ASEAN Journal for Science Education

Journal homepage: https://ejournal.bumipublikasinusantara.id/index.php/ajsed

Quantitative Analysis of The Problems and Prospects of The Nigerian Industrial Sector in the 21st Century

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ABSTRACTS

The Industrial sector of Nigeria is facing a lot of challenges in the 21st century. This is despite the private sector loan, expenditure on health and education for the development of the sector and openness. The objective of this study is to examine the impact of insecurity and human capital expenditure on the performance of the industrial sector. Auto Regressive Distributed Lag (ARDL) and ECM approach were employed on annual time series data covering 1981-2020. The result shows that human development expenditure and insecurity have a negative effect on the performance of the sector in the short run while human development expenditure, loans to the private sector, and trade openness have a positive effect on the sector's performance in the short run. The study recommends that factors hindering the performance of the industrial sector should be properly addressed by the government and policymakers while factors improving the performance of the sector should be improved and protected to revive the performance of the sector.

ARTICLE INFO

Article History:
Submitted/Received 29 Sep 2022
First revised 28 Oct 2022
Accepted 05 Nov 2022
First available online 07 Nov 2022
Publication date 01 Mar 2023

Keyword:
Industrial sector performance,
Trade openness,
Expenditure and Insecurity.

1. INTRODUCTION

Industrial sector development is the backbone of every developed nation and the key determinant of growth and development. Studies have shown that emerging economies with competitive and well-developed industrial sectors flourish more rapidly as compared to other economies. Kniivilä (2007) narrated that better economic growth and reduced poverty levels exist in industrially developed economies like Korea, China and Indonesia. In contrast to this, poor economic conditions along with a poor industrial sector, political instability and insecurity are prevalent in the least developed economies. Developed countries have achieved their present position by developing their industrial sector. According to Samouel and Aram (2016) capital accumulation, economic diversification, unemployment reduction, technological transfers and sustainable development are the advantages of industrial growth and have been well documented in the literature.

The industrial sector is one of the major sectors of the economy because of the role it plays in the development and growth process of a nation. The sector can lead the economy in terms of employment creation, foreign earnings, export promotion and growth enhancement (Onakoya *et al.,* 2012). This sector is known to have created mass employment and linkages between other sectors in the economy which further creates a multiplier effect in the economy leading to sustainable growth.

The industrial sector further serves as an instrument of sustainable growth and development by increasing productive capacity, enhancing revenue, creating employment opportunities, ensuring effective income distribution, poverty reduction, and contributing to export and gross domestic product (Okoye *et al.,* 2016). Presently, this sector is not performing as expected in Nigeria compared to its counterpart in other parts of the world.

The Bank of Industry was established in 2000 to accelerate industrial development through the provision of a loan. National Economic Empowerment and Development Strategy (NEEDS) came up in 2004 to accelerate the pace of industrial development and increase value added at every stage of growth. In 2007 came the National Integrated industrial development (NIID). This was also followed by the Industrial Park Development Strategy (IPDS) in 2009 aimed at driving non-oil growth through the establishment of industries in areas where there are basic infrastructural facilities. The most recent is the medium-term Economic Recovery and Growth Plan (ERGP) introduced for 2017-2020. It was developed to restore economic growth through science and technology, and innovation and to build a knowledge-based economy (ERGP).

All these policies were directly or indirectly established to increase the performance of the industrial sector and they were accompanied by shortcomings and improper implementation before the introduction of a new one. Despite the policies by successive governments, industrial sector output recorded a dismal growth rate. From 1981 to 2015, the highest industrial value added is 22% in 1990 followed by 20% in 2003 and 14% in 2001. From 2009 to 2015, the value-added ranged from -2 to 8%. For a period of the remaining 13 years in 3 decades, negative value added was obtained. This shows that the sector is not performing as expected and not meeting the needs of the increasing population.

In terms of contribution to GDP, from 1981- 1991 data from WDI 2021 shows that the % contribution ranged from 27% to 45% which is the highest in a decade. It also ranges from 33% to 52% between 1991 to 2001. The contribution was better than in the previous decade. From 2001 to 2009 it ranged mostly from 36% to 41%. There was a drastic reduction in the contribution of the sector to GDP in 2010 to 25% and the contribution further ranged between 20% and 28% from 2010 to 2015. With the highest contribution in 2011. From 2016 to 2020, the contribution of the sector maintained a value of 22%. This shows that there is a problem

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

in the industrial sector and this affects the sustainable growth expected in an economy. Continuous fluctuation and decline in this sector value-added will prevent the country from attaining sustainable growth in the future.

Recently, the Nigerian economy is facing a serious insecurity issue which is seriously affecting investment and output in productive sectors of the economy. Many studies viewed insecurity as detrimental to the general well-being of people, destroying and relocating businesses, preventing national development and scaring foreign investors (Adegbami, 2013; Ewetan & Urhie, 2014). Furthermore, human capital development is very important in the development of a country's output. The nexus between education, health and growth are important, especially in African countries where the level of education, health and social well-being is far behind other regions of the world (Eggoh *et al.,* 2015). In Nigeria, most of the mining and construction companies employ skilled labour from abroad to head and manage the production process instead of training the available labour. This increases the cost of production and subsequently leads to an increase in the price of the output involved. The availability of unskilled labour without specialization leads to low-quality production and redundant labour further leading to low patronage of goods produced and an increase in import. That is why Abdul-karim and Ahmad (2012) stated that a well-developed human capital will enable individual labour to use capital and technology efficiently and effectively.

The low level of industrial sector performance has been blamed on many factors such as high exchange rate, importation of finished goods and interest rate. All these problems lead to the high cost of production and low production and an increase in the importation of finished goods. Importation has a negative multiplier effect on the industrial sector and the economy as a whole given the unemployment rate in the country. Furthermore, most empirical studies on industrial sector performance referred to the manufacturing sector as the industrial sector which is only a sub-sector in the sector, Sokunle *et al.* (2018), Kenny (2019), Farayibi and Onodje (2020).

Other studies in this area looked at the impact of trade liberalization on industrial performance. Dutta and Ahmed (2004), Adekunle and Akinwale (2019). Studies like Maryam and Bassey (2018) looked at the industrial sector and economic growth. The studies on policies, problems and prospects of the industrial sector are mostly qualitative; Iwuagwu (2009), Ekpo (2015), and Onakoya (2018) studies on loans to the industrial sector can be seen in the work of (Tawose, 2012) while those on Trade openness can be found in (Bakare & Fawehinmi, 2011; Adofu & Okwanya, 2017). This study, therefore, intends to look at the effect of insecurity and human capital development on industrial sector performance which was not used by the studies above. It will employ data from the industrial sector, not the manufacturing sub-sector and extend data to 2020.

2. METHODS

2.1. Theoretical framework and model

To establish the link between the industrial sector and factors that affect its performance, Romer (1986) endogenous growth model which is an extension of Solow (1956) and Swan (1956) model will be adopted. He expanded the concept of capital in the Solow and Swan model to include human capital. Investment in human capital such as education services, health services and skills training contribute to economic growth. This is because they will enable labour to use capital and technology efficiently. This is why Gebrehiwot (2016) stated that if the owner of the capital employs skilled and healthy workers, the productivity of the capital and the technology will improve.

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

This theory relates to the present study because all the factors that affect industrial performance whether labour, capital or technology deals with investment in human capital and intelligence. It is human capital that manipulates all factors and policies related to industrial growth. When this human capital is defective the whole sector becomes corrupt, insecure and not productive but when human capital is developed right policies will be introduced and implemented efficiently and this will improve productivity.

Since the endogenous growth model is an extension of Solow (1956) and Swan (1956) growth model, it will also start with a Cobb-Douglas production function written as equation (1):

$$Y = K_t^{\alpha} H_t^{\beta} (AL)_t^{1-\alpha-\beta} \mu \quad (1)$$

Transforming the equation into the log-linear form we have equations (2) and (3):

$$\ln Y_t = \alpha \ln k_t + \beta \quad (2)$$

$$\ln H_t + (1-\alpha-\beta) \ln (AL)_t + \mu \quad (3)$$

where Y represents the output level, K represents the physical capital level H represents the Human capital level, AL represents productivity augmented labour, and α and β are the elasticity of physical and human capital concerning output, respectively. μ is the error term.

This work will adapt and modify the industrial production model of Maroof *et al*. (2019) `which is presented as equation (4):

$$Y_g = f (CAO, EO, TO, GOV, DC, FDI, INF) + \_it \quad (4)$$

where Y_g represents the Industrial value-added, CAO represents the Capital account openness, EO represents the Equity openness, TO represents Trade openness, Gov represents the Governance, DC represents Domestic credit to the Private sector, FDI represents the Foreign direct investment and INF represents Inflation variables.

The model for this study is presented as equation (5):

$$LIND_t = \alpha_0 + \alpha_1 LHDI_t + \alpha_2 LLIND_t + \alpha_3 TOP_t + \alpha_4 FDI_t + \alpha_5 LLR_t + \alpha_6 INS_t + \alpha_7 LEXG_t + \varepsilon_t \quad (5)$$

where IND represents the industrial value added. LHDI represents the log of the human development Index, LLIND represents Credit to the private sector TOP represents the log of trade openness, FDI represents the foreign direct investment to industry, LEXG represents the log of the exchange rate, and LLR represents the lending rate, while INS represents the insecurity index.

2.2 Estimation technique

To empirically analyse the relationship and interactions among the study variables, the study employed the bound testing (Autoregressive Distributed Lag) and Error Correction Mechanism (ECM) approaches to examine the long-run and the short-run relationship between industrial sector performance and the independent variables. The ARDL model is presented in equation (6):

$$\Delta LIND_t = \alpha_0 + \sum \alpha_{1i} \Delta LIND_{t-1} + \sum \alpha_{2\,i} \Delta LLIND_{t-1} + \sum \alpha_{3\,i} \Delta LHDI_{t-1} + \sum \alpha_{4\,i} \Delta FDI_{t-1} + \sum \alpha_{5\,i} \Delta TOP_{t-1} + \sum \alpha_{6\,i} \Delta LLR_{t-1} + \sum \alpha_{7\,i} \Delta INS_{t-1} + \sum \alpha_{8\,i} \Delta LEXG_{t-1} + \delta_1 LIND_{t-1} + \delta_2 LLIND_{t-1} + \delta_3 LHDI_{t-1} + \delta_4 FDI_{t-1} + \delta_5 TOP_{t-1} + \delta_6 LLR_{t-1} + \delta_7 INS_{t-1} + \delta_8 LEXG_{t-1} + \varepsilon_t \quad (6)$$

First, the properties of the times series used in the study are investigated to determine their order of integration using Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests. Secondly, the paper investigates the existence of a cointegration relationship by adopting the approach developed by Pesaran *et al.* (2000) which has econometric advantages over other procedures such as (Engle & Granger 1987; Johansen & Juselius, 1990). Its advantages are: it can be used to test for long-run relationships regardless of the order of integration i.e. Variables are I(0), I(1) or a mixture of both. It can be applied to studies that have a small sample size. It employs only a single reduced-form equation. It allows the combination of different optimal lags for different variables.

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In the present study, the Wald test (F-test) was used to determine the existence of any long-run relationship among the chosen variables. Once the F-statistics is higher than the upper bound of the critical values then the null hypothesis of no cointegration is rejected. The long-run and short-run coefficients were estimated using the ARDL specification. Upon establishing a long-run relationship among the variables, a long-run model is estimated as presented in Equation (7):

$$LIND_t = \beta_0 + \sum\beta_{1i} LIND_{t-1} + \sum\beta_{2\,i}\, LLIND_{t-1} + \sum\beta_{3\,i}\, LHDI_{t-1} + \sum\beta_{4\,i}\, FDI_{t-1} + \sum\beta_{5\,i}\, TOP_{t-1} + \sum\beta_{6\,i}\, LLR_{t-1} + \sum\beta_{7\,i}\, INS_{t-1} + \sum\beta_{8\,i}\, LEXG_{t-1} + \varepsilon_{1t} \quad (7)$$

To obtain the short-run coefficients, an error correction model (ECM) is estimated and the ARDL specification of the ECM is represented in Equation (8):

$$\Delta LIND_t = \beta_0 + \sum\beta_{1i} \Delta LIND_{t-1} + \sum\beta_{2\,i}\, \Delta LLIND_{t-1} + \sum\beta_{3\,i}\, \Delta LHDI_{t-1} + \sum\beta_{4\,i}\, \Delta FDI_{t-1} + \sum\beta_{5\,i}\, \Delta TOP_{t-1} + \sum\beta_{6\,i}\, \Delta LLR_{t-1} + \sum\beta_{7\,i}\, \Delta INS_{t-1} + \sum\beta_{8\,i}\, \Delta LEXG_{t-1} + \phi_1 ECT_{t-1} + \varepsilon_{1t} \quad (8)$$

where ECT represents the error correction variable, and its coefficient lagged by one period (ϕ) is the speed of adjustment back to equilibrium when there is any deviation from the equilibrium in the short run.

The null and alternative hypotheses are stated as follow:

(i) H_0: $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, = 0$

(ii) H_1: $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \neq 0$

The likely expectation of the variables is stated as follows:

(i) $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5 > 0$,

(ii) $\beta_6, \beta_7, \beta_8 < 0$

3. RESULTS AND DISCUSSION

The unit root of the variables was first carried out and presented in **Table 1** using the Augmented Dickey-Fuller test and Philip Peron test. It shows that all variables are stationary at the first difference and hence I(1) except for industrial value added which is stationary at level.

After verifying the stationarity status of the variables the presence of a long-run relationship using bound testing statistics was carried out. The F-statistic of (6.96) is higher than (3.21) for the upper bound critical value at a 5% level of significance. This indicates that there is a cointegration relationship among the variables in the study. Thus the null hypothesis of no cointegration is rejected. This is presented in **Table 2**.

Table 1. Results of unit root tests.

	ADF Test		PP test		
Variables	**Level**	**First Difference**	**Level**	**First Difference**	**Stationarity Status**
LIND	-4.49**	_____	-4.46**	_____	I(0)
LLIND	-2.42	-5.66**	-2.36	-6.80**	I(1)
LHDI	-2.50	-7.04**	-2.44	-8.34	I(1)
FDI	-3.78**	-8.13	-3.69	-9.77	I(1)
TOP	-2.02	-4.29**	-2.02	-4.23**	I(1)
LLR	-3.12	-5.49**	-3.12	-9.02**	I(1)
INS	-2.64	-5.25**	-2.55	-6.14**	I(1)
LEXG	2.83	4.72	2.31	4.58	I(1)

Notes: Lag lengths are selected based on Akaike Information Criterion. The test statistics are compared with critical values from Mckinnon (1996); ***, ** and * denote significance at 1, 5, and 10% respectively. Critical value at level(5%) = 2.94 and at 1st difference (5%) = 3.56.

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

Table 2. Bound Test result.

Test Stataistics	**Value**	**K**
F-sta	**6.96**	**7**
CV	**Lower bound value**	**Upper bound value**
10%	1.92	2.89
5%	2.17	3.21
1%	2.73	3.90

Having determined a long-run relationship between the variables, the long-run parameters were estimated using the ARDL technique after selecting the lag length criterion and presented in **Table 3**. The optimal lag length of (2, 1, 2, 0, 1, 1, 2, 1) is suggested by Akaike Information Criterion (AIC).

Table 3. Result of the ARDL Model.

Panel A: Long-run Coefficients-Dependent variable is LIND				
Regressor	**Coefficient**	**Standard Error**	**T-Ratio**	**Prob**
C	20.65***	2.03	10.16	0.00
LLIND	0.07	0.06	1.19	0.25
LHDI	0.01	0.02	0.47	0.64
FDI	-0.04*	0.02	-1.89	0.08
TOP	0.26**	0.09	2.87	0.02
LLR	0.69**	0.27	2.52	0.02
INS	0.05***	0.02	3.38	0.00
EXG	-0.05	0.08	-0.73	0.48
Panel B: Short-run Coefficients-Dependent variable is ΔLIND				
Regressor	**Coefficient**	**Standard**	**T-Ratio**	**P-value**
Δ(LIND(-1))	0.17*	0.09	1.88	0.08
Δ(LLIND)	0.05*	0.03	2.03	0.06
Δ(FDI)	-0.00	0.00	1.04	0.32
Δ(FDI(-1))	0.02***	0.00	4.13	0.00
Δ(LHDI)	-0.05***	0.01	-3.61	0.00
Δ(TOP)	0.08***	0.02	4.31	0.00
Δ(LLR)	0.17***	0.03	5.51	0.00
Δ(INS)	0.00	0.00	0.58	0.57
Δ(INS(-1))	-0.02***	0.00	-4.93	0.00
Δ(EXG)	0.04***	0.02	2.11	0.05
ECM(-1)	-0.55***	0.05	-9.97	0.00
R^2 =	0.98, F-sta = 49.89(0.00), D. W =2.09			

Note: Computation using Eviews 9, L denotes logarithm. Δ is the first difference ***, ** and * denotes significance at 1%, 5% and 10% respectively.

From **Table 3**, the long-run result shows that all variables are correctly signed except FDI and LR in the long run. They are also statistically significant except for loans to the industrial sector and human development expenditure. Loans to the industrial sector, human development expenditure and insecurity have a positive but low impact on the sector's performance. One percent increase in LLIND, LHDI and INS lead to 0.07, 0.01, and 0.05% change in IND respectively. The low impact of LHDI could be due to inefficiency in the production process. This is in line with studies by (Devarajan *et al.,* 1996) Furthermore, the fact is that the money spent as expenditure on education and health is low and does not reach the target employers for training research and development and skills acquisition.

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

Loan to the sector is also low but positive implying that the higher the loan, in the long run, the higher the output of the industrial sector. it is low because the credit to the sector might not feasible and where available not properly invested. INS is also low but positive because the benefit of government expenditure to tackle insecurity will be felt in the long run. TOP also has a positive and significant effect on IND sector performance as a 1% change in TOP leads to a 0.26 percent change in the sector's performance. This is in line with the study by (Onakoya *et al.*, 2018). When the exchange rate changes by 1%, industrial performance reduces by 0.05% showing that the present exchange rate does not favour the performance of the sector. This is in line with the studies (Ayinde, 2014).

The lending rate is positive in the long run and short run showing that a 1% change in lending rate will lead to a 0.69 and 0.17 change in industrial sector performance. This is in line with the study by (Udoh & Ogbuagu, 2012; Gideaon *et al.,* 2015). They also found out the positive impact of lending rates on industrial growth. this means that the marginal efficiency of capital is high or most money invested is not from financial institutions.

In the short run, all variables are statistically significant but most of them have a weak effect on industrial sector performance Industrial loan still has a positive effect of 0.05% on the sector. HDI is negative in the short run but significant. In the short run, a 1% change in INS will lead to a 0.02 decrease in the sector's performance. This implies that the immediate effect of insecurity is not good for industrial performance due to interruption in investment and employment. The coefficient of error correction is negative and statistically significant; it shows that 55% of deviations from equilibrium would be corrected within a year. ECM measures the speed at which LIND adjusts to changes in explanatory variables before converging to its equilibrium.

Conventional diagnostic tests were conducted to check the reliability of the estimated model. They are the Breusch-Godfrey serial correlation LM test, Breusch-Pagan-Godfrey heteroscedasticity test, Jargue-Bera normality test and Ramsey RESET (functional form) test. The results reported in **Table 4** reveal that the ARDL model is well specified and residuals are normally distributed. This is because the p-values of 0.738, 0.712, 0.862 and 0.941 were obtained showing the absence of serial correlation, no bias in the omission of variable, error term normally distributed and error terms are homoscedastic.

Table 4. Diagnostic tests.

LM Test Statistic	Results
Serial Correlation: χ^2	0.311(0.738)
Functional Form (Ramsey Test): F-Stat.	0.142(0.712)
Normality (Jarque-Bera)	0.297(0.862)
Heteroscedasticity: χ^2	0.448(0.941)

The cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMQ) tests were employed to ascertain the stability of the Long run estimates variables and detect any point of a structural break, which are shown in **Figures 1** and **2**, respectively.

From **Figures 1** and **2**, it can be seen that the plot of CUSUM and CUSUMQ statistics moves between the critical bounds at 5% levels of significance, this means that the estimated coefficients in the model are stable. The straight lines in the figure represent critical bounds at 5% of the significance level.

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

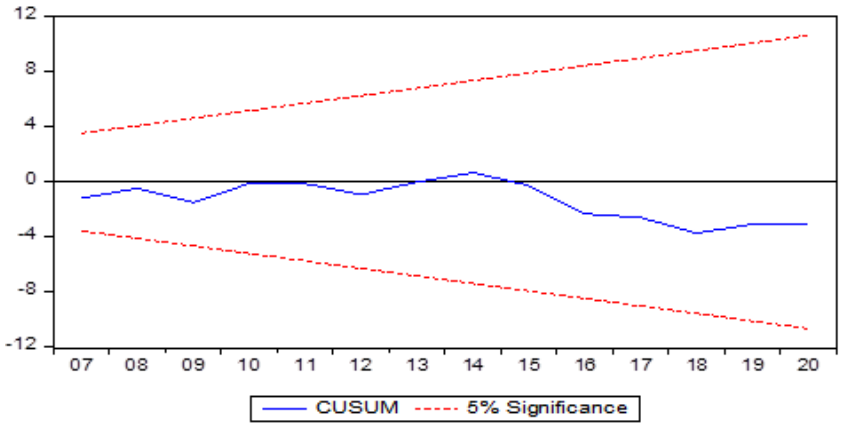

Figure 1. CUSUM data.

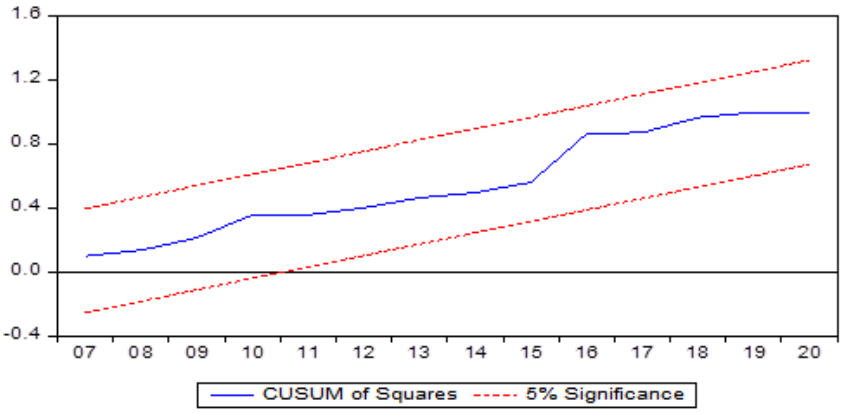

Figure 2. CUSSUMQ data.

4. CONCLUSION

This paper employs the ARDL and ECM techniques to investigate the problems and prospects of industrial sector performance in Nigeria from 1981 to 2021. The bound test cointegration result shows that there is a long-run relationship between industrial output and other variables employed in the study. The results of the estimation show a positive association between industrial sector performances, credit to the sector, foreign direct investment trade openness and expenditure in human capital. The following suggestions were put forward: (i) More credit to industries, foreign direct investment, trade openness and improvement in human development expenditure will lead to higher output in the industrial sector in the long run and short run; (ii) All the above when properly employed will lead to the marginal efficiency of capital, higher productivity of labour, expansion of business, increase in employment and increase in contribution to GDP; (iii) The result further shows that exchange rate and insecurity impacted negatively the sector's performance. They affect investment in the sector thereby reducing output and employment in the sector; and (iii) Government should introduce policies that will strengthen the local currency, and reduce the direct and indirect effects of insecurity. This will help in boosting industrial production and meet the increasing demand of people.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

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DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295