Blue Economy Determinants and Economic Growth: Implications Upon MENA Region Countries

Noha Samir Shawal M. Abouzeid[1]

Abstract

Blue economy refers to the use and the activities related to sea, oceans and coasts where economic growth is achieved for both industrialized and developing countries, where creation of jobs and enhanced life, with an additional conservation area such as carbon storage, sea and ocean protection and biodiversity. This research is conducted to measure the impact of the blue economy factors on economic growth of MENA region countries and to discuss the different challenges and opportunities that results from the transition to sustainable Blue Economy. With the hypothesis that states that there is a positive impact of blue economy factors on the economic growth of MENA region countries in both short run and the long run and contribute positively to the achievement of Goal 14 in the sustainable development goals stated by the United Nations, that states conservation and sustainably use of oceans, seas, and marine resources for sustainable development. By using an econometric model the study provides a quantitative analysis of the relationship between blue economy factors and economic growth, contributing to the empirical understanding of this relationship. The study found that Total Fishery Production and Agriculture, forestry, and fishing, (value added) have a positive impact on economic growth in both the long and short runs. However, the Aquaculture production variable was found to be weakly exogenous in the long run, indicating that there is no causality running from Aquaculture production to economic growth.

Key Words: Blue Economy, Sustainability, MENA Region, Fisheries.

Assistant Professor of Economics and Foreign Trade, Faculty of Commerce and Business Administration, Helwan University

محددات الاقتصاد الأزرق والنمو الاقتصادي: انعكاسات على دول منطقة الشرق الأوسط وشمال أفريقيا

الملخص

يشير الاقتصاد الأزرق إلى الاستخدامات والأنشطة المتعلقة بالبحار والمحيطات والسواحل حيث يتحقق النمو الاقتصادي لكل من البلدان الصناعية والنامية، فيتم خلق فرص العمل وتحسين الحياة. تم إجراء هذا البحث لقياس تأثير عوامل الاقتصاد الأزرق على النمو الاقتصادي لدول منطقة الشرق الأوسط وشمال أفريقيا ومناقشة التحديات والفرص المختلفة الناتجة عن التحول إلى الاقتصاد الأزرق المستدام. مع الفرضية التي تنص على أن هناك تأثير إيجابي لعوامل الاقتصاد الأزرق على النمو الاقتصادي للدول المذكورة على المدى القصير والطويل والمساهمة بشكل إيجابي في تحقيق الهدف 14 من أهداف التنمية المستدامة. باستخدام نموذج الاقتصاد القياسي، توفر الدراسة تحليلاً كميًا للعلاقة بين عوامل الاقتصاد الأزرق والنمو الاقتصادي، مما يساهم في الفهم التجريبي لهذه العلاقة. وتوصلت الدراسة إلى أن إجمالي إنتاج الأسماك والزراعة والغابات وصيد الأسماك (القيمة المضافة) لها تأثير إيجابي على النمو الاقتصادي على المدى الطويل والقصير، وقد تبين أن متغير إنتاج تربية الأحياء المائية خارجي المنشأ له تأثير ضعيف على المدى الطويل، مما يشير إلى عدم وجود علاقة سببية تمتد من إنتاج تربية الأحياء المائية إلى النمو الاقتصادي.

الكلمات المفتاحية: الاقتصاد الأزرق، الاستدامة، منطقة الشرق الأوسط وشمال أفريقيا، مصايد الأسماك.

1- Introduction:

The sea has always been part of economic activities as it represents a major source of food, could be used in transportation, and a means of exchange. The Blue Economy concept has become associated with marine resources oceans in recent years. Over 70% of the world's surface is covered with water (Weforum 2022).

The Blue Economy is relatively a new topic of study that depends on activities that is related to the sea and is linked to sectors such as transportation, energy, tourism, maritime, and fishing, as oceans and seas are the main engines of the global economy and offer immense potential for growth and innovation, blue growth helps maritime and marine sectors grow sustainably. Many countries nowadays have the interest in promoting blue economy for the development of their national economies (Martínez-Vazquez et al 2021). The Blue Economy refers to the sustainable use of ocean resources for economic growth, job creation, and improved livelihoods while preserving the health of the ocean ecosystem. (World Bank, 2017)

Globally, marine fisheries employ more than 200 million people directly or indirectly, with a market value of $3 trillion each year. Furthermore, seas absorb roughly 30% of carbon dioxide created by humans, significantly reducing the effects of global warming (Chen and Bollempalli 2020).

2- Literature Review:

Blue Economy traditional sectors contribute to the GDP of the countries and create direct new job opportunities including new markets that resulted from new industries emerged from seas and oceans such as algae production. (European Commision 2021).

Over 70% of the Earth's surface is composed of oceans and seas that support approximately 80% of all life forms (IOC-UNESCO 2023). These vast ecosystems act as significant carbon sinks, are responsible for producing 50% of the world's oxygen, and provide protein to over 3 billion people (IPCC 2021). Furthermore, they form the foundation of a substantial industry. By adopting Blue Economy value chains, businesses can shift away from linear models that involve excessive resource consumption and waste generation and move towards circular models that are less resource-intensive and generate less waste. This transition involves taking measures to combat marine pollution, coastal litter, and plastics, investing in biodiversity conservation, ecosystem restoration, and protection, promoting nature-based solutions, and developing marine renewable energy and novel blue biotechnologies.

The Blue Economy comprises two types of activities: marine-based activities that occur in the ocean, sea, and coastal areas, including marine capture fisheries and aquaculture, marine mining, marine renewable energy, desalination, maritime transportation, and coastal tourism; and marine-related activities that involve seafood processing, biotechnology, shipbuilding and repair, port activities, digital services, and other activities that use or create products and services from the water (European Commission, 2021).

Challenges Facing Blue Economy:

Overfishing is a significant challenge facing the Blue Economy, which has arisen due to technological advancements, inadequate management of fish stocks, and increased demand. According to the Food and Agriculture Organization (FAO 2018), 57% of fish stocks are fully exploited, while the remaining 30% are depleted or recovering due to overfishing. Unregulated fishing, which accounts for 11 to 26 million tons of fish catches each year, is a significant contributor to the depletion of fish supplies (FAO 2020).

Blue injustice is a term used to describe various environmental and social injustices that occur in the marine environment. One form of blue injustice is ocean grabbing, which involves the appropriation of marine resources and spaces by powerful actors, often at the expense of local communities and small-scale fishers (Blasiak et al 2020). Another concern related to blue injustice is environmental pollution and waste, which has become a significant issue in our oceans.

Every year, approximately 8 million tons of plastic enter the oceans, which is equivalent to dumping a garbage truck full of plastic into the water every minute (Jambeck et al 2015). Plastic pollution makes up as much as 80% of all garbage in our oceans. (Eriksen et al 2014)

Environmental degradation is a significant issue that has negative impacts on the livelihoods of small-scale fishers, resulting in lost access to marine resources necessary for food security and wellbeing. Plastic pollution is a significant contributor to this problem, with up to 1 million sea birds, 100,000 sea animals, and countless fish killed by plastic waste each year (Jambeck et al 2015). Plastic debris stays in the ecosystem for years and causes daily harm to thousands of marine species (Gall and Thompson 2015).

For the time being, the recommendations to mitigate or remove the injustices are still being considered and may include recognizing and protecting resource, taking preventative measures to reduce pollution and protect the environment, reducing development's negative effects on habitats, resources, and ecosystem services, protecting small-scale fishermen's access rights and livelihoods. Protect and encourage access to marine resources that are essential for food security and well-being, also, minimizing the impacts of development on habitats, resources, and ecosystem services (Bennett, et al 2019).

Human-induced coastal habitat degradation has a profound impact on the ocean, causing marine ecosystem devastation, biodiversity loss, and environmental deterioration. This degradation is caused by various factors such as unsustainable coastal development, overfishing, and damaging fishing methods. Land-based pollution, which contributes more than 80% of the world's wastewater, is a major driver of coastal and ocean deterioration, as it flows directly into rivers, lakes, and eventually seas (UNEP 2021). Habitat degradationdirectly affects local communities that rely on marine ecosystem services such as tourism and recreation, fisheries, coastal protection, biodiversity, and climate regulation (Ranganathan 2008). Climate change is a significant challenge for the Blue Economy, with a bidirectional relationship between the two. Some sectors of the Blue Economy are unsustainable, contributing to climate change and increased greenhouse gas emissions, also changes in ocean temperatures, sea level rise, ocean acidification, and changes in weather patterns. These changes can have significant impacts on marine ecosystems, fisheries, and coastal communitiesthat depend on them for their livelihoods. For example, rising sea levels and increased storm surges can lead to coastal erosion, flooding, and damage to infrastructure, affecting coastal tourism and other economic activities. Conversely, climate change caused by economic activities, not just those within the Blue Economy, impacts the quality of coastal tourism, oceans, and the well-being of people living near the coast (Badîrcea et al 2021).

Blue Economy Potentials, Opportunities and Risk:

MENA region covers over 12 million square kilometers, which accounts nearly 10% of the world's total land area. This region includes 19 countries which constitute around 6% of the world's population, with a total population of 396147843 by the end of year 2020 as shown in table 1(FAO 2018). By 2030, the population of the region is expected to reach 586 million, rising to 731 million by 2050 (UN 2017). Due to the development aid and financial financing need, the majority of MENA countries are categorized as low-income and middle-income countries, that are mainly divided into 5 different groups that are, Eastern countries: Iraq, Syria, Lebanon, Jordan, and the Palestinian Territories, Western countries: Libya, Tunisia, Algeria, Morocco, and Mauritania, Nile Based countries: Egypt and Sudan, Arabian Peninsula countries: Saudi Arabia, Kuwait, the United Arab Emirates (UAE), Qatar, Oman, Bahrain, and Yemen, and Sahel countries: Somalia, Djibouti (Kandeel 2019).

Table 1: Population of MENA Region Countries

Country	Population 2020
Bahrain	1701583
Qatar	2881060
Kuwait	4270563
Oman	5106622
Palestine	4803269
Lebanon	6825442
Libya	6871287
United Arab Emirates	9890400
Jordan	10203140
Tunisia	11818618
Syria	17500657
Yemen	29825968
Saudi Arabia	34813867
Morocco	36910558
Iraq	40222503
Algeria	43851043
Iran	83992953
Egypt	102334403
Total	396147843

Source: World Bank, World Development Indicator, (2022). https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ZQ

According to 2020 World Bank statistics, table 2, MENA region countries have lower GDP compared to the global average and Saudi Arabia has slightly higher GDP value than that of the rest of the region data. However, the region is changing from low-income to middle-income level. The region has large population of poorer people and as a result despite several initiatives have been taken by the government, the progress on poverty reduction is limited in terms of GDP (World Bank 2022).

According to the World bank 2022, Morocco's Gross Domestic Product (GDP) is directly dependent on the ocean and coastal-related activities, accounting for 59 percent of the country's total GDP. In Tunisia, the tourist and fishing industries alone employ almost 450,000 people. (World Bank, 2022)

Table 2: GDP, Current US $, 2015 represented in (Nominal Terms), Year 2021 – MENA Region Countries

Country	GDP (Current $ 2015) YR 2021
Saudi Arabia	672126508709.17
Iran, Islamic Rep.	469947053637.55
Egypt, Arab Rep.	425960412713.50
United Arab Emirates	398355489726.86
Iraq	183896942952.40
Algeria	174201329643.30
Qatar	163984573110.55
Morocco	123866072116.04
Oman	82728063878.00
Libya	60910775962.40
Tunisia	46984709045.01
Jordan	42157528600.23
Lebanon	34090266918.90
Bahrain	33998540960.67
West Bank and Gaza	15027100000.00

Source: WDI, World Bank, 2023.

4.2 MENA Region’s Fresh Water Scarcity and Security:

According to the United Nations University, water security is “the capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining” (UN 2013).

Demand for freshwater in MENA is expected to continue to outpace supply, as a result of population increase, socioeconomic development, and rising average income levels, as the area holds only around 1 percent of the Earth's total renewable freshwater resources, where, except for Mauritania and Iraq, all of the region's countries are water-stressed and at least 12 countries, including all of the Arabian Peninsula countries, Jordan, the Palestinian Territories, Libya, Tunisia, and Algeria, are water-scarce (FAO 2018).

Arab Forum for Environment and Development (AFED)'s projections suggest that total water demand in MENA would grow by about 58 percent from 2010 to 2050 (Chatila 2010). MENA is also the region of the world that is most reliant on non-domestic water supplies. Outside of the region's legislative limits are the headwaters of more than half of the region's annually renewable freshwater resources. These resources are primarily concentrated in the Nile, Euphrates-Tigris, and Jordan-Yarmouk River systems. Freshwater security is determined by the quantity, as well as the quality and stability, of the resources accessible to a community at any one time.

The cost of ocean pollution to society is high, that is represented by problems related to seas and oceans which are affecting the economies of MENA region countries such as, overfishing, rising sea levels, marine pollution, ocean warming. Also, increased flooding and coastal erosion are causing homes in coastal areas to be vanished. The touristic locations are harmed by marine plastic pollution, and the urban infrastructure may be harmed by rising sea levels and coastal erosion. In Morocco, the annual cost of environmental degradation of coastal areas reached US$260 million, or 0.27 percent of the country's GDP, which highlighted the crucial need of more sustainable economic models (World Bank, 2021).

5. Methodology:

From literature review many studies showed the role of blue economy on economic growth. Our study will extend the literature by investigating the role of the blue economy determinants on economic growth in MENA Region countries. Based on the literature review, the primary hypotheses of this study have been formulated as below:

1. Total fisheries production (TFP) is positively affecting economic growth in the long run and short run in the MENA region.
2. Aquaculture production (AP) is positively affecting economic growth in the long run and short run in the MENA region.
3. Agriculture, forestry, and fishing, value added AFF is positively affecting economic growth in the long run and short run in the MENA region.

Thus, the findings of the study could help in formulating a policy design in the long run and short run to improve the role of the blue economy in the economic growth of MENA region countries.

Annual panel data that were collected for MENA region countries covering (Bahrain, Qatar, Kuwait, Oman, Palestine, Lebanon, Libya, UAE, Jordan, Tunisia, Syria, Yemen, KSA, Morocco, Algeria, Iraq, Iran and Egypt) covering the period from 1996-2020 were extracted from World Development Indicators (WDI), published by the World Bank.

Table 3: List of Variables			
Variable	Symbol	Description	Source
GDP Growth (annual%)	GDPGR	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.	WDI
Total Fishery Production in metric tonnes	TFP	Total fisheries' production (measured in metric tons) measures the volume of aquatic species caught by a country for all commercial, industrial, recreational and subsistence purposes. The harvests from mariculture, aquaculture and other kinds of fish farming are also included.	WDI
Aquaculture production in metric tonnes:	AP	Refers to farming for consumable production of aquatic life, including fish, molluscs, crustaceans	WDI

		and aquatic plants.	
Agriculture, forestry, and fishing, value added (current US$)	AFF2	Agriculture, forestry, and fishing corresponds to ISIC divisions 1-3 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. (ISIC), revision 4. Data are in current U.S. dollars.	WDI

Unit root test was performed on the stated variables to check the stationarity of the data, Phillips-Perron (PP test) was used, which is non-parametric test for large samples as there are large number of observations, and the results showed that the stated variables show unit root in the level stage, but all variables show stationarity set of data in the 1st difference. Test rejects the unit root null hypothesis for the first differences.

Table 4: Unit root test for stated variables at level

		GDPGR	TFP	AFF1	AP
With constant	T-statistics	0.0188	1.0000	0.5733	1.0000
	Prob.	0.0000	0.2492	0.5697	0.4025
With constant and trend	T-statistics	0.0019	0.9277	0.9795	0.8705
	Prob.	0.0000	0.3335	0.8678	0.0535
Without constant and trend	T-statistics	0.0152	1.0000	0.7352	1.0000
	Prob.	0.0000	0.6365	0.6549	0.8041

Table 5: Unit Root Test for stated variables at first difference					
		GDPGR	TFP	AFF1	AP
With constant	T-statistics	0.0000	0.1673	0.0532	0.0127
	Prob.	0.0000*	0.0061*	0.0393*	0.0000*
With constant and trend	T-statistics	0.0000	0.1352	0.1293	0.0002
	Prob.	0.0001*	0.0294*	0.1192	0.0000*
Without constant and trend	T-statistics	0.0000	0.3058	0.0053	0.0658
	Prob.	0.0001*	0.0003*	0.0032*	0.0000*

All variables with (*) show statistically significant output at 1% significant level representing stationary of data at the first difference

Based on the results presented in Tables 4 and 5, we carefully conclude that panel non-stationary is likely, therefore we treat the variables as integrated of order one, i.e., I(1). Long-run relationship between non-stationary variables can only exist if variables are cointegrated.

The ARDL model is employed to examine the connections between various time series variables in both the long and short run. In this model, the AR (autoregressive) component signifies the past values of the dependent variable and captures the immediate dynamics of the variable relationship. On the other hand, the Distributed Lag Component represents the lagged values of the explanatory variables, thereby capturing the delayed effects of these variables on the dependent variable.

Table 6: ARDL

Dependent Variable: Y
Method: ARDL
Date: 11/20/23 Time: 13:08
Sample (adjusted): 5 304
Included observations: 295 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): AFF AP TFP
Fixed regressors: C
Number of models evalulated: 500
Selected Model: ARDL(4, 4, 0, 4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Y(-1)	0.052101	0.056694	0.918975	0.3589
Y(-2)	0.029259	0.055222	0.529836	0.5966
Y(-3)	-0.010155	0.054601	-0.185993	0.8526
Y(-4)	0.152111	0.053841	2.825171	0.0051
AFF	-3.37E-11	1.14E-10	-0.296463	0.7671
AFF(-1)	2.44E-10	1.74E-10	1.402584	0.1619
AFF(-2)	1.59E-10	1.77E-10	0.900905	0.3684
AFF(-3)	-2.38E-10	1.76E-10	-1.357285	0.1758
AFF(-4)	-2.82E-10	1.21E-10	-2.321944	0.0210
AP	2.13E-06	2.23E-06	0.956307	0.3397
TFP	-5.50E-06	2.72E-06	-2.018751	0.0445
TFP(-1)	2.10E-06	3.66E-06	0.574738	0.5659
TFP(-2)	-3.63E-07	3.67E-06	-0.098883	0.9213
TFP(-3)	8.87E-06	3.65E-06	2.431535	0.0157
TFP(-4)	-4.32E-06	2.63E-06	-1.641615	0.1018
C	3.953426	0.622766	6.348169	0.0000

R-squared	0.212141	Mean dependent var	3.975638
Adjusted R-squared	0.169783	S.D. dependent var	6.419978
S.E. of regression	5.849641	Akaike info criterion	6.423349
Sum squared resid	9546.906	Schwarz criterion	6.623320
Log likelihood	-931.4439	Hannan-Quinn criter.	6.503422
F-statistic	5.008297	Durbin-Watson stat	1.868966
Prob(F-statistic)	0.000000		

.*Note: p-values and any subsequent tests do not account for model selection

Then long run and bounds test will be implemented to check the existence of long run relationship between both the dependent variable which is reflected by the GDP growth rate and the set of independent variables reflecting Agriculture, forestry, and fishing, value added (current US$), Aquaculture production (metric tons) and Total fisheries production (metric tons). Table 7 reflects the results of the test that showed the existence of the long run relationship between the GDP growth rate and the set of independent variables as the F statistic is 14.27909 which is greater than the values of the upper and lower bound at 1% significance levels which recorded 3.65 and 4.66 respectively.

Table 7: Long-run and Bounds Test

ARDL Long Run Form and Bounds Test
Dependent Variable: D(Y)
Selected Model: ARDL(4, 4, 0, 4)
Case 2: Restricted Constant and No Trend
Date: 11/20/23 Time: 13:11
Sample: 1 304
Included observations: 295

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.953426	0.622766	6.348169	0.0000
Y(-1)*	-0.776685	0.094635	-8.207185	0.0000
AFF(-1)	-1.51E-10	4.49E-11	-3.353659	0.0009
AP**	2.13E-06	2.23E-06	0.956307	0.3397
TFP(-1)	7.85E-07	1.29E-06	0.606529	0.5447
D(Y(-1))	-0.171214	0.082427	-2.077158	0.0387
D(Y(-2))	-0.141956	0.070721	-2.007267	0.0457
D(Y(-3))	-0.152111	0.053841	-2.825171	0.0051
D(AFF)	-3.37E-11	1.14E-10	-0.296463	0.7671
D(AFF(-1))	3.61E-10	1.17E-10	3.084710	0.0022
D(AFF(-2))	5.20E-10	1.18E-10	4.414494	0.0000
D(AFF(-3))	2.82E-10	1.21E-10	2.321944	0.0210
D(TFP)	-5.50E-06	2.72E-06	-2.018751	0.0445
D(TFP(-1))	-4.18E-06	2.67E-06	-1.567485	0.1181
D(TFP(-2))	-4.55E-06	2.63E-06	-1.731717	0.0844
D(TFP(-3))	4.32E-06	2.63E-06	1.641615	0.1018

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AFF	-1.94E-10	5.83E-11	-3.328602	0.0010
AP	2.75E-06	2.89E-06	0.950984	0.3424
TFP	1.01E-06	1.66E-06	0.608561	0.5433
C	5.090128	0.589744	8.631075	0.0000

EC = Y - (-0.0000*AFF + 0.0000*AP + 0.0000*TFP + 5.0901)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	14.27909	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
			Finite Sample:	
Actual Sample Size	295		n=80	
		10%	2.474	3.312
		5%	2.92	3.838
		1%	3.908	5.044

Then Error Correction Model will be estimated to measure the speed of adjustment towards the long-run equilibrium. It represents the difference between the actual and equilibrium values of the dependent variable. The coefficient of the error correction term indicates how quickly the variables adjust to restore the long-run equilibrium relationship after short-run deviations. Estimating the ARDL allows for the assessment of both short-run and long-run effects, providing insights into the dynamics of the relationship between the variabes.

Table 8: ECM

ARDL Error Correction Regression
Dependent Variable: D(Y)
Selected Model: ARDL(4, 4, 0, 4)
Case 2: Restricted Constant and No Trend
Date: 11/20/23 Time: 13:13
Sample: 1 304
Included observations: 295

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y(-1))	-0.171214	0.079639	-2.149886	0.0324
D(Y(-2))	-0.141956	0.068816	-2.062835	0.0401
D(Y(-3))	-0.152111	0.052944	-2.873066	0.0044
D(AFF)	-3.37E-11	1.11E-10	-0.304704	0.7608
D(AFF(-1))	3.61E-10	1.14E-10	3.172503	0.0017
D(AFF(-2))	5.20E-10	1.16E-10	4.500710	0.0000
D(AFF(-3))	2.82E-10	1.19E-10	2.369106	0.0185
D(TFP)	-5.50E-06	2.53E-06	-2.176121	0.0304
D(TFP(-1))	-4.18E-06	2.58E-06	-1.620052	0.1064
D(TFP(-2))	-4.55E-06	2.56E-06	-1.776609	0.0767
D(TFP(-3))	4.32E-06	2.57E-06	1.679988	0.0941
CointEq(-1)*	-0.776685	0.091268	-8.509937	0.0000

R-squared	0.532222	Mean dependent var	-0.081033
Adjusted R-squared	0.514040	S.D. dependent var	8.331783
S.E. of regression	5.808154	Akaike info criterion	6.396230
Sum squared resid	9546.906	Schwarz criterion	6.546209
Log likelihood	-931.4439	Hannan-Quinn criter.	6.456285
Durbin-Watson stat	1.868966		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	14.27909	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Table 8 reflects the results of the ECM used to explain the relationship between the dependent variable, GDP growth rate and the set of independent variables including Agriculture, forestry, and fishing, value added (current US$), Aquaculture production (metric tons) and Total fisheries production (metric tons). The results showed that one of the mentioned variables which is Aquaculture production (metric tons) has no impact on the GDP growth rate in the longrun, however the other two variables Agriculture, forestry, and fishing, value added (current US$) and Total fisheries production (metric tons) have long run effect on the GDP growth rate. The long run effect of the two mentioned variables is distributed among its lags.

Regarding the Agriculture, forestry, and fishing (AFF), there is a high significance of its impact in the long run in its second and third lag with a
t-statistcs value of 5.500710 and 2.369106 at 1% significance level, and the total fisheries production has an impact on GDP growth rate in the long run and the significance appears in the second and third lag at a significance level of 10% showing t statistics value -1.776609 and 1.679988 respectively.

Results and Conclusion:

The findings of this research provide insights into the relationship between the blue economy and economic growth. The study employed econometrical method, ARDL with a long run and bounds test and ECM, which overcame possible common econometrical misspecification in previous papers. The importance of applying several unit root tests was also emphasized.

The results showed that there is a long-run relationship between the Blue Economy factors of Total Factor

Productivity (TFP), Aquaculture (AFF), and the dependant variable, which is the economic growth, represented by GDP growth rate (annual%).

Where TFP, is a measure of the efficiency with which inputs, such as labor and capital, are used to produce outputs, such as goods and services, in an economy (Mankiw, Romer, & Weil, 1992). In the context of the blue economy, TFP refers to the efficiency with which natural resources and other inputs are used to produce outputs in the ocean and coastal sectors of the economy. By increasing TFP in the blue economy, it is possible to increase the productivity and efficiency of these activities while minimizing their impact on the environment. When there is a long-run relationship between total factor productivity (TFP) and Gross Domestic Product (GDP), it means that changes in TFP tend to have a persistent and significant impact on the level of GDP over time. In other words, over the long run, increases in TFP are likely to lead to increases in GDP and vice versa (Mankiw, Romer, & Weil, 1992). Long-run relationship between TFP and GDP suggests that policies aimed at improving TFP in the ocean and coastal sectors can have significant and lasting effects on the overall performance of the blue economy. For example, improvements in TFP in fisheries or aquaculture can lead to higher yields and lower costs, which can translate into higher revenues and profits, and ultimately contribute to higher GDP in the long run.

The findings suggest that the impact of these factors on economic growth differs depending on the level of development and technology used in the fisheries sector of the analyzed countries, for example, a country with a highly developed fisheries sector and advanced technology may have a stronger long-run relationship between blue economy factors and economic growth compared to a country with a less developed fisheries sector and less advanced technology. This could be due to factors such as higher productivity and efficiency in the fisheries sector, which could lead to greater economic growth over time. On the other hand, a country with a less developed fisheries sector and less advanced technology may have a weaker long-run relationship between blue economy factors and economic growth. This could be due to factors such as lower productivity and efficiency in the fisheries sector, which may limit the potential impact of blue economy factors on economic growth.

The study found that TFP and AFF2 have a positive impact on economic growth in both the long and short runs. However, the AP variable was found to be weakly exogenous in the long run, indicating that there is no causality running from AP to economic growth.

Overall, these findings highlight the importance of the Blue Economy factors of TFP and AFF in promoting economic growth. Policymakers and stakeholders in the fisheries sector can use these findings to develop strategies that promote sustainable development and economic growth.

The findings of this study can be applied to the fisheries sector in developing countries in several ways. Firstly, policymakers and stakeholders can use the findings to develop strategies that promote sustainable development and economic growth in the fisheries sector. For example, policies that promote Total Factor Productivity (TFP) and Aquaculture (AFF) can be implemented to enhance the efficiency and productivity of the fisheries sector.
Secondly, the study findings can be used to inform investment decisions in the fisheries sector. Investors can use the findings

to identify high-potential areas for investment and develop strategies that maximize returns on investment. As the study found that Aquaculture (AFF2) has a positive impact on economic growth. Thus, investors can consider investing in aquaculture projects or companies that specialize in aquaculture, and to ensure the long-term sustainability of their investment, investors should implement sustainable practices in their operations. This may include using environmentally friendly production methods, adopting fair labor practices, and complying with local regulations.

Thirdly, the study findings can be used to inform capacity building initiatives in the fisheries sector. Capacity building initiatives can focus on promoting sustainable practices and enhancing the skills and knowledge of workers in the fisheries sector. This can help to improve productivity, increase efficiency, and promote economic growth in the sector. Overall, the findings of this study provide valuable insights into the relationship between the blue economy and economic growth. By applying these findings to the fisheries sector in developing countries, policymakers and stakeholders can promote sustainable development and economic growth while ensuring the long-term sustainability of the fisheries sector.

References:

1. Badîrcea, R.M, Manta, A.G, Florea, N.M.; Puiu, S.; Manta, L.F.; Doran, M.D. (2021), "Connecting Blue Economy, and Economic Growth to Climate Change: Evidence from European Union Countries". **Energies**, No.14,4600.
2. Bennett, N.J, Cisneros-Montemayor, A.M., Blythe, J, Silver, J.J, Singh, G.; Andrews, N, Calo, A.; Christie, P.; Franco, A.D, Finkbeiner, E.M.; et al, **(2019), "**Towards a sustainable and equitable blue economy"**, Nature Sustainability,** Vol.2(11), pp. 991-993.
3. Blasiak, R., Spijkers, J., Tokunaga, K., & Pittman, J. (2020). 'The ocean justice movement: Power, privilege, and the pursuit of a more equitable ocean future'. **Marine Policy**, 121, 104153.
4. Chatila, Jean G, , (2010), "Municipal and Industrial Water Management," in Arab Environment: Water, Sustainable Management of a Scarce Resource" **Beirut: Arab Forum for Environment and Development,** 71-90.
5. Chen, S., Bruyne, c.& Bollempalli, M., (2020), "Blue Economy: Community Case Studies Addressing the Poverty–Environment Nexus in Ocean and Coastal Management", **Sustainability 2020**, *12*, 4654, P.3.
6. Eriksen, M., Lebreton, L. C., Carson, H. S., Thiel, M., Moore, (2014). "Plastic pollution in the world's oceans". **PloS one**, 9(12).
7. European Commision, (2021), "The EU Blue Economy Report", **Publications Office of the European Union. Luxembourg.**
8. FAO, (2018), "Impacts of Climate Change on Fisheries and Aquaculture", **FAO Fishiries and Aquaculture Technical Paper No. 627**
9. FAO. (2020). The State of World Fisheries and Aquaculture 2020. **Sustainability in action. Rome**. https://doi.org/10.4060/ca9229en
10. Gall, Sarah & Thompson, R.C.. (2015). The impact of debris on marine life. **Marine pollution bulletin.** 92. 10.1016/j.marpolbul.2014.12.041.
11. Intergovernmental Oceanographic Commission (IOC) of UNESCO. (n.d.) (2023), The ocean and us.

https://www.iocunesco.org/index.php?option=com_content&view=article&id=4177&Itemid=2295&lang=en

12. Intergovernmental Panel on Climate Change (IPCC). (2021). Climate Change 2021: The Physical Science Basis. IPCC https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Headline_Statements.pdf

13. Jambeck, J.R., Andrady, A., Geyer, R., Narayan, R., Perryman, M., Siegler, T., Wilcox, C., Lavender Law, K. , (2015). Plastic waste inputs from land into the ocean, **Science,** 347, p. 768-771

14. Kandeel, A. (2019), "Freshwater Resources in the MENA Region: Risks and Opportunities" Middle east Institute Online Publication, https://www.mei.edu/publications/freshwater-resources-mena-region-risks-and-opportunities

15. Mankiw, G. & Romer, D. & David N. (1992). "A Contribution to the Empirics of Economic Growth," **The Quarterly Journal of Economics**, Oxford University Press, vol. 107(2), pages 407-437.
16. Martínez-Vázquez, R.M., Milán-García, J. & de Pablo Valenciano, J. (2021). "Challenges of the Blue Economy: evidence and research trend"s. *Environ Sci Eur 33, 61 (2021*). https://doi.org/10.1186/s12302-021-00502-1
17. OECD Website, (2022), "Oceans 2030: Financing the Blue Economy for Sustainable Development" https://thedocs.worldbank.org/en/doc/446441473349079068-0010022016/original/AMCOECCBlueEconomyDevelopmentFramework.pdf
18. Ranganathan, J., (2008), "Ecosystem Services: A Guide for Decision Makers"; **World Resources Institute:** Washington, DC, USA.
19. UN, (2017), "The Ocean Conference", https://www.un.org/sustainabledevelopment/wp-content/uploads/2017/05/Ocean-fact-sheet-package.pdf
20. United Nations University. (2013). "UN: Rising Reuse of Wastewater in Forecast but World Lacks Data on 'Massive Potential Resource.'"
21. United Nations Food and Agriculture Organization, FAO Statistical Yearbook (2014): Near East and North Africa Food and Agriculture. (Rome: United Nations Food and Agriculture Organization, 2014).

22. United Nations Food and Agriculture Organization. (2018). FAO AQUASTAT Database.

23. United Nations, Department of Economic and Social Affairs, Population Division. (2017), *World Population Prospects: Key Findings and Advance Tables - The 2017 Revision.* New York: United Nations.

https://esa.un.org/unpd/wpp/publications/files/wpp2017_keyfindings.pdf

24. World Bank, Databank. (2022), *World Development Indicators*,http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators.
https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ZQ

25. World Bank, (2021), "Blue Economy Development Program for Results"

26. World Bank Website, (2022), https://www.worldbank.org/en/programs/mena-blue-program/overview

27. World Economic Forum, (2022), "What Ocean Sustainability Means for Business" P.5