ENVIRONMENT, POVERTY AND INFANT MORTALITY IN NIGERIA

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Abstract

This paper examined the relationship between poverty, environment and infant mortality in Nigeria using data spanning from 1986 to 2018. The researcher employed Augmented Dickey -Fuller test (ADF) to check the stationarity of the series and Johansen cointegration to ascertain the presence or absence of long run relationship among the variable such as poverty, carbon dioxide emission, nitrous emission, infant mortality, expenditure on health and out of pocket expenditure on health. The result established the existence of a long-run relationship among the variables, which informed the choice of the error correction mechanism to ascertain the speed of adjustment. The result of the error correction mechanism shows a moderate speed of adjustment (60%). The Granger causality test indicated that a unidirectional causality flows from environment to infant mortality, while a bidirectional causality exists between poverty and infant mortality. An inverse relationship exists between the environment and infant mortality, likewise also between poverty and infant mortality. The paper, therefore, concluded that a negative relationship exist between environment, poverty and infant mortality in Nigeria. Based this following recommendations were made; antenatal and postnatal care should be subsidised or administered free to reduce the incidence of infant mortality in the country. Environmental laws should be enacted and religiously implemented in the country as the reduce the rate of environmental degradation.

Keywords: Poverty, Infant Mortality and Environment

Introduction

The relationship between poverty and environment can be traced back to the 18th century Malthusian Idea of Poverty and Environmental Nexus wherein the poor never think about the damage done on their environments in the cause of meeting up their basic human need. Poverty is the major reason why the environment is massively degraded. The use of the environment by human has always been in the following ways; as a Resource Bank, as a habitat, as a sink for waste and as a place of experimentation.

As a Resource Bank, the natural environment supplies human with the basic raw material needed to meet those basic needs. As a habitat, the environment provides shelter for human comfort and rest. As a sink for waste, the environment provides a dumping ground for all waste created in the process of meeting human needs. The increase in the population of human on earth leads to increase or pressure on the natural environment in the form of air pollution, nitrogen pollution, destruction of biodiversity and the destruction of the ecosystem. The unwise use of the natural environment may be due to the prevalence of poverty, upsurge in population, unfamiliarity and gluttony by the entrepreneurial class. The massive increase in the urban population in recent time may have led to an increase in poverty in almost all nations of the earth. Basic scientific innovation has led to the reduction of world infant mortality which increased the populations of human on earth without making more provision for the increase in productivity of the environment upon which man will depend on.

The African continent is not immune from the adverse effect of environmental degradation caused by innovation in technology such as improvement in primary health care management which birthed the reduction in infant mortality rate and increase in poverty rate among other miseries facing mankind. Africa as an evolving region is facing a gargantuan rise in urban

population and the natural environment will constantly grieve the magnitude of population escalation as poverty rise unabatedly. Nigeria is the most densely inhabited country in Africa with a projected population of 190,632,261 million (CIA, 2018) dwelling in rural and urban cities in the 36 states of the federation including the federal capital territory (Abuja) are not free from the negative influence on the environment. Basically, several steps have been taken by the Nigerian government since her independence to reduce the level of poverty in the midst of increasing population such as; national poverty eradication programme, Nigeria Economic Empowerment Development Strategy, Nigeria Millennium Development Goal, Trada-Moni and N-Power etc. With major economic reforms in both states and federal level, the country has made some progress in some sectors of the economy given their contribution to the gross domestic product at both market and factor cost. But, the health sector has not witnessed the progress given the rate at which our people travel to seek medical help outside the country including President Muhammadu Buhari . The increasing rate of poverty in the country has earned us the name poverty headquarters of the world (Transparency International, 2018). Both poverty and environment are an important determinant of human wellbeing. Stephen and Bedemi (2018) posited that poverty has a negative impact on infant mortality (health), Gafar, Mukaila, Raj and Micheal (2011), established link between environment and poverty, Macassa and Burston (2008) also believed that poverty has an impact on child mortality rate. However, there has been contending views on poverty and environment, environment and infant mortality as well as the effect of environment and poverty on infant mortality. But, there is limited literature on the joint interaction of environment and poverty on infant mortality in Nigeria. Thus a gap in knowledge has been created which this study intends to fill. The main objective of this study is to investigate the effect of environment and poverty on infant mortality in Nigeria. The rest of this study is organized as thus: section two dwells on the literature review, section three is a research methodology, while section four is the data analysis and discussion of result. Section five is the conclusion and policy recommendations.

Conceptual Clarification

Poverty: Poverty is multi-dimensional and has no terrestrial frontier. It is characterized by the non-existence of purchasing power, disclosure to risk, malnutrition, high mortality rate, low life expectancy, insufficient access to social and economic services and few opportunities for income generation (Morenike 2008). In the same vein, Oluwemimo (2007) stated that poverty includes exposure to contaminated environments, being at risk of criminal victimization, diseases and health risk in urban centres.

Environment: This means living and non-livings things happening naturally or artificially. The term environment is the furthermost time applied to earth or some parts of the earth created by God under the control or influence of human. Meaning that the environment incorporates the interaction of all living species, climate and non-living things.

Infant mortality: This means the death of young children under the age of one. The proportion of death at this stage is measured by infant mortality rate (IMR). Infant mortality rate means the number of children that died before their first birthday per 1000 lives birth.

Theoretical Literature

The contemporary trend in Nigeria made it imperative to research on the effect of environment and poverty on infant mortality in the light of the preposition of Professor W.W. Rostow (1953) stages of economic growth. Rostow proposed five stages of economic growth such as; The traditional society, the precondition for take-off, the take-off stage, the drive to maturity and the age of high mass-consumption.

The traditional stage according to Rostow is the one who's structure is developed within a

restricted production function based on pre-Newtonian science and technology and has a pre-Newtonian attitude toward the physical world. Pre-Newtonian in the above expression does not exclude innovation and inversion but that the economy lacks the tool to make more improvement as over 75% of her population is involved in agricultural practice. In this stage, the government to meet the basic need of man has degraded the environment through massive agriculture.

The pre-condition for take-off which was created only for the western European countries and Britain from the end of the 15th century to the beginning of the 16th century. This stage of economic growth is said to be initiated by four faces such as; the new learning, the new monarchy, the new world and the new religion or the reformation. The stage is said to have exogenous influences on the growth process.

The take off stage consists of the period in which growth takes a geometric progression or an industrial revolution, radical changes in the method of production. The take-off-period is expected to last for only two decades. Rostow gave some tentative dates for the developed countries to enter the take off stage without minding the position in developing countries.

The drive to maturity stage: Rostow sees this stage as the period in which the country has completely and effectively applied modern technology to the bulk of her natural resource. Meaning that, it is a period of long-sustained economic growth extending well above over four decades (40 years). New production system/technology takes the place of old Once, new leading factors and entrepreneur, higher rate of investment and 10% increase in national income.

The age of high mass-consumption according to Rostow means the period of efficiency in production and application of modern technology. The problem of the society in this stage has been shifted to that of consumption and not production. The productive capacity has gone beyond the basic need of the people and the basic attention of the people at this stage of high mass-consumption is to increase the welfare of the people which includes; the pursuit of national policy to enhance power and influence beyond national frontier, to have a welfare state by a more equitable distributions of national resource/income through progressive taxation, increase in social security and leisure to the working population as well as the decision to create new commercial centres and leading sectors like cheap automobile, housing, technological, advancement and reduced infant mortality rate and population control. In high mass, consumption has the propensity to reduce infant mortality and should not be expected in a country like Nigeria that is still swimming in the lake of traditional society with over 75% of her population in agricultural practices. Also on the proposition that agricultural practice causes major damage to the environment in the form of air pollution, nitrous pollution, water pollution etc. Yet the scourge of poverty has indelibly remained unabated in the world of increasing population in Nigeria.

Empirical Literature

Mutunga (2007), focuses on the determinants of infant and child mortality in Kenya. It Specifically, examines how infant and child mortality is related to the household's environmental and socio-economic characteristics, such as mother's education, source of drinking water, sanitation facility, type of cooking fuels and access to electricity. A Hazard rate framework is used to analyses the determinants of child mortality. Duration Models are easily applicable to the problem of child mortality as this class of models straight forwardly accounts for problems like right-censoring, structural modelling and Time varying covariates which traditional econometric techniques cannot handle adequately. A household's environmental and socio-economic characteristics are found to have a significant impact on child mortality. Policies aimed at achieving the goal of reduced child mortality should be directed on improving the household's

environmental and or socioeconomic status if this goal is to be realized.

Adekola (2014), examine the effect of living and environmental condition on infant mortality in a typical local government area (LGA) Nigeria, a case study of Ibadan North LGA from 2006 to 2010 and perceptions of the people were obtained from Focused Group Discussions (FGDs) with mothers of between 15 and 49 years at 6 purposively selected residential areas. Analysis of the demographic records shows that the local government, whose average total population was 306,795 has at least1431 infant deaths. The number of infant death varies based on differences in certain housing/environmental characteristics of selected districts, especially sanitation and waste management concerns ($r < 0.05$). The study indicates that inadequate toilet facilities and poor waste management were the bane of high infant mortality there. The study recommended that infant mortality can be reduced to the barest minimum if good toilet facilities are mandated for each household and good waste management approach is adopted.

Babanyara and Usman (2010) surveyed the linkages between population growth and environmental problems in Nigeria. Issues related to urban poverty, urbanization, deforestation, desertification, water pollution, solid waste management, flooding, erosion, sanitation and health were also highlighted. The study relies mainly on secondary data relating to urban poverty and environmental problems in Nigeria. Data were collected from both published and unpublished sources. Non-statistical and statistical methods were applied in analysing poverty and environmental problems in Nigeria. The paper also analyses the weaknesses affecting environmental management, such as inconsistencies of government policies, neglect of indigenous knowledge, inappropriate technology, inadequate funding, and inadequate awareness.

Lanrewaju (2012) surveys the housing quality in Nigeria cities and the impacts of urbanization on environmental degeneration of urban built environment. The paper identifies the problems that have aided the degeneration to include: Inadequate basic infrastructural amenities, substandard housing, overcrowding, poor ventilation in homes and workplaces, and noncompliance with building bye-laws and regulations. To examine the above-mentioned problems, the study included secondary data. The secondary data involved available census data, official documents and other relevant secondary data were obtained from existing literature, on books and journals. The paper finds that poor housing quality has serious adverse effects on the environment and the health of city residents. Strategies for improving the built environment for sustainable living are suggested. The paper concluded that it is imperative to check and prevent further decay for harmonious living and sustainable developments.

(Duraiappah, (1998) cited in Macassa and Burström (2005) specified agents responsible for environmental degradation and endogenous poverty such as: power, greed and wealth, exogenous poverty, institutional failures, and market failures. He distinguished between two forms of poverty, endogenous poverty caused by environmental degradation and exogenous poverty caused by other factors. Besides, he separates market failures from institutional failures, as the latter represents mal-defined property rights system and the former represents incorrect market signals. They identified six interactions to explain the poverty –environment relationship, that exogenous poverty causes environmental degradation. Also, that power, wealth and greed leads to environmental degradation, that institutional failure is a primary cause of environmental degradation.

That market failure cause's environmental degradation, that environmental degradation causes poverty and that endogenous poverty lead to environmental degradation which drives the descending twisting relation between poverty and the environment.

Research Methodology

The emphases here is placed on the method that is applied in executing this work, the source of data, techniques used , model specification, the definition of variables and method of data analysis.

Source of Data

Data spanning from 1986-2018 were sourced from the Central Bank of Nigeria statistical bulletin, world development indicators, and the National Bureau of statistics. Poverty rate less than $1.25 per day, Public expenditure on Health (PEH), Out of pocket expenditure on Health (OPH),Carbon dioxide emission (CO_2) and Nitrous emission (NEM).

Technique

The work is descriptive and analytical as it makes use of the secondary data in investigating the joint interactions of poverty and environmental degradation on infant mortality in Nigeria. The descriptive tool in this article is the descriptive statistic. The study is further analyzed with the use of ordinary least square (OLS) techniques based Johansen co-integration and vector error correction mechanism. Augmented dickey fuller (ADF) unit root test is used to verify the stationarity of the time series data used in the study and other tests like T-Test , F-Test, DW-Test, the Adjusted-R^2 is used to test the percentage variation in the regressed and that is caused by the regressors. F-Test is used to test the overall significant of the model. DW –Test is used to check autocorrelation of the error term. E-views 10 are used as the software for data analysis.

Model Specification

This research work adopted a modified version of Adesuwa, Obindah, Blessing and Isaac (2017) model specification, while they used life expectancy as the dependent variable, we use infant mortality rate as our dependent variable, while poverty rate, nitrous emission rate, out of pocket on health expenses and expenditure on education form the independent variables. The functional form of the model for this study is express as in the following functional form as;

$$IMR = f(POV, CO_2, NEM, OPH, PEH) \quad \text{--------} \quad (1)$$

Whereas;

The log-transformation of the study model is stated below;

$$IMR_t = \beta_{01} + \sum^{k-1} \alpha_{1i} IMR_{t-1} + \sum^{k-1} \alpha_{2i} Pov_{t-1} + \sum^{k-1} \alpha_{3i} Co2_{t-1} + \sum^{k-1} \alpha_{4i} NEM_{t-1} + \sum^{k-1} \alpha_{5i} LnOPH_{t-1} + \sum \alpha_{6i} LnPEH_{t-1} + \varepsilon t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3)$$

Whereas;

IMR = Infant mortality rate.

Pov = poverty rate below $1.25 dollar per day.

Co2 =Carbon dioxide emission from residential building and commercial services (% of Total combustion).

NEM = Nitrous emission (thousand matric tone of Co2 equivalent).

OPH = Out of pocket expenditure on health

PEH = Public expenditure on health.

α's and β's = unknown parameters of the variables.

f = functional notation.

A priori expectation

$\alpha_3 > 0$, $\alpha_2 > 0$, $\alpha_4 > 0$, $\alpha_5 < 0$, $\alpha_6 < 0$

Definition of Variables

The variables used in the empirical analysis are explained in the table below;

Variables	Identity	Definition	Source
Infant mortality	IMR	Number of children that died before their first birth day (per 1000)	World Bank Indicator
Poverty less than $1.25	POV	People living below $1.25 per day in Nigeria	World Bank Indicator
Carbon dioxide emission	CO2	Air pollution from incomplete combustion.	World Bank Indicator
Nitrous emission	NEM	Nitrous oxide gas emitted through agricultural activities, combustion of fossil fuels and solid waste.	World Bank Indicator
Out of pocket expenditure	OPH	Unplanned expenses move by individual on health care system.	World Development Indicator
Public expenditure on health	PEH	Planned expenditure on health infrastructure and the payment of salaries to health workers.	World Bank Indicator

Empirical Analysis

Table 1: Descriptive statistic result

	IMR	POV	CO2	NEM	LOG(OPH)	LOG(PEH)
Mean	114.8327	59.99545	68082.58	22756.21	4.270535	1.841301
Median	123.3000	61.40000	68154.86	19770.31	4.287991	2.722610
Maximum	169.0000	68.51000	106068.0	46431.49	4.392348	5.551874
Minimum	75.70000	48.11000	21539.96	11470.06	4.102313	-3.218876
Std. Dev.	24.43806	6.402634	24782.60	9947.018	0.077813	2.993812
Skewness	0.080533	-0.499348	0.028606	0.918236	-0.467664	-0.292181
Kurtosis	2.372748	1.950235	1.603098	2.548254	2.233643	1.585214
Jarque-Bera	0.856248	2.886674	3.990659	7.302445	2.375982	3.807538
Probability	0.651731	0.236138	0.135969	0.025959	0.304833	0.149006
Sum	5626.800	1979.850	3336046.	1115054.	166.5509	71.81074
Sum Sq. Dev.	28666.51	1311.799	2.95E+10	4.75E+09	0.230083	340.5907
Observations	32	32	32	32	32	32

The result above indicates the total output of the descriptive statistic. The major reason for the inclusion of descriptive statistic is to check the normality of the series and to verify if their distributions conform to the assumed normal distribution of the population. The skewness of the series indicates that, POV, log (OPH) and log (PEH) are negative implying that they have long-left tail while IMR, CO2, NEM has positive coefficient implying that they have long-right tail. The Kurtosis which measures the peakedness of the distribution shows that IMR, NEM, log (OPH) are peaked Lyptokurtic while others are leptokurtic. Finally, the jarque- Bera statistic and her associated probability value show that all variable is normally distributed except the coefficient of NEM with probability value less than 0.05.

Table 2: Unit Roof Result (ADF)

Level			First Difference		
Variables	T. Statistic	Critical Value	T-Statistic	Critical Value	Order
CO2	-1.805093	-2.923780	-7.337606	-2.925169	I(1)
IMR	0.178800	-2.928142	-5.881092	-2.928142	I(1)
NEM	0.409384	-2.926622	-6.602206	-2.926622	I(1)
POV	-1.292943	-2.957110	-4.120614	-2.960411	I(1)
Log (PEH)	-1.411956	-2.951125	-10.05496	-2.943427	I(1)
Log (OPH)	-2.337358	-2.941145	-7.582268	-2.943427	I(1)

Source: Authors Computation using e-views 10.

The initial stage or process in using time series data is to test for the stationarity of the series through unit root methods but in this study we adopt the Augmented Dickey- Fuller (ADF), to check the level/degree of the stationarity of the variables in the model before determining the regression procedure to apply. The result of the Augmented Dickey- Fuller test shows all the variables in the model are integrated of order one. This informs the adoption of the Johansen cointegration technique to test if there is any long-run relationship among the variables.

Cointegration Result

Basing our position on the preposition of Johnson (1988), and Johnson and Juselius (1990) maximum likelihood framework, we proceeded to determine whether there is a long-run relationship among the variables in the model. The selection of Johnson cointegration equation is based on the fact that we are dealing with a multivariate model that produces asymptotically optimal estimate and incorporate a parametric correction for serial correlation.

Table 3: Johansen Cointegration

Ho	H_1	Eigen	λ Mass test	λ mass 0.95	P-Value	Tran Statistic	Tran Critical	Tran P
r = 0	r = 0	0.916261	7440166	40.07757	0.0000	193.6547	95.75366	0.0000
r ≤ 1	r = 1	0.839561	54.85533	33.87687	0.0001	119.2531	6981889	0.0000
r ≤ 2	r = 2	0.685493	3470250	27.58434	0.0051	64.35773	47.85613	0.0007
r = 3	r = 3	0.487855	20.07440	21.13162	0.0698	29.65524	29.797--	0.0519
r = 4	r = 4	0.261736	9.103706	14.26460	0.2776	9.580831	15.49471	0.3144
r = 5	r = 5	0.015778	0.477125	3.841466	0.4897	0.477125	3.841466	0.4897

Source: Authors computation using e views 10.

Both trace and Max-Eigen value indicate that there are 3 cointegrating equations at 5% level of significance. Meaning that there is a long-run relationship or cointegration among the variables in the model. Given the existence of a long-run relationship, we proceed to determine the dynamic nature of the model by conducting the error correction mechanism to ascertain the speed of adjustment. The lag selection criterion is used to determine the optimal lag for the over parameterized, and from it, we draw out parsimonious result which is shown below.

Granger Causality Test for Infant Mortality Model

Table 4: Granger Causality Test Result

Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
IMR does not Granger Cause CO2	85	1.15522	0.1983
CO2 does not Granger Cause IMR		6.42032	0.0064
POV does not Granger Cause IMR	85	5.06761	0.0070
IMR does not Granger Cause POV		9.28689	3.E-05
PEH does not Granger Cause IMR	85	8.31240	0.0021
IMR does not Granger Cause PEH		1.17357	0.3253

Table 4 shows the result of the granger causality test among the explanatory variables and the dependent variable. The result shows that the null hypothesis that the explanatory variables do not granger cause infant mortality (IMR) can be rejected at the 5 per cent significance level ($P<0.05$). The result shows that the environment (CO2) granger cause infant mortality (IMR). Public expenditure on health (PEH) granger cause infant mortality (IMR). There is a bidirectional between poverty and infant mortality (IMR) in Nigeria.

Error Correction Mechanism (ECM) Result

Restricted Test Equation:
Dependent Variable: D(IMR)
Method: Least Squares

Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.067120	0.053292	-1.259479	0.2205
D(IMR(-1))	1.568231	0.129779	12.08386	0.0000
D(CO_2(-2))	0.616162	0.123621	-4.984299	0.0000
D(LOG(OPH))	-1.057011	0.552774	-1.912194	0.0684
D(LOG(PEH(-2)))	-0.088193	0.033684	-2.618261	0.0154
D(POV(-1))	0.030011	0.011355	-2.642947	0.0145
ECM(-1)	-0.602305	0.046575	-2.350499	0.0092

R-squared	0.882264	Mean dependent var	-1.643333
Adjusted R-squared	0.717637	S.D. dependent var	1.042769
S.E. of regression	0.155938	Akaike info criterion	-0.677755
Sum squared resid	0.559282	Schwarz criterion	-0.350809
Log likelihood	17.16632	Hannan-Quinn criter.	-0.573162
F-statistic	212.2992	Durbin-Watson stat	2.962090
Prob(F-statistic)	0.000000		

Source: Author's Computation using E-views 10.0

The error correction term depicts the speed of adjustment heralding to equilibrium in place of long-run distortion or shocks. It has the right sign (negative) -0.602 which shows the moderate speed of adjustment, this implies that the speed of adjustment is 60 percent. The adjusted R^2 is 0.717, which implies the explanatory variables explained about 72 percent variation in the dependent variable (infant mortality). The value of Durbin-Watson statistic is 2.962 which show the absence of autocorrelation and the F-statistic shows that the model is well fitted, given its probability value of 0.000.

Carbon dioxide emission (CO_2) a proxy for the environment has a positive coefficient of 0.616 and it is significant, given its probability value of 0.000. This implies a direct relationship exist between infant mortality and the environment in Nigeria. A percentage increase in environmental degradation will result in a 0.62 percent increase in infant mortality in Nigeria. Increase in carbon dioxide emission will increase the rate of respiratory disease and by extension the rate of infant death all things being equal.

Out of pocket expenditure on health (OPH) a control variable has a negative coefficient of -1.05 but it is not statistically significant given its probability value of 0.06. The reason for this may be attributed to the high level of poverty which adversely affects out of pocket expenditure on health.

Public expenditure on health (PEH) a control variable at lag period two has a negative coefficient of -0.08 and it is significant given its probability value of 0.015. This implies an inverse relationship exists between PEH and infant mortality (IMR) in Nigeria. One percent increase in public health expenditure will result in 0.08 percent reduction in infant death in Nigeria.

Poverty (POV) has a positive coefficient of 0.03 and it is significant given its probability value of 0.014 and it conform to the theoretical expectation. The implication is that there is a direct relationship between poverty and in infant mortality in Nigeria, a percentage increase in poverty all things being equal will result in 0.03 percent decline infant mortality in Nigeria. Poverty affect the peoples demand for health services and this affect infant mortality adversely, because of the user charge fees that they may not be able to afford because of poverty.

Diagnostic Test

Table 6: Diagnostic Test Result

Serial correlation Lm Test	F(2,61)	1.872829	0.1024
Heteroskedasticity	F (23,60)	1.827275	0.2366
Normality Test	9.525852		0.008541

Source: Author's Computation using E-views 10.0

The above empirical estimations for autocorrelation, hecteroskedasticity are used to test the following null hypotheses:

There is no serial or autocorrelation

There is no heteroskedasticity

There is no non-normal error

The result given table 6 shows that the short-run model passed the diagnostic tests. The results indicated that there is no autocorrelation at the 5 per cent level of significance. There is also no heteroskedaticity in the model and that the error term is normally distributed.

Conclusion and Recommendations

Conclusion

Based on that result from the data analyzed the study concludes that a direct relationship exists between environment proxy by carbon dioxide and infant mortality in Nigeria. That is the higher the level of environmental degradation the higher the rate of infant mortality in Nigeria. Poverty another independent variable also has a direct relationship with infant mortality in Nigeria. Poverty affects the

demand for health which by extension worsens the infant mortality in the country.

Recommendations

1. Given the alarming rate of poverty in the country, antenatal and postnatal care should be subsidised or administered free to reduce the incidence of infant mortality in the country.
2. Environmental laws should be enacted and religiously implemented in the country as the reduce the rate of environmental degradation.
3. The safe motherhood and childhood campaign should be carried out on all fronts.
4. The primary health care management system should be decentralized to villages to make health care accessible to all in Nigeria.

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