# Energy Infrastructure, Capacity Utilization and Manufacturing Sector Performance in ECOWAS Countries

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***Abstract-*** Most developing countries (ECOWAS Countries inclusive) are faced with an underdeveloped manufacturing sector, and this has continued to hinder economic growth. Their main objective has been to achieve and sustain viable manufacturing sector performance. To get this accomplished, emphasis has been on enhancing infrastructural development and capacity utilization. Previous research efforts have centred on country effects of infrastructural development, capacity utilization and manufacturing sector performance. Some other studies examined the economic growth effects of infrastructural development. This study differentiates itself by examining the nexus between energy infrastructures, capacity utilization and manufacturing sector performance in the ECOWAS region, using the GMM estimation technique on ECOWAS countries' data covering 2000-2021. The variables of the model included manufacturing sector performance, energy infrastructure, average manufacturing capacity utilization; financial sector development and foreign direct investment. The findings are indicative of the fact that energy infrastructure (proxy with percentage of the population with access to electricity), average manufacturing capacity utilization and foreign direct investment have a significant and positive relationship with manufacturing sector performance (proxy with manufacturing value added) in ECOWAS countries. Financial sector development has a positive but insignificant effect on manufacturing sector performance in the region during the period under review. The finding again brings to the fore the impact of adequate investment in infrastructures (especially energy infrastructures) on manufacturing sector performance in the ECOWAS region.

**Keywords:** Energy Infrastructure, Capacity Utilization, Manufacturing Sector Performance.

## I. Introduction

Sustainable productivity and economic performance are the goal of developing countries, including ECOWAS countries inclusive. Pivotal to achieving this objective is the manufacturing sector, which is seen as an engine of growth in the economy (Alliance for a Green Revolution in Africa, 2017). Comprising 15 member countries, the ECOWAS region is rich in natural resources and economic potential. The region's performance in terms of manufacturing output has consistently lagged behind global standards, primarily due to the deplorable condition of its energy infrastructure and suboptimal capacity utilization. According to the International Energy Agency (IEA), about 600 million people, or nearly half of the West African population, lack access to reliable electricity (IEA, 2022). This energy deficit inhibits industrial activities and constraints manufacturing growth, underscoring the urgent need for adequate investment and the need for comprehensive reforms in energy policies and infrastructural development. In 2021, the manufacturing sector contributed only 7.5% to regional GDP, far below the global average of 16% (World Bank, 2022). The lack of a stable and reliable energy supply has led to a situation where manufacturers operate at reduced capacity levels. Data from the African Development Bank (AfDB) reveals that capacity utilisation in the manufacturing industry in the region averages around 40%, significantly lower than the 80% threshold commonly considered optimal for profitability and growth (AfDB, 2023). This underutilization not only hinders job creation but also amplifies the region's economic vulnerability, especially in the face of global trade tensions and economic shocks. The consequences of inadequate energy infrastructure are profound and far-reaching. Manufacturers are forced to rely on expensive and inefficient alternatives, such as diesel generators, contributing to rising production costs. Consequently, firms struggle to compete in both local and international markets, which exacerbates poverty and stifles economic development across the ECOWAS region (African Union, 2021).

Within the context of the ECOWAS region, extant literature has focused more on the growth effects of access to energy infrastructure (electricity) and capacity utilization. For instance, Edeme et al (2020a) examined the nexus between infrastructural development, sustainable agricultural output and employment in ECOWAS countries using panel ARDL. Again, Edeme et al in (2020b), using the OLS methodology ascertained the effects of infrastructural development and capacity utilization on manufacturing value added in Nigeria. Ekeocha et al (2022), using the GMM, understudied the impact of public infrastructural development on economic performance in Africa. There seems to be a paucity of studies on the nexus between energy infrastructure, capacity utilization and manufacturing sector performance in ECOWAS countries using the GMM methodology. The GMM methodology adopted in this paper is most suitable because it is highly justified for panel data analysis, as it helps to eliminate endogeneity problem that is common with panel data. However, the paucity of studies on the subject matter is the major motivation for this study. A study of this nature is fundamental to the attainment of the Sustainable Development Goal (SDG) 9, which is anchored on building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation. The objective of the study, therefore, is to examine the effects of energy infrastructure and capacity utilization on the performance of the manufacturing sector in the ECOWAS region.

The study covered the period from 2000 to 2021. The choice of this period was borne out of data availability.

## II. LITERATURE

Several models and theories have been propounded by advancement theorists on the role of technological innovations (physical infrastructures) on productivity and growth. Some of these models include: Solow Growth Model, New Growth Model, etc. According to Bajo-Rubio (2000), the Solow growth model serves as a foundational growth model, and when augmented by the inclusion of other productive factors have been widely accepted to roughly explain cross-country differences in growth of per capita output. Infrastructural facilities, which are major capital projects of an economy, can be seen as capital (stock) as used in the Solow growth model. The New Growth theory, as propounded by Romer (1987), links output with factor inputs and technological innovations. According to this theory, the relationship between output considering factor inputs (capital) and technological innovation (infrastructures) is represented technically as

$$Y = f(C, T) \tag{2.1}$$

The conceptualization of Energy infrastructure encompasses the physical and organizational structures necessary for the production, transmission, distribution and consumption of energy. This includes power plants, transmission lines, substations, pipelines and renewable energy facilities. Robust energy infrastructure is vital for sustaining industrial productivity and economic growth, particularly in the manufacturing sector. A well-developed energy infrastructure ensures reliable access to energy resources, which is crucial for manufacturing operations that rely on a consistent power supply and affordable energy costs (International Energy Agency [IEA], 2021). This reliability can enhance operational efficiency, reduce production costs and improve competitiveness in global markets (Lee & Wang 2015). Conversely, inadequate infrastructure can lead to energy shortages, increased operational risks, and deter investments in manufacturing (World Bank, 2017). The performance of the manufacturing sector is significantly influenced by the state of energy infrastructure. An efficient energy supply supports advanced manufacturing processes that are energy-intensive, such as metal production and chemical manufacturing. Studies have shown that regions with higher energy infrastructure investments tend to experience more robust manufacturing output and growth (Mehta and Rajan 2017).

The developed and developing world alike count industrialization as a significant factor for growth and development, and the relationship between infrastructure and industrialization in any economy can be appreciated from the perspective of the distribution of resources, which include production inputs and outputs to and from industries. Thus, infrastructure and industrialization go hand in hand in the quest for sustainable development in any economy. The connection shared by infrastructure and manufacturing sector growth is undeniable. The multiplier effect expressed by industrial output thanks to infrastructure (for example, energy infrastructure) begs the need for increased access to electricity in any economy. Thus, the significance of energy infrastructure to industrialization in any economy cannot be emphasised. Its enhancement is relevant to the survival of the manufacturing sector.

Evidence abounds in extant literature as to the positive effects of energy infrastructure (electricity) on manufacturing sector performance - Ekeocha, Ogbuabor and Orji (2022); Nnyanzi, Kavuma, Sseruyange and Nanyiti (2022); Umofia, Orji and Worika (2018);

Edeme et al (2020b); Abokyi et al. (2018); Mesagan and Ezeji (2016).

In this current study, capacity refers to the maximum outflow which could be achieved from the installed capital stock in a given period. In other words, capacity is the amount of output a firm can produce, which depends upon the amount of labour, buildings, machinery and other forms of capital stocks it has available for the production process. Utilisation, on the other hand, means the actual amount of capacity which is being employed to get output in the same period (Afroz & Roy 1976). Hence, capacity utilisation in economic terms implies the ratio of actual output to the level of optimum output beyond which the average cost of production begins to rise. That is, capacity utilisation expresses output as a percentage of total potential output. Recent studies provide empirical evidence of the link between capacity utilization and manufacturing sector output. On the local scene, Simon-Oke et al (2010) examined the impact of manufacturing capacity utilization on industrial development using Nigerian data from 1976-2005. The result showed that a long-run positive relationship exists between manufacturing capacity utilization and industrial productivity. Adelopo et al (2022), in a study conducted on Nigerian manufacturing firms, discovered that higher capacity utilization positively influences output levels. The study established that firms with investment in technology and workforce efficiency experienced much higher capacity utilization rates, consequently boosting output. On the global level, Pindyck (2021) analyzed the effects of capacity constraints on manufacturing output across several industries in the US. Using panel data, the study found that firms operating at optimal capacity significantly improved their output levels, highlighting the threshold effects of capacity utilization. Zhai et al (2022) provided a comparative analysis of capacity utilization in emerging economies, arguing that factors such as access to finance, infrastructure quality, and market demand significantly influence the ability of firms to optimize capacity utilization.

From the literature review, there seems to be no studies linking infrastructure development, capacity utilization and manufacturing value added in the ECOWAS. This perceived gap in the literature is what this present study covers.

## III METHODOLOGY

The theoretical framework for this study is premised on the Cobb-Douglas production function. The framework posits that technological advancement in relation to other inputs, such as capital and labour determines output. Assuming that production output is determined by two factor inputs, labour and capital, the relationship can be represented technically in equation 1 as:

$$Q_t = A(K_t)^{\alpha}(L_t)^{\beta} \quad 1$$

Where Q denotes total output, K is capital input, L is labour input, and A is total factor productivity. α and β represent the respective output elasticity of capital and labour inputs. The functional form of the model is specified as:

$$MAF\_GDP_{it} = f(ELECTinfra, AMCU, FDI, FSD) \quad 2$$

In panel form, the above relationship can be stated linearly as follows;

$$In(MAF\_GDP_{it}) = \varphi_0 + \varphi_{1i}\ln(ELECTinfra_{it}) + \varphi_{2i}\ln(AMCU_{it}) + \varphi_{3i}\ln(FDI_{it}) + \varphi_{4i}\ln(FSD_{it}) + \varepsilon_{it} \quad 3$$

Where MAF_GDP denotes manufacturing sector value added (percentage of GDP), ELECTinfra denotes (access to electricity, a percentage of total population), AMCU denotes manufacturing sector capacity utilization (capacity utilization refers to the manufacturing and production capabilities that are being utilized by a nation or enterprise at any given time. It is the relationship between the output produced with the given resources and the potential output that can be produced when capacity is fully utilized. Capacity utilization rate is derived simply by dividing total capacity utilized over a specific period by total production capacity or optimal levels, multiplying by 100. FDI denotes foreign direct investment flows in the economy (foreign direct investment net inflows, as a percentage of GDP), FSD denotes combination of, access to, and efficiency of institutions to provide financial services at low cost. It is measured by four sub-indices – financial market diversity, market liquidity, market efficiency and the institutional environment. ε_it denotes the error term, φ1,φ2,φ3, φ4, and φ5, are respective coefficients to be estimated for the respective variables: subscript i (i = 1,...,N) denotes the individual countries, while t denotes time (t = 1,...,T).

This study adopted the system of General Method of Moments (GMM) estimation procedure for several reasons. Firstly, the system of GMM controls for endogeneity in the modeling exercise by correcting for simultaneity and or reverse causality through the procedure of instrumentation, and also accounting for omitted variables that are time invariant. Secondly, the system GMM can restrict instrument proliferation and can control for cross-sectional dependence as revealed by Tchamyou, Erreygers and Cassimon (2018) via the utilization of forward orthogonal deviations. For the estimation procedure for this study, some pre-estimation tests were conducted to ascertain its suitability. They include: panel unit root test, as well as the co-integration test, which were considered to ascertain the suitability of the variables, the data and the technique that was employed. The Levin, Lin and Chu unit root test and the Pedroni co integration test were adopted for this study. Data used for this study were sourced from World Development Indicators (WDI) published by the World Bank, and the Africa Infrastructure Development Index (AIDI) published by the African Development Bank. The variables for the study are defined in Table 1 below;

Table 1: Definition of Variables.

| Variable | Definition of Variables | Measurement | Sign | Source of Data |
|---|---|---|---|---|
| $MAF\_GDP$ | Manufacturing value added | Manufacturing value added (% of GDP). | Positive | WDI (2023) |
| $ELECTinfra$ | Electricity infrastructure | Access to electricity (% of population) | Positive | AIDI (2023) |
| $AMCU$ | Capacity Utilization | Capacity utilization rate is derived simply by dividing total capacity utilized over a specific period by total production capacity or optimal levels multiplying by 100. | Positive | WDI (2023) |
| $FDI$ | Foreign direct investment flows in the economy. | Foreign direct investment in the economy net inflows, as percentage of GDP | Positive | WDI (2023) |
| $FSD$ | Financial sector development | financial market diversity, market liquidity, market efficiency and the institutional environment | Positive | WDI (2023) |

Source: Authors' computation 2025

III FINDINGS

This section begins with the presentation of the results of the summary statistics. They are presented in Table 2 below.

Table 2: Descriptive Statistics of the Variables in the Model.

| | $MAF\_GDP$ | $ELECTinf$ | $AMCU$ | $FDI$ | $FSD$ |
|---|---|---|---|---|---|
| **Mean** | 8.975022 | 36.66574 | 3.12E+09 | 4.659888 | 15.91325 |
| **Median** | 8.680379 | 33.56191 | 7.10E+08 | 2.432675 | 12.96014 |
| **Maximum** | 21.49191 | 95.81540 | 6.44E+10 | 103.3374 | 73.90753 |
| **Minimum** | 1.532609 | 1.200000 | 16871300 | -2.544539 | 0.000000 |
| **Std. Dev.** | 4.360915 | 22.40961 | 8.74E+09 | 10.08475 | 12.94192 |
| **Skewness** | 0.369893 | 0.491900 | 4.560362 | 7.057377 | 2.205579 |
| **Kurtosis** | 2.741119 | 2.400330 | 24.92513 | 59.11301 | 8.670692 |
| **Jarque-Bera** | 8.446662 | 18.25266 | 7753.610 | 46033.57 | 709.7071 |
| **Probability** | 0.105597 | 0.000109 | 0.000000 | 0.000000 | 0.000000 |
| **Sum** | 2961.757 | 12099.69 | 1.03E+12 | 1537.763 | 5251.371 |
| **Sum Sq. Dev.** | 6256.782 | 165220.7 | 2.52E+22 | 33459.99 | 55105.33 |
| **Observations** | 332 | 332 | 332 | 332 | 332 |

Source: Authors' computation 2025

From Table 2 above, the manufacturing sector value added as a percentage of GDP shows a maximum value of 21.49% and a minimum value of 1.53%. On average, the manufacturing sector value added as a percentage of GDP was 8.97% for the fifteen ECOWAS countries during the period under review. Electricity has a maximum value of 95.81% and a minimum of 12%. On the whole, an average of about 36.33% of the total population of ECOWAS states has access to electricity during the period under review. This is a clear indication of the poor level of electricity infrastructure in ECOWAS states. The descriptive statistics further revealed that all the variables except

MAF_GDP were not normally distributed. This can be clearly seen from the coefficients of skewness and kurtosis, and also summarized by the Jarque – Bera statistics. From the probability value of the Jarque – Bera statistics, all the variables have values less than 0.05 except MAF_GDP with a probability value of 0.1055. This could have been caused by the heterogeneity issues normally associated with panel data analysis, as the constituting units are not normally homogenous. This justified the use of GMM technique which yield consistent results even in this circumstance provided the moment conditions are met.

Table 3a: Panel Unit Root Test for Variables in Level.

| Variables | Levin. Lin & Chu test | |
|---|---|---|
| | Statistic | P-value |
| $MAF\_GDP$ | -2.7086 | 0.0034* |
| $ELECTinfra$ | -0.9875 | 0.1617 |
| $AMCU$ | -0.6798 | 0.2483 |
| $FDI$ | -1.5808 | 0.0470* |
| $FSD$ | -1.2479 | 0.1066 |

Source: Authors' computation 2025*significant at 5%

The result in table 3a above shows unit root results for unit root test for variables in levels tested at 5% level of significance. From the table, all variables have unit root except

MAF_GDP, and FDI. This implies that these variables are integrated of order zero {I(0)}. Other variables that were not stationary in levels were tested for unit root at first order difference. The result is presented in table 3b below:

Table 3b: Panel Unit Root Test for Variables in First Order Difference

Table 3b: Panel Unit Root Test for Variables in First Order Difference

| Variables | Levin. Lin & Chu test | |
|---|---|---|
| | Statistic | P-value |
| DELECTinfra | -8.9450 | 0.0000* |
| DAMCU | -11.1533 | 0.0000* |
| DFSD | -6.1502 | 0.0000* |

Source: Authors' computation 2025 *significant at 5%

From Table 3b above, the entire variables are stationary at 5% level of significance thus implying that they are stationary in first order difference and hence, they are said to be integrated of order one {I(1)}. Since some variables were not stationary in level, there was need to conduct a co-integration test to ascertain if there exist a long run relationship among the variables. The result of the test is presented in the tables 4a and 4b below at 5% level of significance.

Table 4a: Pedroni Residual Co-integration Test (Within Dimension)

| | Statistics | Probability | Weighted Statistics | Probability |
|---|---|---|---|---|
| Panel v-statistics | 3.275761 | 0.0014 | -4.292277 | 0.0000 |
| Panel rho-Statistic | 3.910738 | 0.0001 | 4.705448 | 0.0000 |
| Panel PP-Statistic | -3.925181 | 0.0000 | -5.253938 | 0.0000 |
| Panel ADF-Statistic | -5.841543 | 0.0000 | -4.704920 | 0.0000 |

Source: Authors' computation, 2025

Table 4b: Pedroni Residual Co-integration Test (Between Dimensions)

| | Statistics | Probability |
|---|---|---|
| Group rho-Statistic | 3.643187 | 0.0001 |
| Group PP-Statistic | -6.707238 | 0.0000 |
| Group ADF-Statistic | -3.581836 | 0.0002 |

Source: Authors' computation, 2025

The Pedroni Residual Co-integration Test consists of seven test statistics. The first four statistics which are panel v-statistics, rho-statistics, Philips – Perron statistics and ADF statistics were computed using common autoregressive coefficient (within-dimension). The other three statistics employed individual autoregressive coefficient (between-dimension). The probability value of all the statistics were less than 0.05. This clearly shows that the variables are co-integrated. Given that the variables are co-integrated, it is safe to proceed to compute the short run and long-run coefficients of the variables using the GMM estimation technique.

The results from the GMM estimation are presented below in tables 5 and 8 below. The estimation result which shows the short run coefficients of variables is presented in the table below:

Table 5: Short Run Coefficients for Variables in the Manufacturing Sector Performance Model

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| $ELECTinfra$ | 0.006952 | 0.075420 | 0.092179 | 0.9266 |
| $AMCU$ | 6.88E-11 | 4.60E-11 | 1.495700 | 0.1358 |
| $FDI$ | 0.010719 | 0.022083 | 0.485386 | 0.6278 |
| $FSD$ | 0.092263 | 0.356582 | 0.258742 | 0.7960 |

* = significant at 1% **= significant at 5%

Source: Authors' computation, 2025

Table 6: J-Statistics

| | |
|---|---|
| J-statistic | 5.607329 |
| Prob(J-statistic) | 0.617762 |

Source: Authors computation, 2025

From the above result, the J-statistics has a coefficient of 5.6073 and a probability value of 0.6177. Since the probability value is greater than 0.05, the null hypothesis which states that the instruments are not valid is rejected. This implies that the instruments are valid and hence the results are consistent.

Also, in the result, all the variables met the sign expectation. However, the variables were not statistically significant even at 10% level. The existence of serial correlation among the residuals was tested using Arellano-Bond serial correlation test. The result is presented in the table below:

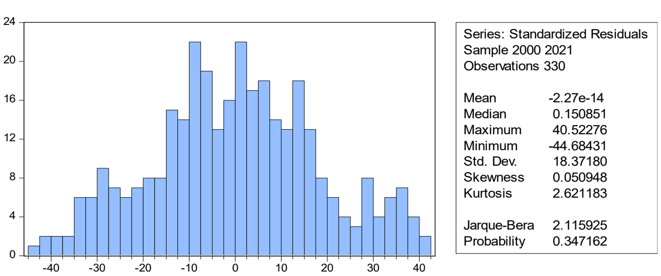
Table 7: Arellano-Bond Serial Correlation Test

| Test order | m-Statistic | rho | SE(rho) | Prob. |
|---|---|---|---|---|
| AR(1) | 0.345518 | 8.100506 | 23.444498 | 0.7297 |
| AR(2) | -0.279763 | -12.030644 | 43.003051 | 0.7797 |

Source: Author's computation, 2025

From the above result, the probability values of AR(1) and AR(2) are 0.7297 and 0.7797, respectively. Since these values are greater than 0.05, the null hypothesis of the existence of serial correlation is rejected against the alternative hypothesis. Hence, it can be concluded that there is no serial correlation among the error terms in the model. The normality of the residual distribution was tested using a histogram. The result is presented below:

Figure 1




Source: Authors' computation, 2025

From the result, the skewness coefficient was 0.0509 with kurtosis of 2.6211. This shows a normal distribution with a standard normal kurtosis. The overall test for normality is shown by the Jarque-Bera statistics. The Jarque-Bera has a coefficient of 2.1159 with a probability of 0.3471. Since the probability value is greater than 0.05, it can be concluded that the residual is normally distributed. Given the good performance of the diagnostic test, it is safe to proceed to compute the long run coefficient which is most useful for policy simulation. The coefficients of variables are shown in the table below:

Table 8: Long Run Coefficients for Variables in Manufacturing Sector Output Model

| Variables | Coefficients | t - Statistics | P - Value |
|---|---|---|---|
| $ELECTinfra$ | 0.0272 | 2.7124* | 0.0001 |
| $AMCU$ | 0.1463 | 2.0529** | 0.0467 |
| $FDI$ | 0.3686 | 2.9843* | 0.0000 |
| $FSD$ | 0.1241 | 1.8293*** | 0.0690 |

* = significant at 1% **= significant at 5% ***= significant at 10%

Source: Authors' computation, 2025

From the above result, all variables met sign expectations. Also, the impact of all the explanatory variables on the dependent variable was statistically significant. Electricity infrastructure (ELECTinfra) has a coefficient of 0.0272, and a t-ratio of 2.7124, and a corresponding p-value of 0.0001. This shows that an increase in electricity infrastructure by one unit will lead to an increase in manufacturing sector output by 0.0272%. This was statistically significant at 1% level.

Average Manufacturing Capacity utilization (AMCU) has a coefficient of 0.1463 and a t-ratio of 2.0529, and a corresponding p-value of 0.0467. This shows that an increase in capacity utilization by one unit will lead to an increase in manufacturing sector output by 0.1463%. This was statistically significant at 5% level.

Foreign Direct Investment (FDI) has a coefficient of 0.3686 and a t-ratio of 2.9843, and a corresponding p-value of 0.0000. This shows that an increase in FDIby one unit will lead to an increase in manufacturing sector output by 0.3686%. This was statistically significant at 1% level.

Financial sector development (FSD) has a coefficient of 0.1241 and a t-ratio of 1.8293, and a corresponding p-value of 0.0690. This shows that an increase in financial sector development by one unit will lead to an increase in manufacturing sector output by 0.1241%. This was statistically significant at 10% level.

Policy Implication of Finding

From the results of the descriptive statistics presented in Table 2, the condition of the manufacturing sector in the ECOWAS region, denoted by MAFGDP indicates a maximum value of 21.49% and, a minimum value of 1.53% and a standard deviation as low as 4.36%. This is a clear indication of the near absence of manufacturing activities in the sub-region. This near absence may account for the high importation of finished manufactured goods into the sub-region. The few manufacturing outfits within the sub-region are operating below installed capacity and as such, cannot be optimal. Access to electricity was used to proxy for energy infrastructure in the sub-region for this study. The results show that, on average, about 36.67% has access to electricity in the ECOWAS region. Electricity distribution in the ECOWAS region has been abysmally poor. The standard deviation of 22.41, among other things, indicates that the state of electricity in the region is similar across countries that make up the region. AMCU in the sub-region has a minimum value of 6.44E+10 and maximum value of 16871300 and a standard deviation of 8.74E+09, thus indicating manufacturing sector capacity utilization is poor and is the same for all the countries in the sub-region. The results for FDI show a minimum value of 2.544539, a maximum value of 103.3374 and a standard deviation of 10.08475, suggesting poor inflow of FDI in the sub-region. The performance of the financial sector denoted by FSD indicate a maximum value of 73.9%, minimum value of 0.0% and a standard deviation of 12.94%. The maximum value of 73.9% is indicative of the fact that the financial sector in the region is well developed. The level of financial sector development seems not to vary across the 15 member countries that make up the ECOWAS sub-region, as the result of the standard deviation suggests.

The short-run results indicate that all variables met sign expectations, exhibiting a positive relationship with manufacturing-sector performance, denoted by MAF_GDP, but were statistically insignificant at the 10% level. The result of the J-statistic indicates that instruments are valid since the probability value 0.0617 is greater than 0.05. This clearly implies that the results are consistent and that the model is suitable for the analysis. The results of the serial correlation test suggest that there is no correlation among the error terms in the model. The histogram of the residuals indicates that they are normally distributed.

In the long run, all the variables met sign expectations. The impact of the explanatory variables on MAF_GDP was statistically significant. Energy infrastructure denoted by ELECTinfra was shown to be a significant determinant of manufacturing sector performance. The results show a t-value of 2.7124 and a corresponding p-value of 0.0001, implying statistical significance at 1% level. An increase in access to electricity has a positive impact on the manufacturing sector's performance. Electricity is used to power machines used in production. This finding agrees with those of Ekeocha et al (2022) and Horvat et al (2020) but contrasts with those of Edeme et al (2020b). Electricity is vital for the growth and development of the manufacturing sector. In the same vein, Capacity UtilizationAMCU, Foreign Direct Investment FDI and Financial Sector Development FSD, from the results of this study, show that they are significant determinants of manufacturing sector performance denoted by MAF_GDP. Average manufacturing capacity utilization had a positive impact on manufacturing value added. The result shows that an increase in the utilization of manufacturing capacity has the tendency to improve manufacturing value added by 1.463%. An increase in financial inclusion and FDIflows in the manufacturing sector improves the performance of the sector by 3.6% and 1.2%, respectively. Edeme et al (2020b) confirm the positive effect of capacity utilization, capital expenditure by the government on manufacturing sector performance in Nigeria.

## IV CONCLUSION

Economic diversification, which has continued to gain prominence in the sub-region in recent history, is predicated upon the success of and contribution of the manufacturing sector to the growth dynamics, notwithstanding the huge infrastructural deficit and low capacity utilization in the sub-region. It is therefore imperative to understudy the nexus between energy infrastructure, capacity utilization and manufacturing sector performance. This paper focused on the ECOWAS region based on data covering the period 2000-2021. The major finding of this paper is that energy infrastructure and capacity utilization are major determinants of manufacturing sector performance in the ECOWAS region. The results of this study have some far-reaching implications. They include:

Manufacturing sector performance in the ECOWAS region depends on the level of infrastructural development. Energy infrastructures measured by access to electricity are vital for the optimum performance of the manufacturing sector in the ECOWAS region.

Average Manufacturing Capacity Utilization is imperative for manufacturing sector performance in the sub-region.

Foreign Direct Investment FDI and Financial Sector Development FSD have shown to be determinants of manufacturing sector performance as expected.

Consequent on the above, the paper makes the following recommendations:

Increased investment in infrastructural development (especially energy infrastructure) in the manufacturing sector, since evidence from this study supports the argument that energy infrastructure enhances manufacturing sector output.

FDI inflows have a positive impact on manufacturing sector performance, as evidence from this study suggests. Policy makers should endeavour to initiate policies that will enhance FDI inflows into the productive sectors of the economy. Adequate infrastructures are necessary in encouraging FDI inflows, Osabuohien et al (2020).

Financial inclusion and financial sector reforms should be pursued vigorously. The results of this study indicate that financial sector development is a significant determinant of manufacturing sector performance in the ECOWAS region.

The main limitation of this study is data-related. The study relied on data extracted from both the World Development Indicators (WDI) published by the World Bank and the Africa Infrastructure Development Index (AIDI) published by the African Development Bank. Likely errors from these backgrounds are possible, though the integrity of the sources minimizes such. High-frequency data, such as quarterly data, would have been most preferred as it will increase the number of observations and reduce the problem of data smoothing inherent in annual time series data. Regrettably, since quarterly data are not available for most of the variables, the study, therefore, employed annual time series data for the analysis.

For further research suggestions, other methodologies could be used to verify the findings of this study in an effort to better appreciate the recommendations thereof.

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