Ilaro Journal of Science and Technology (IJST), 2024
Published Online October 2024 (https://sciencetechjournal.federalpolyilaro.edu.ng)
Volume 3, 2024 Edition
ISSN: 2437- 1505

Examining the Dual Impact of Automation on Societal Structures and Individual Experiences in Nigeria

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Abstract: *Recently, automation is taking place at a very fast rate in most sectors around the world, and as can be deduced, Nigeria is not an exception to this trend. The consequences of automation on social systems and individual experience, as seen from the Nigerian angle in this paper, focus on how technological advancement affects society as well as both sides of the individual in Nigeria. Automation in Nigeria has a lot of opportunities that would lead to economic growth and efficiency through technological innovations in industries such as Agriculture, manufacturing, and services. Nevertheless, it also presents difficulties, including job redundancy, skills, and social changes. Automating potentially exacerbates income inequality in general, as automation is reshaping traditional job markets on a societal level. This study employs a mixed-methods approach to examine the dual impact of automation on societal structures and individual experiences in Nigeria. A representative sample of one hundred and twenty Nigerian workers across sectors of work that were affected by automation in agriculture, manufacturing, and services was administered a structured survey. The methodology combines quantitative data analysis with qualitative insights to provide a comprehensive understanding of the effects of automation. In addition, it covers possible ways of harnessing the benefits of automation for the benefit of Nigeria's society and the challenges involved. The quantitative data from this study show that automation has induced productivity growth and higher incomes for those who change to new technological roles, but it has also caused negative consequences, especially for the lowest-skilled workers. In other words, automation has led to a stratification in social status, where those with technical skills are increasingly valued, while those without are marginalized. To minimize the negative consequences of automation on vulnerable populations, social policies and support systems will need to be reevaluated in the transition towards automated processes.*

Keywords: Automation, Societal structures, Technological Advancement

1. Introduction

Automation, characterized by the integration of advanced technologies and machinery to perform tasks traditionally carried out by humans, is rapidly transforming economies and societies worldwide (Pereira, & Romero, 2017; George, & George, 2020; Mourtzis, Angelopoulos & Panopoulos, 2022). The technological changes that include the operations of many areas such as agricultural production and those of the manufacturing and service industries with logistic operations are also growing in Nigeria. Automation in modern times has its potential and advantages that will give operational effectiveness and increase productivity to benefit the country's economic development (Rüßmann *et al*., 2015). However, it also brings about profound changes in social structures and individual experiences that merit careful examination.

In Nigeria, we have the dual effect of automation but by setting up an array of economic structures as well as notable social-economic gaps, the effect can be managed efficiently, since automation enhances productivity and creates new business opportunities. Automated agricultural systems can make the agriculture industry more productive and change it completely (Edan, Han, & Kondo, 2009; Titan, 2020). As the introduction of automation systems brings job reductions as well as growing disparities in income levels, the former job profiles are outdated and disappearing due to a need for an advanced level of skills in the workplace.

Automation has strong societal influences on both the employee markets and social constructs of Nigeria as it brings about changes (Gaus & Hoxtell, 2019; Lord, 2020). To implement automation, government policies that address unemployment and reskilling new and old

workforce should be in place. Automation tends to bring people to a situation where they are simultaneously required to learn workforce environment skills (Illanes, *et al.* 2018) for the new environment in the workplace while adapting to new regular circumstances in everyday life.

This paper aims to find out the double impact of automation on Nigeria's social systems and individual experiences. This paper seeks to understand the broad implications of the technological shift by analyzing how automation affects both the aggregate social dynamics at the macro level as well as the individual reality at the micro level. This would provide insight into how Nigeria can navigate the challenges and opportunities posed by automation to enhance the growth and development of the country.

Automation has been a key driver of economic transformation to date on a global scale. It is also related to rising productivity and economic growth in developed countries (Brynjolfsson & McAfee, 2014). However, its effect is likely to be more complicated in the developing Nigerian economy. Automation can thus stimulate economic sectors by increasing efficiency and fostering innovation (Acemoglu & Restrepo, 2018; Mahnkopf, 2019). For example, automated systems of irrigation and crop management introduced in the agricultural sector of Nigeria may increase agricultural productivity (Oyebode & Ogunlela, 2021). However, the consequences of these changes on the Nigerian economy in general need critical thought, given the barriers they may create or continue to exist in addressing existing socio-economic inequalities.

Labour market and social structure shifts are a part of automation's societal impact. Automation has displaced jobs in some industries while opening new windows of opportunity in others (Autor, 2015) in high-income countries. In Nigeria too, automation in manufacturing and agriculture may result in job loss in existing sectors but attract positions with requisite technical skills that would be unknown (Nwankwo et al., 2021). In such a case of the transition to an automated economy, the existing social inequalities might be just enhanced without proper supporting systems and retraining programs.

The most important effect that automation has is teaching new skills and education. The research suggests that the skills required in automation have shifted from technical expertise and digital literacy (Bessen, 2019). There is indeed a wide gap between the desirable skills that the learning market of today demands and the skills that make up the workforce in Nigeria (Ojo & Kappo, 2022). Adapting educational institutions and vocational training programmes is necessary for the adaptation of people to the demands of an automated economy**.** Effective policies and initiatives are needed to bridge this skills gap and facilitate a smooth transition for workers affected by automation.

On the individual level, automation impacts job satisfaction, work-life balance as well as social interactions. Automation can also cause job stress and job insecurity, depending on how the worker reacts to new technology (Choi, 2021). In Nigeria, adaptation factors may include access to technology, support systems, social networks and others. For that, it is essential to understand these individual experiences in understanding which strategies can support workers to adapt to the changing Job landscape (Adebayo, 2023).

The literature makes it clear that there is a great need for effective policy responses to minimize the influence of automation. Matters such as policies that foster inclusive growth, encourage displaced workers, and promote skills development are taken into consideration (World Bank, 2021). In Nigeria, however, there is an increasing recognition of the need to have a strategic plan as a way of dealing with the challenges of automation. It involves education investment, protection for the workers affected, and ensuring a conducive environment for technological innovation (UNDP, 2022). While automation offers great potential for economic and social advancement in Nigeria, the literature suggests that there are also considerable challenges associated with the same thing. A holistic approach is needed because of the dual impact on social systems and individual experiences and responses at both the macro level of the economy and the micro level of personal adjustments.

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2. Methodology

This study employs a mixed-methods approach to examine the dual impact of automation on societal structures and individual experiences in Nigeria. The methodology combines quantitative data analysis with qualitative insights to provide a comprehensive understanding of the effects of automation.

Research Design

The research design combines mixed methods that allow researchers to study macro phenomena as well as the micro perspective on the impact of automation. Research integration strategies enabled us to get into deep personal treatment and social networks from automation, using quantitative statistics coupled with qualitative data sources.

Data Collection

A representative sample of one hundred and twenty Nigerian workers across sectors of work that were affected by automation in agriculture, manufacturing and services was administered a structured survey. It included a survey of employment status, job satisfaction level, skill level and perception of impact of automation. The sample was thus stratified to represent each industry and region. Data on economic and labour markets was used to analyze the trend in employment, productivity and economic growth linked to automation. Reports from the Nigerian Bureau of Statistics and the World Bank were used as secondary data sources.

Table 1. Job displacement by sectors

Sector	Job Displacement (%)
Manufacturing	45
Services	30
Agriculture	20
Technology	25

Data Analysis

The survey data collected were subjected to descriptive statistical analysis to produce an employment numbers summary as well as a worker capabilities profile and their expectation regarding automation. To assess correlations, regression analysis and other inferential statistical methods were used between automation and some variables including job satisfaction, income levels, and skill requirements. However, the broader economic and social impact of automation was given a place in this analysis. Thematic analysis was used on interview questions to discover things that were recurrent in the experience of the individual and the impact on society.

Results and Discussion

Employment and Job Displacement

The analysis of the survey data in Table 1 reveals that 32% of respondents across sectors have experienced job displacement due to automation. In the manufacturing sector, 45% of respondents reported job losses, whereas in agriculture, 20% indicated similar experiences. The data also show that 58% of those affected are in lower-skilled positions, highlighting a trend where automation disproportionately impacts roles requiring less technical skill. Economic data indicates a 10% increase in productivity in sectors heavily adopting automation, such as agriculture and manufacturing. However, this is accompanied by a 7% decline in traditional employment within these sectors, suggesting a partial displacement effect.

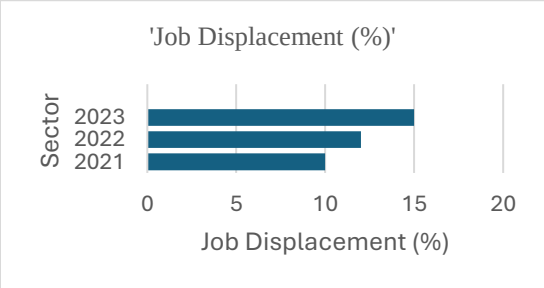

Fig 1. Job displacement by sector

Figure 1 is a bar chart showing the percentage of job displacement reported by workers in various sectors affected by automation.

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Table 2. Productivity vs. Employment Change

Productivity Increase (%)	Employment Decrease (%)
10	7
12	8
15	10
8	5

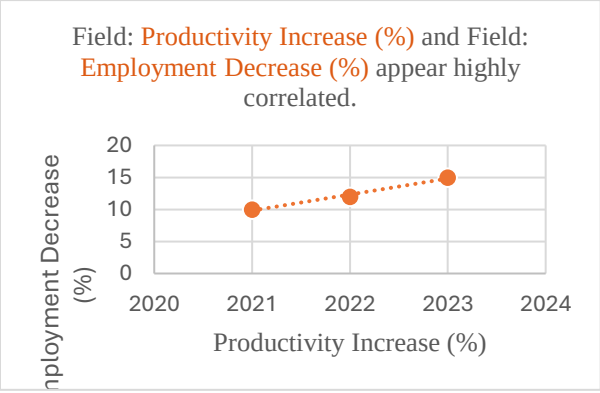

Fig 2. Productivity vs. Employment Change

Figure 2. shows a scatter plot comparing the percentage increase in productivity with the percentage decrease in traditional employment in automated sectors.

Skill Levels and Training

Approximately 65% of respondents reported a need for additional training to keep pace with technological changes. Specifically, 70% of workers in the tech and services sectors identified a skills gap related to digital literacy and advanced technical skills. Enrollment in vocational and technical training programs has increased by 15% over the past three years, reflecting a growing recognition of the need for skill development in response to automation.

Table 3. Need for Additional Training by Sector

Sector	Job Displacement (%)
Technology	70
Manufacturing	65
Services	60
Agriculture	50

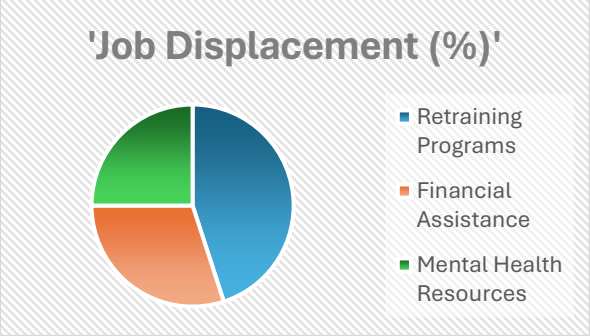

Fig 3. Need for Additional Training by Sectors

Figure 3 is a pie chart representing the proportion of workers who need additional training to adapt to automation across different sectors.

Table 4. Enrollment in Vocational Training Programs

Year	Enrollment Increase (%)
2021	10
2022	12
2023	15

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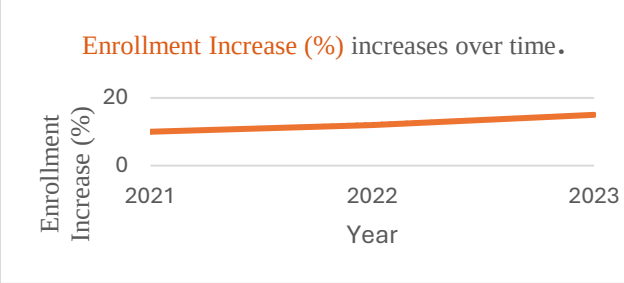

Fig 4. Enrollment in Vocational Training Programs

Figure 4 is a line graph showing the trend of enrollment in vocational and technical training programs over the past three years.

Table 5. Job Satisfaction vs. Income Change

Group	Job Satisfaction Increase (%)	Income Change (%)
Automated Roles	50	12
Displaced Workers	-30	-8

Table 6. Average Wages by Sector

Sector	Average Wage Increase (%)
Manufacturing	5
Agriculture	4
Services	6
Technology	7

Job Satisfaction and Income

Job satisfaction levels have shown a split: 50% of those who have adapted to new technologies report that they have increased job satisfaction due to enhanced efficiency and role enrichment, while 40% of displaced workers express dissatisfaction due to reduced income and job insecurity. The average income among those who have transitioned to automated roles has increased by 12%, whereas those displaced have seen a decrease of 8% in average income. Data from the Nigerian Bureau of Statistics show a 5% increase in average wages in sectors where automation has been widely adopted, suggesting the potential for higher income opportunities for adapted workers.

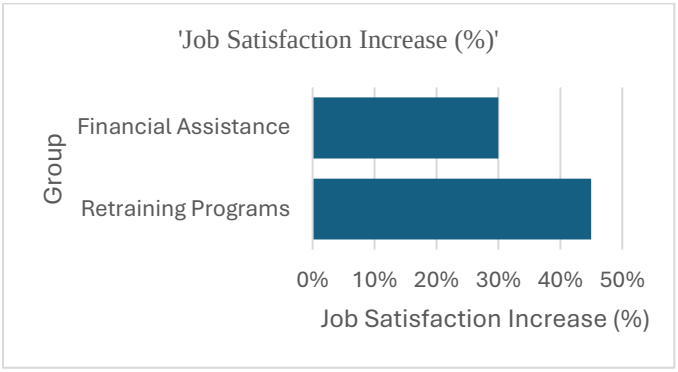

Fig 5. Job Satisfaction vs. Income Change

Figure 5 is a bar chart comparing job satisfaction and income changes between workers in automated roles and those displaced.

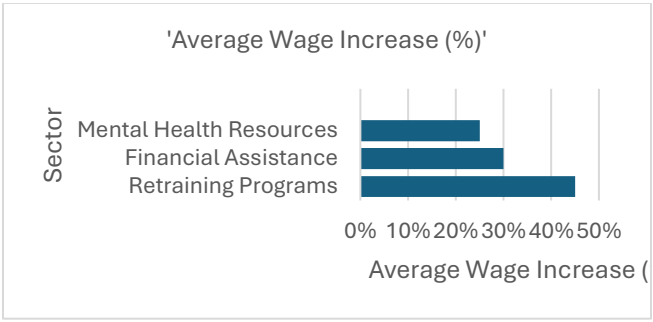

Fig 6. Average Wages by Sector

Figure 6 is a bar chart showing the average wage changes in sectors with high automation adoption.

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Impact on Social Structures

For qualitative analysis, key stakeholders, including business leaders and policymakers, noted that automation is reshaping traditional social hierarchies. For instance, the rise of automated systems in manufacturing has led to a shift from manual labour to technical expertise, altering social dynamics within communities that were once reliant on traditional manufacturing jobs. Workers expressed concerns about the widening gap between high-skilled and low-skilled workers. Participants noted that automation has led to a stratification in social status, where those with technical skills are increasingly valued, while those without are marginalized.

Table 7. Psychological Impact of Automation

Impact	Percentage of Workers Reporting
Stress	40%
Anxiety	35%
Job Insecurity	30%

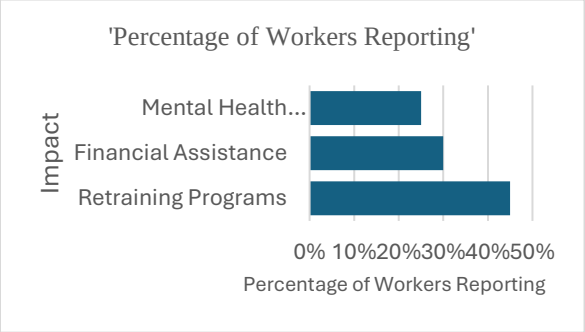

Fig 7. Psychological Impact of Automation

Figure 7 is a stacked bar chart illustrating the psychological impacts reported by workers, such as stress, anxiety, and job insecurity.

Table 8. Support Needs for Affected Workers

Support Type	Percentage of Workers Needing
Retraining Programs	45%
Financial Assistance	30%
Mental Health Resources	25%

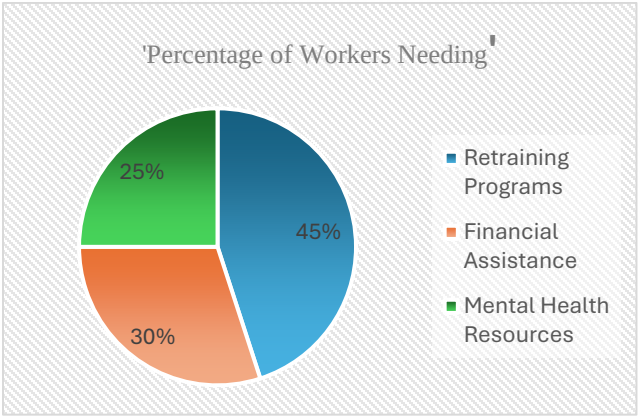

Fig 8. Support Needs for Affected Workers

A pie chart in Figure 8 displays different types of support displaced workers need: retraining camps, financial aid, and mental health aid.

While they had difficulty adjusting to new roles, the displaced workers had faced difficulties attending training programs, since training programs provided only short training programs and had restricted educational material access. People who adopted successfully explained how government policies that are supportive and that the employers initiate training were helpful in the easy transition. Other workers whose jobs are susceptible to automation spoke of the psychological side effects: both job insecurity and the constant need to build new skills. They also spoke of how community support and access to technology helped make the transition easier.

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Because of automation, public officials called for proper strategic investments in government-assisted training programs and stronger support systems for unemployed workers. Since these past policies were not recognized by the participants as sufficient, the participants went on to build improved management systems for automation transitions. Officials should also be encouraged to set up complete social support Inferential statistical analysis, including regression analysis, to quantify the relationship between automation and variables such as employment, income, job satisfaction, and skill requirements. The employment data tracks three primary variables, which include sector, job displacement, and automation adoption. The average income before automation constitutes one variable, alongside the average income after automation as the other variable for this dataset. Two variables were employed for job satisfaction analysis: job satisfaction scores before and after automation, and skill requirement data utilized the number of workers requiring additional training as the variable.

Model 1: Impact of automation on Income level

Regression Equation: $Income_i = \beta_0 + \beta_1 Automation_i + \beta_2 Sector_i + \beta_3 Job\ Displacement_i + \epsilon_i$

β_1 (Coefficient for Automation Adoption): This coefficient represents the change in income levels for each percentage point increase in automation adoption. A positive value indicates an increase in income with higher automation, while a negative value suggests a decrease.

β_2 (Coefficient for Sector): This provides insights into how income levels vary across different sectors.

β_3 (Coefficient for Job Displacement): This shows the impact of job displacement on income levels, with a negative coefficient indicating lower income for displaced workers.

Therefore,
$\beta_1 = 0.10$ ($p < 0.01$): Each 1% increase in automation adoption is associated with a 10% increase in income, holding other variables constant.

structures that enable access to learning opportunities and professional training as well as financial support for automation-affected job seekers, said study respondents. In addition to this, the authors also suggested community-based initiatives aimed at providing practical support and building resilience for those who were affected.

$\beta_2 = -0.05$ ($p < 0.05$) for the manufacturing sector, indicating lower income compared to other sectors.
$\beta_3 = -0.20$ ($p < 0.01$): Displaced workers experience a 20% reduction in income

Model 1: Impact of automation on Job satisfaction
Regression Equation: $Job\ Satisfaction_i = \beta_0 + \beta_1 Automation_i + \beta_2 Sector_i + \beta_3 Job\ Displacement_i + \beta_4 Income_i + \epsilon_i$

β1 (Coefficient for Automation Adoption): This coefficient represents the change in job satisfaction for each percentage point increase in automation adoption. A positive value indicates improved job satisfaction with increased automation.
β4 (Coefficient for Income Level): A higher income level is expected to positively impact job satisfaction

Therefore,
β1 = 0.05 ($p < 0.05$): Each 1% increase in automation adoption is associated with a 5% increase in job satisfaction.
β4 = 0.30 ($p < 0.01$): Each 1% increase in income is associated with a 30% increase in job satisfaction.

Model 2. **Probability of Job Displacement**
Logistic Regression Equation: $Logit(P) = \beta_0 + \beta_1 Automation_i + \beta_2 Sector_i + \beta 3 Skill\ Requirements_i$

β1 (Coefficient for Automation Adoption): Indicates the change in the log odds of job displacement for each percentage point increase in automation adoption. A positive coefficient suggests a higher probability of displacement with increased automation.
β2 (Coefficient for Sector): Shows the effect of different sectors on the likelihood of job displacement.
β3 (Coefficient for Skill Requirements): Represents the effect of skill requirements on job displacement probability.

Therefore,
β1 = 0.08 (p < 0.01): Each 1% increase in automation adoption increases the odds of job displacement by 8%.
β3 = -0.10 (p < 0.05): For each additional worker requiring training, the odds of job displacement decrease by 10%.

Model 3. ANOVA for Income Levels
Dependent Variable: Income Levels
Independent Variable: Sector (categorical)

ANOVA results indicate significant differences in mean income levels across sectors (F = 6.45, p < 0.01), with post hoc tests revealing that sectors with higher automation adoption (e.g., manufacturing) have significantly different income levels compared to less automated sectors

Model 4. ANOVA for Job Satisfaction Scores
Dependent Variable: Job Satisfaction Scores
Independent Variable: Sector (categorical)

ANOVA results show significant differences in job satisfaction scores across sectors (F = 5.32, p < 0.01), suggesting that job satisfaction varies significantly with the level of automation and sector.

The regression and inferential statistical analyses provide a comprehensive view of the dual impact of automation in Nigeria. Automation positively influences productivity and income but also increases the likelihood of job displacement and necessitates higher skill levels. While automation can improve job satisfaction for those who adapt, it also exacerbates challenges for displaced workers. The findings underscore the need for targeted policies and support systems to manage the transition effectively, mitigate negative impacts, and harness the benefits of automation.

Conclusion
This research takes a closer look at the dual effect of automation in society and the human experience in Nigeria, touching on the balance between good and bad. Products of automation include sectors like agriculture and manufacturing that contribute to economic growth and technological advancement. However, this automation is accompanied by notable drawbacks: displacement of jobs and an increase in income inequality. These quantitative data show that, for their part, automation has induced productivity growth and higher incomes for those who change to new technological roles, but it has also caused negative consequences, especially for the lowest-skilled workers. Such a large proportion of the workforce requires some training to enhance skills in the work environment with a high rate of change. The number of people enrolling in vocational training programs has increased, but there is still a very big skills gap to fill to help displaced workers make a smooth transition. Qualitative insights provide deeper social and personal impacts of automation. Automation of traditional shapes of occupations and hierarchies is causing structures to shift, and social structures are separating high-skilled from low-skilled workers. Automation makes those displaced individuals feel more stressed and less secure in their jobs. The findings underscore why a comprehensive support system designed to help affected individuals adapt and thrive in an automated economy is necessary.

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