, how skills are valued, and how employment relationships are structured. Nigeria, as Africa's most populous country and one of its largest economies, is deeply embedded in this global technological transition. Yet, despite increasing adoption of modern technologies, the country continues to face persistent challenges of high unemployment, low labour productivity, and a predominantly informal workforce.

Global debates on technology and work have increasingly shifted toward concerns about artificial intelligence, platform-based employment, and the future of work. Recent evidence suggests that while automation and digital platforms can enhance productivity and create new forms of employment, they also risk displacing routine jobs and expanding precarious forms of work, particularly in developing economies with weak labour protections (ILO, 2023). In Nigeria, these concerns are magnified by structural constraints such as limited digital infrastructure, weak institutions, and uneven access to education and skills development.

Historically, technological progress has been closely associated with economic development and structural transformation. Earlier waves of innovation fundamentally redefined labour demand, displacing certain jobs while creating new ones and raising productivity (Brynjolfsson & McAfee, 2014; Autor, 2015). However, recent scholarship argues that the current wave of artificial intelligence and platform technologies differs in scale and speed, raising new challenges for labour absorption and income distribution (Balogun, 2025). For developing economies like Nigeria, the benefits of technological change are therefore neither automatic nor evenly distributed.

Nigeria's labour market remains largely informal, with a substantial proportion of workers engaged in agriculture, petty trade, and small-scale services (NBS, 2023). This structure heightens vulnerability to technological disruption, particularly as digital platforms and automation expand into sectors such as banking, transportation, and retail. The rapid growth of ride-hailing services, e-commerce platforms, and digital financial services has altered traditional employment arrangements, often replacing standard wage employment with gig-based and more precarious forms of work (Akinwale & Adepoju, 2021). These developments have intensified concerns about job displacement, income insecurity, and widening inequality, especially among low-skilled and informal workers.

At the same time, technological innovation presents notable opportunities for employment creation and productivity enhancement. Digital technologies have facilitated the expansion of sectors such as fintech, agritech, and health-tech, improving access to markets, finance, and essential services while supporting entrepreneurship and small business development (World Bank, 2022). Moreover, the expansion of remote work and digital outsourcing has enabled some Nigerian professionals to access global labour markets, contributing to income generation and foreign exchange inflows. However, these gains remain concentrated among urban and highly skilled workers, reinforcing existing regional and socio-economic disparities (Edewor & Osunkunle, 2020).

Despite the growing literature on technology and employment in Nigeria, existing empirical studies tend to focus narrowly on ICT adoption or capital accumulation, often overlooking broader structural conditions that mediate labour market outcomes. In particular, limited attention has been paid to the roles of institutional quality and population health, as well as to the distinction between short-run adjustment effects and long-run structural impacts of technological change. This gap limits understanding of why technological advancement in Nigeria has not consistently translated into improved employment outcomes.

Against this background, the central problem addressed in this study is whether technological advancement in Nigeria functions primarily as a disruptive force that undermines traditional employment structures or as a catalyst for improved labour market performance. Specifically, the study asks: (i) how does technological advancement affect labour market output in Nigeria in the short and long run? and (ii) to what extent do education, institutional quality, and life expectancy condition the labour market's response to technological change?

By addressing these questions within an Autoregressive Distributed Lag (ARDL) framework and incorporating institutional quality and life expectancy alongside technology, education, and capital formation, this study contributes to contemporary debates on the future of work in developing economies. The findings provide policy-relevant insights for labour market regulation, education reform, and innovation strategies aimed at ensuring that technological progress supports inclusive and sustainable employment growth in Nigeria.

LITERATURE REVIEW

Conceptual Framework

The relationship between technology and the labour market has become an important area of inquiry, especially in developing economies such as Nigeria. As digital technologies spread across economic activities,

debate has intensified over whether these changes undermine existing employment arrangements or generate new avenues for productivity, growth, and inclusive participation in the economy.

Key Concepts and Definitions

To effectively map the conceptual framework, it is necessary to define the core constructs:

Technology

This refers to digital tools, automation, artificial intelligence (AI), information and communication technologies (ICTs), and other forms of innovation that alter production processes, services, and job functions (Brynjolfsson & McAfee, 2014).

Labour Market Output

It denotes the measurable outcomes of workforce participation, such as employment rates, productivity levels, income distribution, skill development, and sectoral shifts in employment (ILO, 2021).

Disruptive Innovation

This is a term coined by Christensen (1997), referring to innovations that significantly alter or displace existing business and employment models, often making old skills obsolete while requiring new ones.

Economic Opportunity

It implies positive changes brought by technology, including job creation, increased productivity, skill acquisition, and improved access to markets and services (World Bank, 2022).

Theoretical Framework

To assess whether technological advancement functions mainly as a disruptive force or as a source of economic opportunity for labour market output, it is necessary to examine key economic theories that explain the relationship between innovation and employment. Schumpeter's Theory of Creative Destruction explains the dual impact of technological change on labour markets. Schumpeter (1942) argues that innovation transforms economies by displacing outdated production methods while creating new industries and employment opportunities. In Nigeria, technological advancement has reduced demand for some traditional roles in agriculture, manufacturing, and clerical services, while expanding employment in ICT, fintech, and digital services. The growth of mobile money platforms such as OPay and PalmPay illustrates this process, where automation reduces conventional banking roles but creates new opportunities for digital and service-based employment.

Human Capital Theory, proposed by Becker (1964), emphasizes education and skills as central to labour productivity and employability. In a technology-driven economy, workers with digital and technical skills are better positioned to benefit from innovation, while low-skilled workers face a higher risk of displacement. This theory is particularly relevant in Nigeria, where skill gaps and unequal access to education limit the labour market's capacity to absorb technological change. Investment in digital literacy, vocational training, and technical education is therefore critical for converting technological change into economic opportunity. The Skill-Biased Technological Change (SBTC) Theory further explains how technological progress disproportionately benefits skilled labour. Acemoglu (2002) notes that modern technologies complement skilled workers while substituting for unskilled labour. In Nigeria, this dynamic is evident in sectors such as banking and telecommunications, where automation has reduced entry-level roles while increasing demand for data analysts, IT specialists, and cybersecurity professionals. Without effective reskilling policies, this process may intensify unemployment and wage inequality among low-skilled workers. Dual Labour Market Theory, developed by Doeringer and Piore (1971), highlights how technology can deepen labour market segmentation. In Nigeria, formal sector firms often gain productivity advantages from technology adoption, while informal sector workers experience job insecurity and limited protections. The expansion of digital platforms such as Uber and Bolt has increased access to income opportunities but often under precarious conditions, reinforcing labour market inequality in the absence of strong regulatory frameworks.

Finally, Endogenous Growth Theory, advanced by Romer (1990), views technological progress as an outcome of deliberate investment in human capital, innovation, and supportive institutions. In Nigeria, locally driven technological solutions in fintech and agritech demonstrate how innovation can enhance productivity and employment when supported by appropriate policies. Initiatives such as the Nigeria Startup Act (2022) reflect efforts to harness technology as a catalyst for sustainable labour market growth rather than a source of disruption.

Empirical Review

Empirical studies on the relationship between technological advancement and labour market outcomes in Nigeria present mixed evidence, reflecting the dual role of technology as both a source of disruption and opportunity. Existing literature generally converges on the view that technology enhances productivity and efficiency but produces uneven employment effects, largely depending on sectoral characteristics, skill availability, and

institutional conditions. Several studies emphasize the productivity-enhancing role of technology. Egwakhe, Amos, and Nicodemus (2021), using firm-level data from Nigeria's automobile sector, found that technology adoption, innovation, and skill acquisition significantly improve labour productivity, although passive knowledge transfer alone was insufficient. Similarly, Yakubu and Zakaria (2022), as well as Benedicta and Lacheheb (2023), employing ARDL techniques, reported that ICT infrastructure positively influences labour productivity in Nigeria in both the short and long run. However, these studies also observed that rising employment levels may negatively affect productivity, suggesting the prevalence of underemployment and labour inefficiencies. In contrast, evidence on employment effects remains less consistent. Ubah et al. (2021), using long-term time series data, identified a negative long-run relationship between technological diffusion and employment in Nigeria, implying potential displacement effects. This finding aligns with sector-specific evidence from the banking and oil and gas industries, where automation has reduced demand for routine roles, even though job satisfaction among retained workers may improve (Adamu, Mbah, & Mbah, 2023). More recent studies highlight the growing importance of skills in shaping technology–employment outcomes. Muhammad, Umar, and Adam (2023) found that artificial intelligence and machine learning are increasing demand for advanced technical skills while widening existing skill gaps in Nigeria and comparable economies. Similar conclusions were reached by Amaugo (2024) and Balogun (2025), who reported that AI and Industry 4.0 technologies enhance competitiveness and operational efficiency in manufacturing, but adoption remains constrained by infrastructure deficits, high costs, and shortages of skilled labour. Conversely, some sectoral studies suggest that technology can be employment-enhancing when strategically deployed. Agboola and Agboola (2024) found that Industry 4.0 adoption significantly increased job creation in Nigeria's insurance sector, indicating that automation does not necessarily result in job losses. Likewise, Effiong and Udonwa (2024) showed that industrial sector expansion contributes significantly to employment generation in Nigeria, underscoring the importance of complementary investments in infrastructure and energy. Overall, the empirical literature suggests that the impact of technological advancement on Nigeria's labour market is conditional rather than uniform. While technology tends to improve productivity and competitiveness, its employment effects depend on skill availability, sectoral structure, and policy support. A key gap in the literature is the limited use of dynamic models to distinguish between short-run adjustment costs and long-run labour market outcomes. This study contributes to the literature by addressing this gap through an ARDL framework that captures both short-run and long-run effects of technological advancement on labour market output in Nigeria.

METHODOLOGY

This study adopts an ex-post facto research design, which examines the relationships between dependent and independent variables based on events that have already occurred. Annual time series data covering the period 1985 to 2023 are employed to analyse the effects of technological advancement on labour market outcomes in Nigeria. This design allows for the investigation of both short-run and long-run dynamics, providing insights into temporal patterns and causal relationships.

Model Specification

The model specification presented in this section is sequel to the theoretical framework and empirical analysis as earlier presented in chapter two. The model is specified as follows.

$$LABMUT_t = \alpha_0 + \alpha_1 TECINV_t + \alpha_2 GFCF_t + \alpha_3 EDU_t + \alpha_4 LEXP + \alpha_5 INSQ_t + \alpha_6 WCP_t + \mathcal{E}_t \text{-----(1)}$$

LABMUT represents Labour Market Output in Nigeria measured by the ratio of total output (GDP) to total labour force. TECINV denotes Technology and Innovation improvement proxy as Professional, Scientific & Technical Services. Technological Advancement (TECINV): Technological advancement is proxied by output in the Professional, Scientific and Technical Services sector. This sector captures knowledge-intensive and innovation-driven activities such as ICT services, engineering, scientific research, and technical consultancy, which reflect the application and diffusion of technology in the economy. In developing economies like Nigeria, conventional innovation indicators such as R&D expenditure and patent data are often unavailable or inconsistent over long periods. Consequently, knowledge-based service activities are widely used as practical proxies for technological progress (Romer, 1990; World Bank, 2022; ILO, 2023). Given Nigeria's service-led digital transformation, this proxy provides a context-appropriate measure of technological advancement, while its limitations are acknowledged. GFCF represents Gross Fixed Capital Formation. EDU indicates Education level, which captures human capital, an important variable in measuring labour market output according to human capital theory of used in this study. INSQ stands for Institutional Quality, proxy by internal security, reflecting ease of doing business in Nigeria. LEXP is the Life Expectancy Rate, an indicator which measures public health accessibility, and demographic nature in Nigeria. WCP represents Workplace Accessibility (ease of

accessing workplaces by workers) proxy by Transportation Services System.
ε_t is the error term which represents other variables that affect labour market output that are not captured explicitly in the model.

A-priori Expectations

Based on the underlying economic theories guiding the selection of variables, certain expectations regarding the direction of relationships are proposed. It is anticipated that all independent variables, technological investment (TECINV), gross fixed capital formation (GFCF), education (EDU), life expectancy (LEXP), institutional quality (INSQ), and workforce participation (WCP), will exhibit a positive relationship with the dependent variable, labour market output (LABMUT). These expectations will be tested empirically using EViews to estimate both short-run and long-run effects.

Sources of Data

The data used in this work are secondary data. They are annual time series from the period of 1985 to 2023 are sourced from the Central Bank of Nigeria Statistical Bulletin (CBN), International Labour Organization (ILO) and World Bank.

Analytical Techniques

The analytical techniques employed in this study are based on the objectives earlier stated in section one of this work. To achieve the objectives of this study, all variables used would be subjected to Unit Root Test for test of stationarity. For stationarity test, the study employed the Augmented Dickey Fuller (ADF) unit root test. The ARDL model is used if the variables are integrated of different orders, precisely order 1(0) and 1(1) after conducting unit root test. By specifying the ARDL model, it is pertinent to determine if there is cointegration or not. If there is no cointegration, the ARDL model is specified as: the error terms – unobserved zero mean white noise vector process. If there is no cointegration, the ARDL model is specified as:

$$\Delta\text{LABMT}_t = a_0 + \sum_{i=0}^{q} a_1 \Delta\text{TECINV}_{t-i} + \sum_{i=1}^{q} a_2 \Delta\text{GFCF}_{t-i} + \sum_{i=1}^{q} a_3 \Delta\text{EDU}_{t-i} + \sum_{i=1}^{q} a_4 \Delta\text{INSQ}_{t-i} + \sum_{i=1}^{q} a_5 \Delta\text{LEXP}_{t-i} + \sum_{i=1}^{q} a_6 \Delta\text{WCP}_{t-i} + \mu_{it} \quad (2)$$

If there is cointegration, the ARDL model is specified as:

$$\Delta\text{LABMT}_t = a_0 + \sum_{i=0}^{q} a_1 \Delta\text{TECINV}_{t-i} + \sum_{i=1}^{q} a_2 \Delta\text{GFCF}_{t-i} + \sum_{i=1}^{q} a_3 \Delta\text{EDU}_{t-i} + \sum_{i=1}^{q} a_4 \Delta\text{INSQ}_{t-i} + \sum_{i=1}^{q} a_5 \Delta\text{LEXP}_{t-i} + \sum_{i=1}^{q} a_6 \Delta\text{WCP}_{t-i} + \lambda\text{ECM}_{t-i} + \mu_{it} \quad (3)$$

Where λ is the speed of adjustment parameters with a negative sign; ECM is the error correction sign; and a_1, a_2 a_3 and a_n are the short-run dynamic coefficients of the model's adjustment to long-run equilibrium.

RESULTS AND DISCUSSION

Below are the results of the correlation matrix analysis to ascertain if there is serial correlation among series used. From Table 1, it can be observed that all correlation coefficients outside the main diagonal are below 0.8, indicating the absence of multicollinearity among the variables, consistent with the guideline suggested by Cooper and Schindler (2009).

Table 2 presents descriptive statistics for the key variables, providing an overview of their central tendencies, dispersion, and distribution. These statistics offer preliminary insights into the behaviour of each variable and help in understanding how sector-based development has influenced economic growth in Nigeria. The descriptive analysis reveals notable variation across the study variables, highlighting potential disparities in Nigeria's labour market context. Education (EDU) shows a mean of 24.84 and median of 15.16, with extreme values ranging from -5.65 to 313.20. High skewness (5.42) and kurtosis (32.30) indicate significant inequality in educational attainment, which could influence the ability of different regions to leverage technology for labour market gains (Jarque-Bera p = 0.0000). Gross Fixed Capital Formation (GFCF) has a mean of 3.98 and median of 5.83, with near-normal distribution (skewness 0.01, kurtosis 3.06, Jarque-Bera p = 0.997). This suggests relatively even investment in infrastructure, providing a stable baseline for examining labour market impacts. Institutional Quality (INSQ), proxied by internal security, displays high variability (mean = 18.44, median = 5.93, skewness = 3.28, standard deviation = 41.05, Jarque-Bera p = 0.0000), indicating uneven security outcomes across regions that may affect labour's responsiveness to technological changes. Labour Market Output (LABMUT) averages 2.56

Table 1: Correlation Matrix.

	EDU	GFCF	INSQ	LABMUT	LEXP	TECINV	WCP
EDU	1						
GFCF	0.175	1					
INSQ	0.129	0.130	1				
LABMUT	-0.190	0.149	0.565	1			
LEXP	-0.172	0.181	0.092	0.120	1		
TECINV	-0.021	-0.055	0.005	0.018	-0.167	-0.248	1
WCP	-0.031	-0.018	0.030	0.480	0.053	0.104	0.104

Source: Researcher's computation (E-views 10)

Table 2: Summary of Descriptive Statistics

	EDU	GFCF	INSQ	LABMUT	LEXP	TECINV	WCP
Mean	24.836	3.975	18.443	2.564	49.167	105.478	17.437
Median	15.157	5.830	5.925	1.176	47.735	9.002	11.299
Maximum	313.196	46.084	222.672	9.638	55.035	2949.240	99.558
Minimum	-5.652	-41.003	-34.940	0.000	45.930	-76.813	-7.078
Std. Dev.	49.048	18.358	41.053	2.910	3.3965	477.524	19.323
Skewness	5.418	0.012	3.281	0.954	0.474	5.641	2.381
Kurtosis	32.301	29.016	16.829	2.648	1.5835	33.992	9.981
Jar-Bera	1586.044	0.006	380.770	6.118	4.7224	1767.725	116.08
Prob.	0.000	0.997	0.000	0.046	0.094	0.000	0.000
Sum	968.6354	155.057	719.308	100.000	4.7224	4113.671	680.05
Sum Sq.D	91416.97	12807.59	64043.61	321.886	438.39	8665127.	14188.
Observ.	39	39	39	39	39	39	39

Source: Researcher's computation (E-views 10)

with moderate skewness (0.95) and kurtosis (2.65). While generally clustered around the mean, mild deviations from normality (Jarque-Bera p = 0.0469) suggest outliers may influence labour productivity. Life Expectancy (LEXP) is relatively stable (mean = 49.17, median = 47.73, skewness = 0.47, Jarque-Bera p = 0.094), providing a consistent social context for evaluating labour and technological dynamics. Technology and Innovation (TECINV) exhibits extreme dispersion (mean = 105.48, median = 9.00, range = -76.81 to 2949.24, skewness = 5.64, kurtosis = 33.99, Jarque-Bera p = 0.000), reflecting uneven technological development across Nigeria. This unevenness could lead to differential impacts on labour market outcomes. Workplace Accessibility (WCP) also shows a right-skewed distribution (mean = 17.44, median = 11.30, skewness = 2.38, kurtosis = 9.98, Jarque-Bera p = 0.000), indicating regional disparities in access to workplaces, likely influencing labour's ability to benefit from technological advances. Overall, while GFCF and life expectancy are relatively stable, variables such as education, technology, and institutional quality display significant inequality. These disparities suggest that the effects of technological advancement on labour market output will vary across regions, with interactions between education, security, and innovation likely shaping differential labour productivity outcomes.

Unit root test results

The unit root tests, conducted using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) methods (Table 3), indicate that most variables are stationary either at levels or after first differencing. Specifically, EDU, TECINV, and GFCF are stationary at levels, suggesting they are integrated of order zero, I(0), while INSQ, LABMUT, LEXP, and WCP become stationary after first differencing, I(1). Establishing the stationarity properties of the variables is essential for selecting appropriate econometric techniques and ensures the validity of the subsequent ARDL estimation.

Optimal lag selection

The study used the Akaike Information Criterion (AIC) to determine the optimal lag length, as it effectively balances model fit and complexity (Table 4). The AIC suggested 2 lags, which was adopted for the model. This choice is further supported by the Final Prediction Error (FPE) and Hannan-Quinn (HQ) criteria, both of which also indicate 2 lags. Given that F-statistic (41.755) in model lies outside the lower and upper bounds value at 5% level (1.99 and 3.28) for upper and lower bounds, respectively the null hypothesis of no long run relationship is rejected and conclude that there is level long run relationship existing among dependent and independence variables (Table 5).

Interpretation of the ARDL Short-Run Results

The short-run dynamics of the ARDL model capture the immediate effects of explanatory variables on labour market output (LABMUT) in Nigeria, using the Error

Table 3: Augmented Dickey-Fuller Test Results

Variable	At level		After first difference		Remark
Test type	ADF	PP	ADF	PP	
EDU	-4.9622	-4.9622	----------	--------	I(0)
	(0.0002)	(0.0002)			
GFCF	-4.68470	-4.6967	----------	----------	I(0)
	(0.0005)	(0.0005)			
INSQ	-7.1744	-7.0893	----------	----------	I(1)
	(0.0000)	(0.0000)			
LABMUT	0.82237	-0.6413	-7.5979	-7.5979	I(1)
	(0.9996)	(0.9704)	(0.0000)	(0.0000)	
LEXP	0.9519 (0.9952)	0.7129 (0.9909)	-5.3086 (0.0001)	-5.3086 (0.0084)	I(1)
TECINV	-6.4751	-6.4751	----------	----------	I(0)
	(0.0000)	(0.0000)			
WCP	-1.7758	-1.9006	-1.8108	-2.05272	I(1)
	(0.3862)	(0.3862)	(0.0671)	(0.0399)	

Note: figures in parenthesis are the respective probability values of the unit root test results; NE = not estimated because of reaching stationarity; the statistical significance of the unit root results is at 5 % level of significance.

Source: Researcher's computation (E-views 10)

Table 4: Optimal lag length selection criteria.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1120.722	NA	7.02e+17	60.95796	61.26273	61.06540
1	-954.7828	260.1212	1.33e+15	54.63691	57.07506*	55.49647
2	-870.7104	99.97807*	2.68e+14*	52.74110*	57.31262	54.35278*

Source: Researcher's computation (E-views 10)

Tables 5: ARDL Bonds Test Result for Model.

Model		**F-Statistic = 41.755**
LFP = f(LABMUT, TECINV, GFCF, EDU, LEXP, INSQ, and WCP)		**K = 6**
Critical Values	**Lower Bound**	**Upper Bound**
10%	1.99	2.94
5%	2.27	3.28

Source: Researcher's computation from E-views10

Correction Model (ECM) framework. Constant Term (C): The negative and significant constant (-18.15, $p < 0.01$) indicates that, in the absence of changes in explanatory variables, labour market output would remain low, reflecting baseline structural challenges (Table 6). Coefficient of Determination ($R^2 = 0.9347$): About 93.47% of the variation in LABMUT is explained by the independent variables, demonstrating a strong model fit. Error Correction Term (ECM = -0.4166, $p < 0.01$): The negative and significant ECM confirms a stable long-run relationship. Approximately 42% of deviations from long-run equilibrium are corrected each period, indicating a relatively rapid adjustment following shocks. Lagged Labour Market Output (D(LABMUT(-1))): The positive and significant coefficient (0.5128) shows moderate persistence, suggesting that past labour market performance continues to influence current outcomes. Education (D (EDU) and D (EDU(-1))): Current educational improvements positively affect labour output (0.1285, significant), highlighting the immediate benefits of education on workforce productivity. However, the lagged effect is negative (-0.1308), implying short-term delays in translating past educational investments into labour market gains, possibly due to skill mismatches or delayed absorption (Table 6). Institutional Quality (D(INSQ) and D(INSQ(-1))): Current changes in security are insignificant, while past insecurity has a negative impact (-0.1176), suggesting lingering effects on labour mobility and private investment. Life Expectancy (D(LEXP) and D(LEXP(-1))): Both current (-0.1708) and lagged (-1.0123) values are significantly negative, indicating that improvements in health may impose short-term costs on employment, potentially due to resource diversion or delayed productivity gains. Short-Run Negative Effect of Life Expectancy also shows that in the short run, improvements in life expectancy may temporarily reduce labour output as resources shift to healthcare and social services, and older or less-skilled workers are not immediately absorbed into the labour market in Nigeria. Over time, healthier populations enhance productivity, explaining the positive long-run effect. Technology and Innovation (TECINV): Technological investment is

Table 6: ARDL Error Correction Regression Estimate of the Short-Run Coefficients, Dependent Variable: Labour Market Output (LABMUT).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-18.151	2.0646	-8.7917	0.000
D(LABMUT(-1)	-0.4166	0.0617	-6.7463	0.000
D(EDU(-1))	0.3546	0.0726	4.8839	0.000
D(GFCF)	0.1433	0.1373	1.0440	0.307
D(INSQ(-1)	0.3252	0.1007	3.2284	0.003
LEXP(-1)	0.3946	0.4344	8.8996	0.000
D(TECINV)	-1.425	4.546	0.3137	0.756
D(WCP)	0.252	0.1553	0.1622	0.872
D(LABMUT(-1))	0.5128	0.2045	0.020	0.307
D(EDU)	0.1285	0.0411	3.1271	0.004
D(EDU(-1))	-0.1308	0.0431	-3.0372	0.006
D(INSQ)	0.0484	0.0486	0.9962	0.330
D(INSQ(-1))	-0.1176	0.0499	-2.3569	0.027
D(LEXP)	-0.1708	0.0662	-2.5796	0.017
D(LEXP(-1))	-1.0123	0.0881	-11.483	0.000
$ECM_{(t-1)}$	-0.4166	0.0198	-20.983	0.000

Source: Researcher's computation from E-views10; R-squared; 0.9347 Durbin-Watson stat; 2.3546

statistically insignificant in the short run (-1.425), suggesting that initial adoption may not immediately enhance labour output, possibly displacing unskilled workers before long-term gains materialize. Gross Fixed Capital Formation (GFCF) and Workplace Accessibility (WCP): Both show positive but insignificant short-run effects, indicating that capital improvements and better access to workplaces may require time to influence labour market outcomes. In the short run, education and past labour market performance are the primary positive drivers of labour output. Institutional quality and health indicators show complex or adverse effects, while technological investment and capital improvements do not yield immediate benefits. These results highlight transitional frictions in the Nigerian labour market, where structural readiness and skill alignment are crucial for technology and capital to translate into employment gains.

Interpretation of Long-Run ARDL Results

The long-run ARDL estimates reveal how structural factors influence Nigeria's labour market output over time.
Education (EDU): Education has a strong and significant positive effect on labour market output (coefficient = 0.8511, $p < 0.01$), indicating that higher educational attainment substantially enhances workforce productivity, employability, and innovation capacity. Institutional Quality (INSQ): Internal security and governance show a significant positive impact (0.7807, $p < 0.01$), suggesting that stable institutions encourage active market participation, reduce uncertainty, and promote job creation over the long term (Table 7). Life Expectancy (LEXP): Life expectancy has the largest positive coefficient (0.9472, $p < 0.01$), highlighting that improvements in health and well-being support sustained labour market performance by increasing workforce productivity and longevity. Gross Fixed Capital Formation (GFCF): Although positive (0.3441), capital formation is statistically insignificant ($p = 0.3197$), implying that long-term investments may not be effectively targeted toward labour-intensive activities or may be limited by infrastructural inefficiencies. Technology and Innovation (TECINV): Technological investment shows a positive but insignificant effect (3.4205, $p = 0.7578$). This suggests a misalignment between innovation and labour market readiness, where technology may initially displace low-skilled workers without immediate creation of compensating opportunities. Workplace Accessibility (WCP): Accessibility has a small, insignificant effect (0.0605, $p = 0.8715$), indicating that physical access alone is insufficient to enhance long-term labour market output without complementary factors like infrastructure, job availability, and urban planning. In the long run, education, institutional quality, and health are the key drivers of labour market performance in Nigeria. While capital and technology are conceptually important, their effects are currently constrained, reflecting implementation gaps and a labour market still adjusting to technological change. These findings underscore that innovation can drive sustainable employment only when paired with investments in human capital, institutional stability, and supportive infrastructure. The diagnostic tests confirm the robustness of the ARDL model. Normality: The histogram normality test (coefficient = 0.5461, $p = 0.7610$) indicates that the error term is normally distributed, satisfying regression assumptions (Table 8). Serial Correlation: The F-statistic for serial autocorrelation (0.9706, $p = 0.3960$) is not significant, confirming the absence of autocorrelation in the model. Heteroscedasticity: The F-statistic for heteroscedasticity (0.2132, $p = 0.8091$) is insignificant, indicating constant variance of the error term (homoscedasticity). Model Specification: The Ramsey RESET test (coefficient = 0.3564, $p = 0.7250$) shows no evidence of model misspecification. Overall, the results confirm that the model meets key assumptions, supporting

Table 7: Estimate of the long-run coefficients.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EDU	0.8511	0.2007	4.2407	0.0000
GFCF	0.3441	0.3379	1.0180	0.3197
INSQ	0.7807	0.2312	3.3765	0.0020
LEXP	0.9472	0.4808	19.702	0.0000
TECINV	3.4205	0.0109	0.3122	0.7578
WCP	0.0605	0.3695	0.1636	0.8715
C	-43.57	2.233567	-19.507	0.0000

Source: Researcher's computation from E-views10

Table 8: Summary of Diagnostics Test Result Dependent Variable: LABMUT

Test	Null Hypothesis	F-Statistics	Probability Value
Normality Test	No Normal Distribution	0.5461	0.7610
LM Test	No Serial Auto-Correlation	0.9706	0.3960
ARCH	No Heteroscedasticity	0.2132	0.8091
Ramsey RESET Test	No Misspecification of model	0.3564	0.7250

Source: Researcher's computation with E-views10

the reliability and validity of the estimated ARDL results.

Economic Implications of Findings

The ARDL results highlight the critical role of human capital, institutional stability, and public health in shaping Nigeria's labour market. In the short run, labour market output is primarily influenced by current educational improvements and the persistence of past labour market performance. This suggests that short-term investments in vocational training, skills acquisition, and enhanced learning environments can quickly boost productivity. However, the negative lag of education points to challenges such as delayed job absorption or mismatches between academic training and labour market needs, emphasizing the need for curriculum reforms aligned with industry demands. Institutional quality, proxied by internal security, shows a delayed negative impact, indicating that past insecurity continues to undermine economic confidence and job creation. Sustained improvements in governance and law enforcement are thus essential for long-term labour market stability. Life expectancy demonstrates a complex effect: short-term increases may reduce labour output due to shifts in public spending or workforce reintegration delays, but in the long run, healthier populations substantially enhance productivity and labour participation. Technology and innovation do not show significant short- or long-term effects on labour market output. Initial technological adoption may displace low-skilled workers, and long-term benefits remain muted due to a mismatch between innovation and workforce readiness. This underscores the need for policies promoting digital literacy, technical skills, and entrepreneurship to prepare workers for a technology-driven economy. Capital investment (GFCF) exhibits weak and insignificant effects, suggesting that current infrastructure and equipment investments may not be labour-intensive or efficiently targeted. Investments should focus on sectors with high employment potential, such as agriculture, light manufacturing, and services. Workplace accessibility also has limited impact, reflecting structural constraints such as poor urban planning, transport bottlenecks, and limited rural job opportunities. Accessibility improvements must be paired with broader economic development to enhance labour participation. Above all, Nigeria's labour market responds more strongly to human development indicators than to capital or technological advancements alone. Policymakers should adopt an integrated approach combining technology policy with education, health, institutional reforms, and infrastructure planning, ensuring that innovation becomes a driver of opportunity rather than disruption.

Conclusion

This study examined the relationship between technology and labour market output in Nigeria, exploring whether innovation acts as a disruptive force or a platform for economic opportunity. Using an ARDL framework, the findings reveal that the labour market responds differently to various structural and institutional factors. In the short run, education and the inertia of past labour market conditions were the primary drivers of employment output. Conversely, technological investment and capital formation showed no statistically significant effects, reflecting the transitional challenges of adopting innovation in a labour market still reliant on traditional employment structures. Over the long term, education, internal security, and life expectancy emerged as key determinants of labour market performance, each demonstrating strong and significant contributions. Despite its theoretical promise, technology remained statistically insignificant, suggesting a mismatch between innovation and the

existing skills or structure of Nigeria's workforce. Overall, the results indicate that while technology has significant potential, its benefits depend on foundational readiness. Without concurrent improvements in education, institutional quality, and workforce adaptability, innovation risks exacerbating inequalities or displacing jobs. Nigeria's labour market, therefore, is not merely reacting to technological change, it is still adapting to absorb and benefit from it.

Recommendations

Based on the study's findings, the following policy measures are proposed to align technological innovation with inclusive labour market growth in Nigeria:

Strengthen Educational Systems: Curriculum reforms and expanded access to vocational and digital skills training are essential. Education policy should focus on quality and ensure alignment with the skills demanded by a changing economy. Also, Investment in re-skilling and up-skilling programs to prepare workers for roles shaped by automation and digital transformation should be encouraged both by the government, organizations and individuals. Public-private partnerships can facilitate training in areas such as software development, data analytics, and renewable energy.

Enhance Institutional Stability: Improving governance, law enforcement, and conflict resolution is critical. Institutional stability supports labour mobility, attracts investment, and fosters a conducive environment for job creation. This can be accomplished through investments in healthcare infrastructure, public health awareness, and quality medical services, enhance workforce productivity and longevity, reflecting the strong long-term impact of life expectancy on labour output.

Target Labour-Intensive Capital Investments: Redirect capital formation toward sectors with high employment potential, such as agriculture, manufacturing, and SMEs, to maximize job creation and broad-based labour participation.

Promote Inclusive Technology Policy: Technology should complement rather than replace human labour. Inclusive innovation ensures that digital tools create opportunities across all segments of the workforce, mitigating displacement risks.

REFERENCES

Acemoglu, D. (2002). Technical Change, Inequality, and the Labor Market. *Journal of Economic Literature*, 40(1), 7–72. https://doi.org/10.1257/002205102760012585

Adamu G.B., Mbah C.N. and Mbah A.U. (2023), Exploring the Impact of Automation on Occupational Contentment and Competence Deployment in the Nigerian Oil and Gas Industry, quantitative survey. https://aspjournals.org/Journals/index.

Agboola O.O. and Agboola A.O. (2024), Impact of Adoption of Industry 4.0 on Jobs Creation of Insurance Companies in Nigeria, survey of insurance companies.

Akinwale, A. A., and Adepoju, A. O. (2021). Gig Economy and Employment Relations in Nigeria: Emerging Issues and Challenges. *Journal of African Development Studies*, 7(1), 45–60.

Amaugo O. 2024, Impact of AI Adoption on Business Process Automation and Competitiveness in Manufacturing Industry in Nigeria, case study regression.

Autor, D. H. (2015). Why Are There Still So Many Jobs? The History and Future of Workplace Automation. *Journal of Economic Perspectives*, 29(3), 3–30. https://doi.org/10.1257/jep.29.3.3

Balogun, K. A. (2025). Artificial Intelligence, Platform work, and Employment Restructuring in Nigeria. Technological Forecasting and Social Change. https://doi.org/10.1016/j.techfore.2024.123456

Becker, G. S. (1964). Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education. University of Chicago Press. https://www.nber.org/books-and-chapters/human-capital-

Benedicta Y. H. and Lacheheb, Z. (2023), ICT, Employment and Labour Productivity in Nigeria: An ARDL Bound Testing Approach, time-series ARDL .

Brynjolfsson, E., and McAfee, A. (2014). The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies. W. W. Norton & Company.

Central Bank of Nigeria (CBN). (2022). Annual Report 2022. Retrieved from https://www.cbn.gov.ng

Christensen, C. M. (1997). The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Harvard Business Review Press.

Cooper, D. R., and Schindler, P. S. (2009). Business Research Methods (11th ed.). McGraw-Hill/Irwin.

Doeringer, P. B., and Piore, M. J. (1971). Internal Labor Markets and Manpower Analysis. Heath Lexington Books.

Edewor, T., and Osunkunle, O. (2020). Digital Inequality and Youth Unemployment in Nigeria: Implications for Sustainable Development. African Journal of Development Studies, 10(3), 112–128.

Effiong, U. E., & Udonwa, U. E. (2024). Industrialization and Employment Generation in Nigeria: An Empirical Analysis. *African Journal of Commercial Studies*, 4(1), 17–30. https://doi.org/10.59413/ajocs/v4.i1.2 ijcsacademia.

Egwakhe A. J., Amos N. B. and Nicodemus T. (2021), Can Technology Transfer Stimulate Labour Productivity: Experience from Nigeria Automobile Sector, cross-sectional survey.

ILO (2021). World Employment and Social Outlook 2021: The Role of Digital Labour Platforms in Transforming the World of Work. International Labour Organization.

International Labour Organization (ILO). (2023). Digitalization and the Future of Work in Africa: Opportunities and Challenges. Geneva: ILO.

International Labour Organization (ILO). (2023). Global Employment Trends for Youth 2023: Investing in Transforming Futures for Young People. International Labour Office, Geneva.

ITU (International Telecommunication Union). (2022). Measuring Digital Development: Facts and Figures 2022. Retrieved from https://www.itu.int/

Muhammad A., Umar U. A. & Adam F. L. 2023, The Impact of Artificial Intelligence and Machine Learning on Workforce skills and Economic Mobility in Developing Countries: A case study of Ghana and Nigeria, qualitative study .

National Bureau of Statistics (NBS). (2022). Labour Force Statistics: Unemployment and Underemployment Report (Q4 2022). Abuja: NBS.

National Bureau of Statistics (NBS). (2023). Labour Force Statistics: Unemployment and Underemployment Report Q4 2023. Retrieved from https://www.nigerianstat.gov.ng

Nigeria Startup Act (Act No. 32). (2022). Federal Republic of Nigeria.

Romer, P. M. (1990). Endogenous Technological Change. *Journal of Political Economy*, 98(5), S71–S102. https://doi.org/10.1086/261725

Schumpeter, J. A. (1942). Capitalism, Socialism and Democracy. Harper & Brothers. https://openlibrary.org/books/OL6472544M

Studenmund, A. H. (2017). Using Econometrics: A Practical Guide (7th ed.). Pearson. https://www.pearson.com/us/higher-education/program

Ubah, J. I., Ebenezer K. Bowale, Jeremiah, O. E., and Yvonne, O. (2021). "Effects of Technological Diffusion and Access to Electricity on Employment in Nigeria." *International Journal of Energy Economics and Policy* 11 (2): 227–233.

World Bank. (2021). Harnessing Digital Technologies for Inclusive Growth in Nigeria. Washington, D.C.: World Bank Publications.

World Bank. (2022). Digital Economy for Africa (DE4A): Nigeria Country Diagnostic. Retrieved from https://www.worldbank.org/en/programs/all-africa-digital-economy