Role of Blue Economy in Economic Growth: An Empirical Analysis of Pakistan

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Role of Blue Economy in Economic Growth: An Empirical Analysis of Pakistan

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"In the Name of Allah, the most Beneficent, the most Merciful"

DEDICATION

I DEDICATE THIS HUMBLE EFFORT TO MY PARENTS, AZAD KHAN & NOOR SANNAT BIBI, WHO TAUGHT ME THAT IT'S NEVER TOO LATE TO TRY FOR ACHIEVING YOUR GOALS.

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Shaguftah Azad

Abstract

Pakistan is naturally blessed with great blue potentials but unfortunately these potentials are underutilized. The basic purpose of this study is to quantify the blue economy and then its impact on economic growth of Pakistan. The ongoing study is a time series analysis from 1972 to 2018. The crucial part of our study is quantification of blue economy. For this we construct multidimensional index of blue economy. It is ever first attempt in this regard and even in the context of Pakistan. For this, we opt 13 variables and five dimensions of blue economy. We assign equal weights to each variable in each dimension. After tackling the measurement issues of blue economy, we developed an amended form of neo-classical production function as our econometric model in which we introduced blue economy as an engine of growth to solve the growth puzzle. The other supporting independent variables are human capital, inflation, and foreign direct investment. Our dependent variable is GDP. After checking the unit root order of all variables with the help of ADF and PP unit root tests, we estimate the model through Johansen and Juselius co-integration method. We do so to estimate the long run impact of blue economy on economic growth of Pakistan. Hereafter, to check the dynamic stability of our model we estimate the VECM form of our model and also test the different diagnostics tests for our model. The results of the study show that blue economy, human capital and foreign direct investment has positive impact on economic growth in the long run while inflation is negatively related to economic growth. Study finds natural resource (blue economy) as a blessing for our economy in the long run and we can say that blue economy is an engine of growth. The study wraps up with the effective policy recommendations like sustainable coastal management, improved marine policy along with ports efficiency, tourism development and sound development of aquaculture industry to vitalize blue economy potentials successfully. The effective, intelligent and judicious use of water resources can prove to be marvelous for the economic growth of Pakistan.

Key words: Gross Domestic Product (GDP), Blue Economy (BE), Human Capital (HC), Vector Error Correction Model (VECM), Sustainable Development Goals (SDGs).

Abbreviations

ADF	**Augmented Dickey Fuller**
AIR	**Adriatic-Ionian Region**
ASP	**Agriculture Statistics of Pakistan**
BE	**Blue Economy**
BEI	**Blue Economy Index**
COPS	**Codes of Practice and Certification Schemes**
CPEC	**China Pakistan Economic Corridor**
EEZ	**Exclusive Economic Zone**
EIA	**Environmental Impact Assessment**
ELG	**Export Led Growth**
ESs	**Ecosystem Services**
ESP	**Economic Survey of Pakistan**
EU	**European Union**
FAO	**Food and Agriculture Organization**
FDI	**Foreign Direct Investment**
FMPs	**Fisheries Management Plans**
FVCB	**First Value Carried Forward**
FY	**Fiscal Year**
GDP	**Gross Domestic Product**
ILG	**Import Led Growth**
IORA	**Indian Ocean Rim Association**
IOR	**Indian Ocean Region**
KPT	**Karachi Port Trust**

LDCs	**Least developed Countries**
LVCF	**Last Value Carried Forward**
MDA	**Maritime Domain Awareness**
MDG	**Millennium Development Goals**
MPAs	**Marine Protected Areas**
MSFD	**Marine strategy framework directive**
MSP	**Maritime Spatial Planning**
OECS	**Organization of Eastern Caribbean States**
OHI	**Ocean Health Index**
PNSC	**Pakistan National Shipping Corporation**
PP	**Phillips Perron**
PQA	**Port Qasim Authority**
PSYB	**Pakistan Statistical Year Book**
R&D	**Research & Development**
SDGs	**Sustainable Development Goals**
SEA	**Strategic Environmental Assessment**
SEEA	**System of Environmental Economic Accounting**
SIDS	**Small Island Development States**
SNA	**Non-System of National Accounts**
SPS	**Sanitary and Phytosanitary**
UNCTAD	**United Nations Conference on Trade and Development**
UNDESA	**United Nations Department of Economic and Social Affairs**
UNDP	**United Nation Development Program**
UNEP	**United Nations Environment Programme**
UN	**United Nation**

VECM	**Vector Error Correction Model**
WDI	**World Development Indicators**
WFD	**Water Framework Directive**

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Chapter 01

Introduction

1.1 Introduction

The term economy is widely used in literature; it is referred to a situation where optimal allocation of resources is made between production and consumption activities. In broader perspective, blue economy is defined as the sustainable socio-economic development by utilizing the resources of blue water. It is also referred to the systematic utilization of natural resources that are living above and below the blue water. The basic objective of blue economy is the resources utilization with efficiency, minimal waste and degradation of the environment. The other economic opportunities attached with blue economy are generating new jobs, construction of new social-capital, improving the living standard and the most important to save the ecosystem(Pauli, 2011).

Oceans are the lifeline of our planet. Oceans provide economic, social, and strategic benefits in multiple ways (UNDESA, 2014). Almost seventy percent of total surface area of our planet is covered by oceans and share of blue water is almost 97% of total water reservoir(UNDESA, 2014). Oceans provide minerals, food, and keep the climate in check by generating oxygen. Moreover, blue water reduces the environmental threats via absorbing the greenhouse gases, maintain the temperature, maintain ground water level, and, serve as highways for sea-borne trade and transportation(UNCTAD, 2014). The survival of humanity is tie with survival of blue water. Blue economy approximately contributes three to six trillion dollar per annum in global economy. Approximately 3 billion people around the globe rely on seafood as their primary protein intake, while around 10 to 12 % of the population over the globe depends on seafood for their livelihood (Potts et al., 2016).

In twenty first century, we come to know many types of colorful economies like black economy, white economy, green economy, and blue economy. The basic philosophy of all colorful economies remains the same. So, blue economy is a combination of optimal allocations of resources between production and consumption of marine, species, and many other natural resources embedded in the seabed for sustainable economic growth. The term blue economy is

introduced by Gunter Pauli in 1994 (see: Pauli, (2011)). Pauli is a pioneer of blue economy. After propagating the green economy for more than three decades, Pauli proposed blue economy as an engine of growth with special focus on sustainability of environment (Pauli, 2011). Growth of blue economy is a simple idea and relatively less costly to accomplish the goals of sustainable growth. To see the importance of blue economy, we have to see the global agenda of United Nations Development Program (UNDP) in the form of Sustainable Development Goals (SDGs)[1].The Sustainable Development Agenda of 2030 is acknowledged by majority of UN member nations in 2015. This global agenda contains blue prints for peace and prosperity of this planet (Stephens & Couzens, 2016). So, we can make solid conclusion on the basis of SDGs that sustainability of environment with economic benefits is prime goal to achieve.

Naturally Pakistan is one of the important maritime states in Indian Ocean. Pakistan is naturally blessed with extended coastlines, natural harbors, unhindered sea trade, abundant marine resources and committed professional in maritime sector (Zafar, 2016). It is gifted with blue water in the form of maritime territory of 290,000 sq km and 1050 km long coastline. These maritime spaces offer good deal of prospects for Pakistan to utilize living and non-living ocean-based resources, provide much needed economic and employment opportunities for the well-being of people. The maritime sector acts as the bedrock of the national economy. Although, currently main contributor in blue economy of Pakistan is Sindh province but in the coming years paradigm will be shift to Baluchistan province, especially after functioning of the China Pakistan Economic Corridor (CPEC).

The scope of blue economy of Pakistan is vivid and it requires serious considerations for future generations. Blue economy contains various components. Fishery sector is a subsector of blue economy and it contributed in real terms in Pakistan's exports. In fiscal year (FY) 2018-2019 fishing share showed increase of 0.79% to the value addition in agriculture sector(Government of Pakistan, 2018). Pakistan is blessed with three vast and deep seaports which are great economic and strategic assets for the economy. Karachi Sea port is the busiest one and its operational performance during the second half of FY (2018-2019) stood at 35,361,000 tons, showing an increase of 13% in export cargo handled. Import cargo stood at

[1] https://www.undp.org/content/undp/en/home/sustainable-development-goals.html

24,945,000 tons, showing a decrease in imports by 22% due to the government policies to discourage unnecessary imports(Government of Pakistan, 2018).

Port Qasim is the oldest port of Pakistan and its operational performance during the second half of FY (2018-2019) stood at 36.580 million tons, showing an increase of 12.6 % in the corresponding period of last year. The export cargo handled at sea port stood at 5.287 million tons and showed an increase of 3.7 %, while the volume of import cargo stood at 31.293 million tons, showing 14.4 % increase. Total 1,139 ships in which 371 container ships and 768 non-container ships were called on Port. Gwadar Port is the third port of Pakistan. It has handled 53 ships, carrying approximately 7.156 metric tons of cargo(Government of Pakistan, 2018). It is having immense potential to be subjugated carefully.

Pakistan's maritime territory in Indian Ocean is equivalent to the province Punjab in terms of land area. In Pakistan lifesaving drugs, vegetables from sea, renewable energy (wind, solar, tide, and wave), and submarine are most trending industries. The only pitfall in proper utilization of all these valuable resources is the inappropriate technology and untrained labor force. Development of CPEC will bring positive vibes in blue economy by coastal development and tourism on Makran coast. Last but not the least, in 2017 Pakistan stood at 4^{th} position in ship recycling industry in the world. Blue economy is a token of evolution and progress in case of Pakistan's economy because of its immense maritime territory. It only needs good maritime policies and practices to harvest its potential fully and achieve economic growth through it.

1.2 Rationale of the Study

The basic purpose of this study is to analyze the situation of Blue Economy and its economic implications on Pakistan economy. The concept of blue economy is new discipline, so it requires serious considerations for analysis and planning. It is the dire need of the hour to invest in Blue Economy and harness maximum benefits from it. Pakistan may confront number of challenges while working on Blue Economy, but it should embark upon boosting its economy by focusing on maritime and other related sectors.

1.3 Significance of Study

This study is going to empirically analyze the impact of Blue Economy on economic growth of Pakistan. To know the comprehensive situation of blue economy, we construct an

index which gives us profound assessments regarding the scope and current state of blue economy in Pakistan. There is not a single study available so far, which analyzed the impact of blue economy. This sector needs dire attention, as it seems the way out to solve many serious socio-economic issues of Pakistan.

1.4 Objectives

The objectives of study are as follows:

- To develop a time series data-base multidimensional index for Blue Economy.
- Empirically analyzes the impact of blue economy on economic growth of Pakistan.
- At the end, we propose some policy recommendations on the basis of our findings as a way forward.

1.5 Statement of Problem

Pakistan is naturally endowed with blue potential because of its maritime territory. Fortunately, it enjoys an important position in Indian Ocean too. Blue economy is an underutilized concept in case of Pakistan. Its potential is more than one can even imagine. If blue economy is utilized properly, it can act as a game changer for the destiny of Pakistan. As it will play role in reducing poverty and food shortage issue, with rapidly growing population. It will open up new ways of employment generation and mineral resources significant for economic growth of Pakistan. So, keeping in mind all these factors, in this study, we are going to analyze the role of blue economy in the economic growth of Pakistan.

1.6 Structure of Study

The study will be structured into six chapters. First chapter contains introduction of study, second chapter discuss the existing literature, and, third chapter explore the quantification of blue economy issues. The fourth chapter discusses the theoretical framework, model and methodology. Empirical findings are discussed in chapter five and at the end conclusion and policy recommendation are presented in chapter six.

Chapter 02

Literature Review

2.1 Introduction

Blue Economy is an emerging branch in field of economics. In 21st century, it is acting as a substitute of green economy (Pauli, 2010). There are different definitions of Blue Economy. Even different terminologies are used for Blue Economy. Blue Growth and Blue Economy are most-extensively used terms in literature. Blue Economy is an economy that improve the quality of human well-being socially and economically, while decreasing conservational risks associated to it (UNEP, 2013). According to the World Bank, "Blue Economy is sustainable use of ocean resources for economic growth, improved livelihoods and jobs, and ocean ecosystem health[2]". Thus, this section is devoted to reviewing Blue Economy literature on national and international levels.

2.2 Literature Review

2.2.1 Review of International Literature:

Rayner et al., (2019) summarized the expected changes in ocean economy of United States. This study enhanced the understandings of the existing and probable future marine economy. The ocean economy is a diversified and large economy and having enormous potential It accounts nearly 1.5 US$ trillion value-added economic activities through the globe. This was a systematic plan to more than double its economic benefits and sustainability in a decade (2030). Delivering this much economic growth was highly dependent on ocean observations. For scientific research of ocean, consistent and sustained ocean observations played an essential role. Along with it, wide range of support was being provided to the security, operational effectiveness, and regulation of activities going in or around oceans and seas. It was because of the fact that they played dynamic role in societal and economic benefits. The study discussed already established sectors (fisheries and aquaculture, processing of seafood, ports, shipping, shipbuilding and repair, offshore oil and gas, marine manufacturing, marine R & D, maritime and coastal tourism) and newly emerging sectors (open water aquaculture, marine biotechnology, maritime safety and surveillance, deep-water gas and oil, offshore wind energy, ocean renewable

[2] https://www.worldbank.org/en/news/infographic/2017/06/06/blue-economy

energy sources, high-tech aquatic products and services). There are many challenges in collecting and benefiting from ocean observations i.e. difficult value chains, and captivating relevant stakeholders. Author recommended that certain steps can help us in achieving our goals. These steps included tracking the data providers of ocean observations, user groups of ocean observations, downloaders of the information and those who uses this data. This could help in documentation and reaching out to end consumers, in both scientific and operational sense. Ocean economy quantification is a hard nut to crack. There was no obvious way to gauge them. But using these steps can help in generating the way out to record data. Moreover, the concerned and dedicated survey of end-utilizers of ocean observations can be helpful in accumulating information about the kind of goods and service they entail, and the maximum benefit they availed by spending all available ocean observations. Investigations surveys can be conducted on wide scale with cooperation of open data boards like Australian open data system and other concerned authorities.

Mollona et al., (2019) investigated the importance of Blue economy and its role for economy of Kenya. For this purpose it defined the blue economy and its key modules to present, how Kenya can pull and influence the blue economy's backward and forward linkage with its various segments of the economy. The policy briefly explained the considerations on the vital policies that could be implemented. In this way, leverage to the blue economy will be provided for sustainable development. It will ultimately lead to comprehensive growth rate in Kenya and Eastern Africa region. Along with it, it also served as a basic structure for advance, enriched and developed policies to technically support the blue economy in the county. The blue economy has an immense potential to contribute fair share in fastest GDP growth in Kenya. Development and innovation in the coastal, maritime and marine sector could provide protein rich food, energy, transport, among other products and services, and provide sustainable development in Kenya. Extending the economy beyond traditional land based activities to its coastal, marine and maritime sectors is critical to accomplish. It is difficult to deliver smart, sustainable and inclusive Sustainable Development Goals (SDGs). It has vital importance in the context of the faster growth that the country is experiencing without any incidental reduction in poverty threat. Oceans played a key role in building up humanity's future. The potential linkage was highlighted between the blue economy, sustainable development and economic growth in 2030 Agenda for Sustainable Development. The sustainable use of fisheries, aquaculture and tourism accounts for

the sustainable marine resources use. The ocean is of immense importance as it generates economic values that are not quantified usually, such as habitat for marine and fish life, shoreline protection, recycling waste and storing, and ocean activities that effect biodiversity and climate of the region. Sustainable development and growth implies that it is commenced in a way that does not drain the natural assets for its people in the long run. In a nutshell, the balance in all socio-economic, and environmental dimensions for sustainable development is significant component of the BE. In this study, activities in line with blue economy are highlighted. There are several negative externalities attached to the ongoing activities of BE, such as over exploitation of ocean resources, habitat loss and pollution. Currently ocean waters are underperforming their true potential, in relations to food security, human wellbeing and livelihood. At the end, the author suggested institutional reforms to decrease access to resources of ocean and offer safe initiation for users to take long run stake for the natural resources. In addition to it, blue economy was defined as the significant potential of oceans to provide much more than the wide-ranging economic growth.

Wenhai et al., (2019) presented blue economy concept from international perspective. This study took China, as its center of analysis for blue economy because it's in the critical stage of transition from achieving speedy development to quality development. It gave a very clear stance for the future. With the growing increase in industrialization and population, it was the need of the hour to invest in some renewable resource, which can cope up with the increasing demand. As Blue growth expanded, the world increasingly started taking interest in accepting its importance. All research institutions and inclusive policy makers, globally became concerned for the ocean and coastal regions associated to it. They demanded improved understanding of the Blue Economy. The study focused on ideas management, monitoring, data access and availability, and product improvement. States were making choices according to their own requirements. As the world is interconnected with each other, so lack of consensus was driving the need for dialogue, to mitigate the upcoming expected challenges for the humanity. In this study, case studies were taken to carefully define and discuss fundamental concepts of Blue Economy. The article showed a worthy effort of awareness and scientific experience, collected from around the globe, by ocean observers group. It was accomplished successfully with support, inspiration and help of all concerned supporters. Authors developed consensus and presented nine successful dimensions of blue economy from the case studies taken. The ongoing study

focused on three theoretical aspects of blue economy i.e. national macroeconomic management, policy framework and technology management. The application cases included science and service based products for achieving blue economy. Authors classified all the cases in the paper into Marine industry support, pollution prevention, disaster prevention, ecological restoration and system platform. Despite being new area of study, they have validated promising search in a number of areas to see future in. They put forward useful and significant suggestions for the development of blue economy. The suggestions included heavy carrying example of sharing global duties to protect marine atmosphere, strengthen worldwide communication. It can only be made possible by participating in development skills and encouraging the formation of universal blue partnership. However, there will always remain ample room for growth and development in understanding the scope and wisdom of joint analysis and understanding. Authors suggested that it is high time to join hands, collaborate in management of these resources wisely, to save our oceans from collapse.

McCook et al., (2019) reported the governance schedules for systematic administration of marine and coastal ecosystems of Southern China, mainland China and Hong Kong. It focused on marine protected areas (MPAs) in Southern China with main modifications in the governance managements. Over the past few years, China had undergone massive industrial and economic development at the cost of severe marine and coastal environmental degradation. In South China Sea coast, there were almost 123 designated marine protected areas (MPAs) spread across the coastline, although not recognized internationally. Yet, the value of these MPAs in ecosystem conservation was extremely restricted by a familiar range of scarce resources, pressures, inadequate enforcement of law and gigantic coastline development. Contemporary development in national policy includes wide range of useful plugs i.e. integration of all endangered areas (marine also) in a single governing agency, limitations on further coastline development water pollution. Authors recommended the tactic approach of ‘eco-civilization’ to put stability and equilibrium in eco-friendly management with commercial development. If these policies were effectively executed, they will deeply change the marine environment in China, with globally significant consequences. The study recommended a whole sum of suggestions to improve MPA performance in China. It included conserving and enhancing marine capacity, amplified resourcing, reinforced by comprehensive and systematic economic valuation of ecosystem goods, services and natural capital. Upgraded definite implementation of present eco-friendly

laws and regulations, combined with advancement and modification in it. Special focus should be given to cumulative impact management, major reduction in all forms of water pollution, and incorporation of integrated marine management between South Africa Region, Hong Kong and surrounding Guangdong province. Community engagement, education and participation should be on top for achieving desirable results. Finally, to overcome the damage done already and to save future generations from its repercussions, study demanded much collaborative global community engagement with Chinese marine conservation management. It will surely provide mutual benefits in the long run.

Keen et al., (2018) conducted exploratory nature of research to develop a conceptual framework of Blue Economy. Study discussed Pacific Island and Solomon Islands Australian governments, along other regional agencies working on sustainable ocean management via proactive policies. Study analyzed the data of various review reports, literature, and regional speeches by leaders of same region. Study took three case studies i.e. fisheries sector, urban fish and a ground tuna processing. The study aimed at achieving economic sustainability, ecosystem resilience, enabling technological capacity, institutional arrangements and community engagement as important areas of blue economy. The findings showed an inequity in consideration paid to the important modules of Blue Economy and overlooked opportunity for integration across time, scale and stakeholders. Last but not the least, the conceptual framework derived was beneficial for evaluation of exercise, and helping to focus important omitted elements, mandatory for viable development of oceans. Apart from this, the proliferation in terms used for blue economy adds more complexities.

Sarker et al., (2018) highlighted the Blue Economy potentials of Bangladesh. Study took data from primary and secondary sources for empirical analysis. Primary data was taken by consultation from different stakeholders related to blue development. Secondary data was composed from policy review papers, scholarly articles and newspaper reports from governmental agencies through personal contact. They concluded that coastline and maritime resources are main modules of Blue Economy, in case of Bangladesh economy. Trade and commerce activities on the sea and shore have financial and commercial returns. Such activities had great potential for growth of blue economy. Major challenges for blue economy development in Bangladesh were identified as sea level rise, floods, tsunamis, climate, climate driven impact, pollution, human interventions and weak law enforcement agencies. A strategic

planning focusing on potential sectors of Blue Economy like knowledge generation through ocean governance, research and development are required to attain sustainable development of Blue economy in Bangladesh. Moreover, they argued that for enhancing blue growth to achieve SDGs, there should be balance between the two.

Klinger et al., (2018) highlighted the challenges and opportunities of multi sector management in Blue economy for European Union. As systematic and integrated management of multiple segments and socially optimal use of natural resources of ocean is a basic gist of blue growth. But execution of integrated management always remained an area of concern. Study took key existing sectors like (fisheries, Transportation, and offshore hydrocarbons), the newly emerging sectors like (tourism, aquaculture, and sea bed mining) and the inter-sectors interconnections in between them. Study used different methods to quantify findings like ecosystem services (ESs), ecological assessments, market evaluation, non-market evaluation and cost and benefit analysis. Global use of natural resources increased, as a result global exploitation also expanded. Many diversified sectors were interacting with each other, so integrated interactions were needed between multi-sectors to attain maximum benefits and avoid pitfalls associated with it. Study highlighted different quantification methods for interactions of sectors related to blue growth. Author recommended that it was important that cross-sector interactions were identified and incorporated into governance framework. In this way, the chance of actual realization of blue economy will surely increase.

Pauly, (2018) conducted the study for Canada. The paper aimed at discussing the history of marine fisheries, which stressed the development of industrial marines in the previous century. The study took different case studies to see history of marine fisheries. The study highlighted the fact that industrial fisheries lack the ability of sustainability, which is an important element of blue economy. In order to make fisheries a chief component of blue economy, small scale fisheries such as artisanal, recreational and subsistence fisheries were taken. It is because they can be fished with sustainability. It could be done only when care was taken to decrease motivations for building up fishing efforts. But unfortunately, they received little consideration from plan makers, as reflected by the complete lack of small fisheries clip data from the fellow countries of FAO. On the other hand, industrial fisheries were documented but they lack the feature of sustainability and compatibility with blue growth. Study concluded that small-scale fisheries possess the basic feature important for blue growth, so they may symbolize the likely

future of sustainable fisheries in the longer run. Artisanal fisheries could deliver animal protein to limited markets, specifically in country areas, hence playing vital role in fisheries sector. But they could also be sold in global markets, where they can get connected to marketing channels, dealing in quality seafood produces. In the same way, the subsistence fisheries which referred to the catching of aquatic vertebrates and fish, contribute to the food security in emerging world, specifically in the South Pacific Region. Author concluded that fisheries had a long term future in local actions secure in blue economy, the counterpart of green economy on land.

Voyer et al., (2018) took case study of Australia. The objective of the study was the intersection and interdependence of sea security and the blue economy in Indian Ocean Region. Author identified two primary connections between oceanic security interests and blue economy. Firstly, marine security was a key enabler of the flourishing blue economy. By working on maritime security, navigation routes will be safeguard. In this way important oceanographic data will be provided to concerned industries. Hence defending and acknowledging privileges over valued aquatic resources and marine activities, this came in the maritime jurisdiction of particular country. Secondly, maritime security played the role of a source of economic growth for blue economy. The expanded the blue economy, the more maritime security will be needed. As a result, it will trigger more investment and growth in these capacities. Maritime security played a vital role in blue economy and it can be seen in all sectors of Indian Ocean Region. Study developed conclusion on the basis of practices being carried out in previous studies. Author reviewed the methods in which maritime security was backing blue economy happenings in the Indian Ocean. It included use of four categories of oceans i.e. mining of non-living resources and living resources, commerce and trade in ocean and ecosystem safety. Author concluded that the ocean security and the blue economy in the Indian Ocean Region (IOR) are mutually dependent on each other. Ocean economy is having economic potential which needs maritime security to be executed efficiently. With increased Maritime security, investment will increase. In fact investment in the growth of particular industries like ship building, maritime domain awareness (MDA) will help in generating new employment and economic opportunities for Indian Ocean Region.

Clark Howard (2018) aimed at showing the role of participants in the progress of Blue growth in case of United States. Sustainable development was often misunderstood as a political

or scientific problem, but stakeholders played a special role in it. As it was the actions of the stakeholders which make or break the goals set out by international bodies and UN to achieve sustainable development. The author conducted exploratory research by interviewing a number of important actors; about how they had seen and thought that by working together 'blue economy' could be achieved. The study took fisheries, aquaculture, shipping and sustainable environment as variables. The author took examples of Uganda, South Africa, Gulf region and Maldives for Blue Economy. The study concluded that blue economy was an adaptable concept and countries could take it in a way they want, according to the blue potential of the country. But an important dimension related to the blue economy was the development and conservation of marine environment along with the economic benefits from it, which was resultantly the cause of destruction of the marine environment. The study recommended that it was high time for the consumers, industries, scientist and stakeholders to negotiate and renovate maximum economic benefit. Study highlighted resolvable issues like poverty elevation, employment generation, food sources for the increasing population and protection of marine environment. As if neglected, oceans economy won't last forever without inherent sustainability. So every sector should come forward and play their positive role in conservation of ocean economy as it was expected to get double by 2030. Things need to come in record also to be used for scientific purpose carefully.

Investigative opinions and actions about the various prospects of blue economy were discussed (Bari,2017). This paper aimed to highlight the blue economy and sustainability development agenda, while successfully harmonizing its social, commercial and conservational benefits. Study also explored the contribution of blue economy in GDP of South Asian countries. Moreover, study claimed that Bay of Bengal is a great blessing for this region. It is geographically surrounded by India, Bangladesh, Sri Lanka, Myanmar and Indonesia. In this study, fisheries, aquaculture, maritime transportation, sea borne trade, ship breaking industry, coastal tourism, marine based energy and deep-sea minerals for five coastline countries (Sri Lanka, Bangladesh, India, Maldives and Pakistan) were analyzed. Shipbuilding, shipping and ship scrapping are great sustainable economic activities discussed in the study. Study stated that in South Asian Region, particularly in Bangladesh, lack of numeric data on socio-economic values of ocean-based industries is an issue. Study concluded that oceans are economic hubs that further generate economic activities. Study recommended all endeavors to be in line with blue economy notion. Bangladesh being an important part of South Asia has enormous potential and

scope for practical implementation of blue economy but there is dire need of strong political commitments, research, public awareness and approach to raise the essential beneficial to attain long run sustainable success.

Niavis et al., (2017) evaluated the significance of maritime transportation for the society, environment and economy. The study focused to analyze the establishment and control of legal and policy framework of sea transportation. Study was developed on the basis of existing policy and value estimation methodology by focusing on the Adriatic-Ionian Region (AIR). In this way an integrated assessment tool was developed, which will help in relative valuation between sea transport and other drivers of the area. Different indicators were used to quantify the intensity of indicators used for sustainability and integration. The scoring procedure to gauge the amount of uses was based upon index principle approach. Findings suggested that marine transport was the second most vital factor of revolution in the AIR followed by tourism and recreation next. In terms of pressure on the environment, it's having the most passionate utilization among maritime coastal and marine activities established in AIR. In relations to its economic intensity, it was again the second most powerful use after tourism. Maritime transport seems to be less demanding, as jobs and occupations generated through fishing; tourism and aquaculture are more than this. Last but not the least, there was a dire need of systematic and integrated progress roadmap. It is because; many frameworks did not embrace obligatory procedures and schedules to adapt. The results served as inputs for the wide European initiative to expose marine potential and design a growth framework for Blue Economy.

Importance of Blue economy can be realized from the fact that SDG-14 of United Nations agenda is about sustainability, conservation, use of oceans resources, sea resources and marine resources for providing the economic benefits to least developed countries and small island developing states (Ninawe, 2017a). It includes sustainable administration of aquaculture, fisheries and tourism on top. Blue economy has marvelous potential of increasing the economic growth, employment opportunities and sustenance of economy in the long run. Indian Ocean Rim region is focusing blue economy more because of its increasing economic importance for the human welfare. The author states that Indian Coast supports about 30% of 1.25 billion Indian populations living there. The zone ecosystem is highly known for biological productivity because of rich fauna and flora. Ocean industries in collaboration with other large industries like

coastal tourism, maritime tourism, offshore oil and gas, shipbuilding and maritime apparatus are expanding in the area day by day, ultimately increasing economic activity in the area. There is a great potential for capture fisheries, marine aquaculture, fish processing, offshore wind, and port based activities to generate employment opportunities. The sea treasure has always been a great excitement for the public and scientific community. It provides financial service to meteorological consultancy, coastal community, submarine telecom, geo-engineering and geo-informatics.

Mulazzani & Malorgio, (2017) discussed blue economy as an important sustainable dimension in the ocean economy of Italy. The objective of the study was to retrace the meanings associated with the concepts of blue economy and blue growth. It was because both concepts were interlinked and important to achieve the worldwide sustainability of ecosystem services and sustainable environment. An example of Mediterranean Sea case study was presented too. Various social, economic and environmental variables like fishing, aquaculture, blue technology, tourism, mining, oil and gas renewable energy, shipping, passenger service, protection against flooding and erosion, habitats protection, environmental monitoring, protection and prevention of illegal movement of people and goods are taken. These variables were taken to check out the relation between blue growth, sustainability and Ecosystem Services ESs. The methodology was theoretical perspective because of lack of statistical data. So, author made an attempt to introduce the framework for the inclusion of ecosystem services also known as abiotic services for blue economy accountability with the specification of System of Environmental Economic Accounting (SEEA). This was basically done by the estimation of an adjusted net value added for blue economy which should include the depletion of natural assets and non- System of National Accounts (SNA) benefits taken from environment. Author suggested that strong academic world collaboration for the development of accepted measure of benefits, assessed as blue growth were needed. This study highlighted that though blue growth and blue economy are new and widely used terms but most misperceived terms too. Author stated ‘sustainable ocean economy’ as the most suitable definition of Blue economy.

Llewellyn et al. (2016) conducted the study for Australia. Author discussed the importance of Indian Ocean in shaping the lives, livelihood, economies and culture of the

bordering states. Indian Ocean Rim Association (IORA)[3] is an arrangement of twenty nations. IORA is hosting global economic and strategically important interests of global powers. Author took newly emerging sectors and already established sectors. Study discussed the development of fisheries, tourism, offshore oil and gas and maritime industries which has major influence on the economies of IORA. Author used case study approach to extract findings. At the end, author focused on hidden potential of IORA that must be explored. By doing this IORA would be complete economic package for emerging new sectors. But this package will be more effective if there is regional connectivity and cooperation among IORA nations. Study suggested that sharing of data, skills, knowledge, integrated planning of nations and marine policy is important for synchronized growth of blue economy within the Indian Ocean. Moreover, effective governance at national level and at industrial level within IORA region is required for the long run economic stability. The collective execution of these values will instigate Indian Ocean nations to build up their abilities and increase their sea knowledge that will support sustainable blue growth.

Patil et al., (2016) report aimed to define blue economy concept for Caribbean policymakers. As in development circles it's the emerging paradigm for ecological development of Oceans and Seas. This objective is in line with the sustainable development goal 14. The report focused on the challenges and potential opportunities for blue economy especially for countries sharing the Caribbean Sea. It's a guide for the policy makers to follow and achieve blue economy and socially equitable and sustainable blue growth. The report estimated the ocean economy value to be US$ 407 billion (2012) in the Caribbean. Global shipping through Caribbean Sea, tourism and oil and gas of the region dominated this value mainly. Study divided ocean economy into three components i.e. renewable stocks, such as fisheries, non-renewable stocks, such as sea bed minerals; and ecosystem that consist of interaction between the first two as a key unit (such as coral reef ecosystem, mangrove forest ecosystem, etc.). Growing economic activity together with human-driven changes in the ocean has deteriorated the natural capital of ocean economy. Blue economy conceptual framework was developed in which inputs received by the ocean includes natural capital of ocean economy. Blue economy conceptual framework

[3] Australia, Bangladesh, Comoros, India, Indonesia, Iran, Kenya, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Seychelles, Singapore, South Africa, Sri Lanka, Tanzania, Thailand, United Arab Emirates, Yemen

was developed in which inputs received by the ocean includes natural capital of ocean, and the outputs from that economy that affect this natural capital and the flows of the benefits that they can provide sustainably. On the basis of this policy, framework was designed. Keeping in mind the important sectors of aquaculture, marine renewable energy, nature-based tourism, fisheries, and green infrastructure, report also provide successful examples of policies being undertaken by the Organization of Eastern Caribbean states (OECS) in 2013 and Grenada case. Report recommended three core guiding principles: (a) ocean principles for guideline, direction and needed investment. (b) Reviews, success stories, discuss and adopt BE policy framework governed by a proposed set of policies. (c) Ocean strategies to sustain the transition in BE. The five strategies recommended includes: Strategy1: Measure both the natural capital and the region's ocean economy to gauge performance, Strategy 2: Integrated Management of the Caribbean ocean, Strategy 3: Invest in key public goods and sustainable growth; strategy 4: Monitor the transition properly/ systematically; Strategy 5: Repeat steps from 1-4, adapting based on experience. In a nutshell, this report would be the first step towards assessing the potential of Ocean economy, while developing policies to manage the sustainable use of ocean.

People depend on ocean for various ranges of functions like ecosystem amenities, sustaining economies and providing sustenance to people. Selig et al., (2015) demonstrated a global ocean health index framework which can be used to gauge ocean health for state of Fiji. In this way, author took developing island nation, Fiji and modified and incorporated the objectives according to its local scenario. Although such alterations did not have any significant impact on the total index value, but two among the ten goals showed significant change from the global health index framework. The study developed ocean health index (OHI) with equal weighing approach for ten goals as its indicators having sub indicators too. The ten goals taken for index were fishing opportunities, food provision, natural goods product, carbon storage, coastal livelihood and economics, coastal protection, tourism, clean water, sense of place and biodiversity. The results showed massive improvements in tourism and recreational goal. The artisanal opportunities goal showed significant increase in the model of Fiji as compare to global health index. This may reflect the current status of country in means of development priorities and national values. This study provides suitable measuring ocean health procedure for countries having data constraints. By calculating ocean health index for a set of ten goals and re-calculating marks over time, the probable tradeoffs between goals can be understood easily.

Moreover, this study helped Fiji in setting their pathways for improvements in the health of ocean. In addition to it, this study provided a useful way to gauge ocean health in data-limited countries.

Aquaculture in Europe is going through a new era of expansion (Science for Environment Policy, 2015). The study addressed the environmental implications of oceans and its ways of expansion in a sustainable manner. Aquaculture plays a vital role in food security and its economic growth. So, in its expansion to meet the growing demand, aquaculture needs to continue with sustainable environmental legislation. This research report outlined the perfect selection of water and ecological impacts of aquaculture, information on already existing and upcoming measures to mollify negative impacts. It also throws light on upgrading the knowledge gaps as it would help to improve aquaculture's sustainability. The policies presented in this report are pretty much relevant to the running EU legal requirements affecting aquaculture. The policies included Marine Strategy Framework Directive (MSFD), the Water Framework Directive (WFD), Environmental Impact Assessment (EIA), Strategic Environmental Assessment (SEA) and Directive on Maritime Spatial planning (MSP)(Science for Environment Policy, 2015). This study classified aquaculture on the basis of water, specie type and intensity and water flow. Environmental concerns recognized are organic waste and nutrient pollution, pharmaceuticals and pesticides are managed via EU policy of managing sea food contamination ecological interactions are identified like escapees, interbreeding with wild species; genetic impacts, invasive alien species, managing escapes and disease management is discussed in detail. Research indicated that some environmental pressures can be mollified absolutely, as seen as dramatic reduction in case of escapees and antibiotics use in Salmon farms Norwegian. Similarly significant improvements in efficiency level have also been reported, as in case of reduction of wild fish for feeding purpose. Moreover, the biological and technological developments will accelerate further, only if ecological interactions are systematically managed and monitored. Aquaculture is expanding day by day, so environmental sustainability should be continuously revisited for up gradation. Report proposed that Mussel hatcheries should be used as it alleviates pressure on wild stock. Scientific evidence and innovations must continue to play key role in the best performance of this sector. Applied scientific research is needed to tackle environmental problems practically. Future of aquaculture is very much relevant with updated consumer demand and policy developments. Lastly, there is dire need of careful planning of the co-location

of marine activities, like aquaculture, offshore energy and shipping, with improved spatial data. This practice would help in energy that all activities carried on can benefit from synergies and any negative ecological impacts can be reduced through early identification.

Attri, (2014) took case study of Indian Ocean Region (IOR) to provide in-depth and detail analysis of the ongoing developments and growth in the member states of IOR, with a view to recommend implementable policy framework. Member countries include India, Mauritius, Seychelles, Thailand and Bangladesh. The newly emerging paradigm of Blue Economy is inclusive of Ocean Economy, Green Economy, Marine Economy, and Coastal Economy. It has a great potential for higher and faster GDP growth scale in IOR. Blue Economy sponsors the same sort of outcomes as the Green Economy. It included human welfare, societal equity, dipping environmental risks and ecological scarcities. The study highlighted the challenges to the ocean economy i.e. unprecedented pressure from human activities at sea and shortage of time in dealing with them. The widening gap between ocean health and economic activity needs to be bridged on emergency basis; otherwise 'Blue Speak' in terms of a sustainable and ecological ocean economy may regress rather than advancing or flourishing. Author analyzed the member states of IOR in depth and concluded that there are six basic pillars of sustainable economic development i.e. good governance, vision, efficient blue management, recognized institutional and regulatory reform, technology and monitoring. On the basis of these pillars stated, Mauritius and Seychelles have made great progress in ocean economy. In fact, in Mauritius, blue economy is considered an important pillar of economic development of the country, as it contributed around 10-11% of its share in GDP. The study recommended that future policy frame-work may focus on structural collaboration, holistic approach, encouraging and training youth for the successful utilization of this resource along with bilateral cooperation at national and international level. In addition to it, new sustainable vision should be developed having cross sectorial skills, changing universities syllabus and establishing some good connections and linkages between science and society's challenges for having more practical approach. The Blue economy is an emerging and innovative concept, author suggested targeting barriers in the way of innovation first and concentrating on major sectors of it i.e. renewable ocean energy, tourism, fishing, aquaculture, shipping, sea-ports management and seabed exploration and minerals.

Kathijotes, (2013) presented to shift society on Blue Economy Models i.e. from scarcity of resources to abundance of resources. Author conducted research for Malaysia. The desired aim could be achieved only, when world starts valuing what they already have, and to start mitigating the challenges to environmental sustainability. The study mentioned the hampering factors as environmental alteration to surface and coastline waters, and subsidizes nutrient inputs, storm water discharge and municipal waste overflows, sewer overflows, urban and agricultural run-off, aquaculture; and obviously several others. Author took nutrient pollution, sea transport, coastline tourism, sea-based blue energy and blue biotechnology for study. The study recommended that administration decisions and investments that prioritize the welfare of the oceans and humanity are the need of hour, if the world wants to continue availing the profits of natural resources. Up till now, many marine natural resources are degraded by unsustainable usage, ultimately putting them at dangers. Though the application of putting 'blue economy' concept in current scenario would be a massive step, but it will be on the right path. In the prevailing scenario 'innovation', is the main word to concentrate and work upon. Marine ecosystem of the world provides basic food facility to over millions of people around the globe. It would not only help in unlocking the blue potential, but will also reduce ocean deprivation and relieving poverty.

The ocean and seas played a grave title role in supporting human well-being, by providing basic food, recreational facilities and livelihood to adaptable global climate in check. It is important to have sustainable ocean health for the well-being of mankind. For this reason ocean needs a broad and quantifiable method to size and regulate the health of attached human-ocean system. Halpern et al., (2012) created an index for all coastal countries of the world. Study took ten diverse public goals i.e. artisanal fishing opportunities, food provision, natural goods, carbon storage room, coastline livelihood and economies, coastal protection, tourism and recreation, clean water, suitable place and biodiversity for a healthy joined human-ocean activities system and calculated the index. These goals were further divided into sub goals to quantify its role in ocean economy. In constructing the index, author encountered six key challenges; identifying meek goals widely acknowledged to evaluate health of the ocean and benefits at any scale, developing models that gauge, how well each aim can be attained; describe robust reference points for model taken; incorporating sustainability of environment into the index; ensuring that the index made was quiet reactive to real differences and modifications in

ocean health; and allowing elasticity to adapt to limitations of data (or for further developments), quality and quantity. Though the index could be applied at any scale but study took global and exclusive economic zone (EEZ) scales for developing the index. The results showed overall index score out of 100. The results showed that developed countries performed genuinely better, in nearly all indicators as compare to developing countries with few exceptions. The overall index results showed that except 5% countries, all scored less than 70 on index. The index was created for global health assessment with prominent exceptions. The constructed index offered an influential tool to increase general public consciousness, resource administration, improving policy, focus scientific research and compare the status of utilization of ocean resources. This index proved to be the initial way of quantifying the health of ocean, when there was not much data available. In this way, countries can pave ways for measuring their immeasurable indicators.

Sinan & Whitmarsh, (2010) did case study of Maldives's marine fisheries. Authors aimed at deriving an estimated potential resource rent of marine fisheries of Maldives. The study discussed how its dissipation can be prohibited, the constraints and trade off faced in its application. Marine fisheries economic value can be measured by the resource rent earned. It generally showed real wealth flow for the public at large. Study used threshold and CYP model. Study estimated resource rent generated by marine fisheries of the island state of Maldives. It constituted around 27% of the present value of landings. Author used linear regression to estimate and run the model. The results showed in the paper indicated that the probable rent of the fisheries in Maldives, represents overestimated current catch value of fish. But due to economic over-exploitation this catch rate was lost. This rent was mostly lost due to open-access fishing, being practiced in the region. While to implement wealth-based approach for Maldives fisheries management, resource rent is must need to capture the rent. They argued that approach mentioned in paper is in route with the objectives of the Development Plan. It was rightly emphasized that wealth based approach are needed to confirm sustainability of marine capitals for contemporary as well as upcoming generation.

2.2.2 Review of National Literature

Laghari, (2018) highlighted the challenges and opportunities in fisheries sector of Pakistan. Secondary data are used that took data from various authentic sources, like Fisheries Department of Pakistan and FAO. The study took marine fisheries, inland fisheries and

aquaculture production variables. Fisheries are an important sector, contributing in nutrition security, national macroeconomic stability and employment generation. But unfortunately this sector had performed crucially due to overfishing, natural disasters, industrialization, climate change and environmental pollution. Therefore to meet the growing public demand of aquatic protein aquaculture species is increasing. Though aquaculture was also suffering from major challenges like change in temperature, degradation of environment, global environmental change and aquatic feed but it's the only way out to deal with the growing demand of fisheries. Pakistan is naturally blessed with about 193 freshwater fish species, and nearly 800 marine species. Out of them only 31 fresh water fish species were considered dynamic commercially and those were cultured also. On the other hand, 120 marine species were important commercially but none of it was practiced for being cultured. Therefore, the author concluded that immediate actions were required by the government and policy makers to tackle the crucial performance of this sector and take suitable measures to make it a productive and prolific sector.

Water is an important element of oceans. This asset represents blue economy of the region. As blue economy, it is achievable use of water and its resources like seas and oceans for the economic progress of a country. Zafar, (2016) took case study of Pakistan, to show blue economy impact on economic growth. Blue economy progression is immensely dependent on; agriculture, marine life, biotechnology, health, energy and recreational sector. This article aimed to find water as an economic commodity, showing blue economy and its association with other sectors in the market. It aimed to highlight the hindering factors which are hampering the blue economy growth in one way or the other. The author took secondary data from 1992-2015 for blue capital generation in Pakistan. The study had widely reviewed literature reviews and data relevant to the economic development of water carried out. This study used data collected from concerned institutions and various linked publications. Study discussed all blue economy sectors in scenario of Pakistan i.e. agriculture, fisheries, aquaculture, exports via sea, hydropower, offshore oil and gas, mangroves and tourism. Nearly all the industries running in Pakistan are directly or indirectly dependent on water. It means water is a critical input important for achieving targeted potential in blue economy in Pakistan. The hampering factors include; deterioration of water quality, over exploitation of natural ocean resources, lack of research and development and lack of awareness for harnessing of marine resources fruitfully, absence of infrastructure, inept consumption of water in agriculture sector, deficiency of reliable water

ruling system, decayed and deteriorated coastline ecosystem. The constant deterioration in coastal ecosystem is because of the inappropriate human doings, technological innovations; energy production from waste water, drugs exploration and by products from water sediments. At the end, the study gave some recommendations to overcome the barriers associated with it. Author recommended effective governance, management of scarce resources, effective irrigation, political instability, implementable policy outline, investment in water, energy and technical sectors, affordable and accessible blue capitals to the poor and under privileged people of the community, effective governing system for the abatement of synchronized gap amid all evaluation, observing and controlling department. All these recommendations are important for achieving blue economic development in case of Pakistan.

Iftikhar, (2016) highlighted the strategic importance of Pakistan in the maritime domain particularly in the ongoing project of 'Port of Gwadar'. Study aimed to show its emerging economic architecture in the region and globally. It mainly focused on China's initiative of Gwadar port in 21st century MSR under CPEC. The main objective of this development was ensuring strengthen regional connectivity in the region. The drive of this study was to critically evaluate the need to strengthen maritime security governance, particularly Gwadar Port and 21st century Maritime Silk Road. This study used mixed sort of analytical and descriptive approaches to assess the theoretical, as well as empirical evidence to gauge the significance of maritime security governance. In addition to it, it also highlighted the ways in which Gwadar Port can be badly affected by the current challenges in the Sea. On average, regionalism, constructivism and critical security studies slogans the core argument of 'strengthen maritime security governance'. Study found that the regional security is need of the time. It is important to control and regulate sea crimes by collective security and regulations. The study targeted recommendations to policy makers and academia. So that they may see maritime security governance as a coherent approach towards cooperation and security build up. Gwadar port's strategic position in the Indian Sea and in the Arabian Sea signifies its rising importance in the region. Arabian Sea is an indispensable economic artery of the region. That's why; it's acting as a maritime corridor for the security and stability of world. As major business of the world are carried through it. In addition to it, it acts as the life line for many states because many of their energy shipments and other commodities use this path. In association with it, Gwadar Port also needs an effective and systematic maritime security mechanism for secure and safe sea operations governance. The study focused on

maritime security and governance of the region, transitional crimes of the sea and international legal framework to mitigate the challenges. This study used mixed method approach by taking primary and secondary data. Primary data was taken from the speech contents, arguments of naval personnel and diplomatic personnel, conference proceedings and from newspapers. This primary source of data focused on the importance of Pakistan in the sea in context of Gwadar port- the Maritime Silk Route and the dire need to reinforce security governance in the region. Secondary data sources included relevant bibliography and journal papers to support theoretical knowledge of maritime security and present international stance on the subject. Maritime security governance is a subjective concept measured in a multi-perspective approach by observing past events in sea, transitional crimes in the sea and collective security measures of the region. The possible threats to the ongoing commercial activities in Pakistan's water specifically port of Gwadar included smuggling of terrorists, humans, weapons in commercial containers illegally, hijacking of a ships, attacks on onshore facilities e.g. LNG terminal, and an oil tanker, attacks on vessels carrying LNG and petro chemical commodities. The peace and security of the region opens up ways of economic prosperity in the region. Last but not the least; international cooperation amongst the nation is the only way to achieve the desired peace, stability and economic development.

Development, (2018) reported the current status of fisheries and agriculture sector in the growth of Pakistan. Study aimed to highlight the potentials, challenges and viable suggestions to tackle impediments in case of Pakistan. The study took fisheries, marine fisheries production, inland fisheries capture and aquaculture. The study found that Pakistan is having immense potential in its fisheries and aquatic resources but unfortunately it's not reflected in its current growth and production. The pitfall highlighted in the study included overfishing, over-exploitation of marine fisheries stock, illegal fishing, and lack of surveillance. Aquaculture downsides include low budget, institutional rivalries, and weak enforcement of legal regulatory provisions. Apart from these, there is grave issue of weak enforcement of policies, lack of integrated policies among the agricultural sector leads to benefit one sector at the cost of others, hence disturbing the sustainability of the environment. Author recommended enabling a suitable environment for growth and development, managing the marine capture fisheries for long term, supporting sustainable aquaculture for medium and short term, refining value chain performance and enhancing the benefits of an efficient fisheries sector, for economical as well as social goals.

The results of the study strongly emphasized on the skill, training and research and development as vital pre-requisite for achieving sustainable growth to overcome the deficiency of resources with increasing population.

Mohsin et al., (2015) aimed to analyze situation of fisheries and trade in case of Pakistan. Author took fish production, exports and imports of Pakistan from 1991-2010. Water asset of Pakistan is good in having diversity of marine organisms. Amid them, fish got undeniable attention. It was because of its worth from exports and revenue earning point of view. Exports and imports of any state played role of the driving force to boost country's economic status. Among trade, study took two schools of thoughts i.e. export led growth (ELG) and import led growth (ILG), for boosting economy of any country. The study took data from Fisheries and Aquaculture department (FAO), and did extensive literature review. They found that fisheries production got substantial increase from 1991 to 2010 i.e. from its production of 22,255 tons in 1991 to 82,448 tons in 2010. Apart from fish, its other types like salted or smoked, dried and frozen, have shown massive increase in production and demand too. Exports in means of quantity and value showed decreasing trend while imports statistics showed increasing trend, in the two decades taken for study. The decrease in exports over the past few years was because of the ban by EU market on seafood of Pakistan. The study stressed fisheries sector, as when production increases, exports of fish and fish related products increases too. As a result economy can enjoy a boast too.

2.3 Literature Gap

After reviewing the international and national studies on Blue economy, we find the following literature gap. No doubt, all studies made tremendous efforts to enrich the literature of this emerging discipline in economics. Kathijotes, (2013) puts formula of transition from shortage of resources to plenty and confronting ecological hazards on the forefronts, (Mulazzani & Malorgio, 2017) headfirst tracing the definition of Blue economy and sustainable management of ecosystem. Keen et al., (2018) developed theoretical framework of blue growth for marine management. Clark Howard, (2018b) discussed the vital role of stakeholders and other participants in blue growth. Sarker et al., (2018) presented organization framework of blue economy that it needs combined global struggles to enhance blue growth and attain SDGs, (Halpern et al., 2012;Selig et al., 2015) helped to quantify ocean health via Ocean Health Index

(OHI) for countries having data constraints. Many of those studies were totally of qualitative nature. But we cannot find a single study which constructs the index of Blue economy over the time with multiple dimensions and concerned indicators. Moreover, we estimate the role of Blue economy on economic growth of Pakistan. We make conclusions and some policy suggestions on the basis of quantitative analysis. This study opens the new avenues of research. The future of Blue Economy is bonded with the success of CPEC projects. It's blue economy of Pakistan that can gain maximum economic benefits. In addition to it, strategically its importance cannot be denied for the future of human well-being.

Chapter 03

Quantification of Blue Economy of Pakistan

3.1 Introduction

Measurement of blue economy is a hard nut to crack due to unavailability of appropriate data especially in developing nations. South Asian countries have recently started working on Blue Economy. First of all, there is a great confusion on the definition of blue economy. There is no generally recognized meaning of blue economy. Mulazzani & Malorgio, (2017) define the meanings of blue growth and blue economy with special focus to bring coherence between academic literature of blue economy, and ecosystem. The statistical aspects to quantify the blue economy are going to be discussed in proceeding sections of this chapter.

According to our best knowledge, there is not a single study that develops the index for blue economy in case of Pakistan. So, this study is driving to integrate five various dimensions to develop an index. Common and individual indicators are taken after normalizing the data. This index can also be used to compare the real situation of blue economy overtime. Index shows the present situation of blue economy. This newly developed index uses positive and negative indicators to capture the net effect. Moreover, all indictors are in quantitative form and data is obtained from various authentic sources.

The real issue associated with blue economy is its measurement criteria. First of all, how can economic activities of blue economy are sorted out from other types of economic activities? How can one identify and gauge that the blue economy is contracting or expanding with the passage of time? How will it be known that whether blue economy is moving towards or away from the perfect balance of ecosystem and its economic uses? How will new technologies, innovations and inventions affect changes in the natural composition of blue economy? Without spatially consistent robust data set to provide significant answers to these queries, the blue economy will serve as a destination forever lying just above the horizon, towards which no obvious course can be charted in anyway (Colgan, 2016).

In this study, we are going to construct the blue economy (BE) index by using various indicators that are used in literature (Bari, 2017;Niavis et al., 2017;Laghari, 2018) and some new

additions of proxy variables for blue economy index. Table 3.1 shows Multidimensional Blue Economy Index. It includes 13 indicators taken as proxy for 5 dimensions taken in the study. The table also shows the hypothesized effects of these indicators on dimensions.

Table 3.1: ***Multidimensional Blue Economy Index***

	Dimensions	**Indicators**	**Hypothesized Effects**	**Data Source**
BLUE ECONOMY INDEX	***Fisheries***	Inland Fisheries Production (metric tons)	+	ASP[4]
		Marine Fisheries Production (metric tons)	+	ASP
		Inland fishing crafts	+	ASP
		Marine fishing crafts	+	ASP
	Aquaculture	Aquaculture	+	WDI[5]
	Shipping	International Shipping Entered at Karachi Port	+	KPT[6]
		International Shipping Entered at Port Qasim	+	PQA[7]
		No. of vessels	+	PNSC[8]
		Deadweight tons (Million Rupees)	+	PNSC
	Trade	Exports Cargo handled at Sea ports (000 tons)	+	KPT & PQA
		Imports Cargo handled at Sea ports (000	+	KPT &

Sources of Data: [4]Agricultural Statistics of Pakistan, [6]World Development Indicators, [7]Karachi Port Trust, [8]Port Qasim Authority, [9]Pakistan National Shipping Corporation, [10]Economic Survey of Pakistan.

	tons)		PQA
	Fish & Fish Preparations exports(Million Rupees)	+	ESP[9]
Environment	Total Co2 emission	-	WDI

3.2 Methodology

We adopt simple and transparent methodology. The framework of the BE index has been constructed using five main pillars of blue economy: a) fisheries, b) aquaculture, c) shipping, d) trade, and e) environment. These five dimensions are comprised of 13 indicators. Data from diverse sources are combined into composite BE index. Each dimension measures different aspects of blue economy.

3.2.1 Technical Assumptions

All indicators of dimension shipping miscalculate shipping by certain quantity. It is because the indicators taken in study come from different sources i.e. International shipping entered at Karachi port from Karachi port trust, International shipping entered at Port Qasim from Port Qasim authority, number of vessels and deadweight tons from Pakistan national shipping corporation, so there is no obvious reason to assume that when one indicator overrates shipping by some amount, the other indicator of a dimension will do the same. It is assumed that the errors will cancel out each other when the indicators are aggregated overall. The more number of indicators are added to a dimension, the more likely it is that the errors sum equal to zero. The same strategy goes for all dimensions taken in the index. Data discrepancy problem is attached with aggregation data. So, here we never entertain the data discrepancy issue at all and move forward as it is. At the end, when we add more variables along their discrepancies, definitely it might enhance the problem in index. Statistical discrepancy might be adjustable, when we know the data generation procedure.

3.2.2 Measurement selection and criteria for inclusion

Some variables that are part of index have some missing observations. To ensure continuity, it is necessary to impute the values. So for the sack of precision and accuracy the linear interpolation is the best method of imputation for filling the missing data (BP, 2015).

The interior missing values are generated with formula given below (BP, 2015). For exterior missing observation of a time series, previous observation from that particular time is considered the best approximation. Hence, exterior missing values are generated with the nearest observation by last value carried forward (LVCF) or first value carried backward (FVCB) (BP, 2015). Linear interpolation can be shown as follows:

$$x_2 = x_1 + (t_2 - t_1) * \frac{x_3 - x_1}{t_3 - t_1} \quad (3.1)$$

Where, x_2 be the value of a variable in year t_2. If the data for variable in time t_2 is missing, and there are data for the preceding year t_1 and the following year t_3, whereby t_1 and t_3 are the nearest years to t_2 with the property that $t_1 < t_2 < t_3$.

3.2.3 Normalization

The data of our concerned variables are collected from various sources and each variable has different unit of scale. While mostly variables, as move forward bring positive impact on blue economy while other has negative (e.g. inland fisheries production higher score is better, but carbon dioxide emission high score is worse). To address this issue, we have to normalize all indicators after doing so they can provide us meaningful results. Normalization of data of variables is prerequisite before combining them. Each variable is normalized by using the min-max method. The beauty of this method is that it provides an order conserving the linear change of the data. In such a way that maximum value of series obtains the highest score and the minimum value gets low score.

As our BE index uses 13 indicators with different scales, directions, and magnitudes. So, our first task is to de-scale all these indicators in order to make a homogenous unit scale of index of blue economy. For this purpose, we employ the following two formulas (Khan, & Ullah, 2014; Wang, Wang, Li, & Wei, 2015). The min- max normalization method subtracts the actual value from minimum value of the entire series of specific variable and then divides by the range of the variable series. The value of each indicator in a particular year where the polarity of the raw data is 'higher score is better' are transformed as follows.

$$x = 100 * \frac{actual\ value - minimum\ raw\ value}{Maximum\ raw\ value - minimum\ raw\ value}$$

$$X_t^i = \frac{x_t^i - Min x_t^i}{Max\ x_t^i - Min x_t^i} \qquad \text{Benefit} \quad (3.2)$$

If the polarity of the raw data is 'higher score is worse', the formula must be altered as equation 4.3. In which good performance is shown by high values and low values good presentation for others, so we subtract this whole sum from 100. In this way, the best performer will always take highest values and the worst performers will always get the lowest values (Gisselquist, 2014).

$$x = 100 - 100 * \frac{actual\ value - minimum\ raw\ value}{maximum\ raw\ value - minimum\ raw\ value}$$

$$X_t^i = \frac{Max x_t^i - x_t^i}{Max\ x_t^i - Min x_t^i} \qquad Cost \qquad (3.3)$$

Where in equation (3.3) capital $X_t^i$is normalized value and x_t^i is actual value of *x* variable at year't' and, '*i'* represents the indicators (i.e. *i* =1,2,…13). The modified and normalized variable X_t^i is unit scale and dimension free and its value lies between zero and one. This method of normalization allows all values to be in unit less form. After normalizing the indicator, we simply multiply it with hundred. So, now its value lies between zero to hundred. In which zero shows worst performance and hundred shows best performance. By doing so, meaningful comparisons can be made between variables, dimensions and even sub-dimensions (Khan and Ullah, 2014; Gisselquist, 2014; BP, 2015). Moreover, in this way data is not affected by the skewed values and no assumptions about the distribution of data can be made (BP, 2015).

3.2.4 Aggregation and Weighting

Next task is to allot weight to each indicator. Again, there are diverse opinions regarding the allocation of weights depending upon the objective of measurement (Greco et al., 2019). Here, we use equal weights for indicators in each dimension and equal weight for dimensions of blue economy index. Although, there are number of different method regarding assigning the weights. But it vary from study to study and no exact set standard for aggregation in composite indices (Greco et al., 2019). After allotting the equal weights, linear aggregation method is used for final index value. Due to its advantages in form of simplicity, transparency and accessibility, equal weight method is used (Greco et al., 2019; BP, 2015; Gisselquist, 2014) . Moreover, assigning equal weights to five dimensions of the BE index is implying that we give equal importance. For example, fisheries are composed of four underlying indicators (a) inland fish production, b) marine fish production, c) inland fishing crafts and d) marine fishing crafts). While shipping is an aggregation of four indicators (a) international shipping entered at Karachi

Port, b) international shipping entered at Port Qasim, c) number of vessels, and 4) deadweight tons), each having equal weight of 1/4 (BP, 2015). Last but not the least, all indicators taken as a representative of dimension is based on literature (See also: Laghari, 2018; Klinger et al., 2018; Bari, 2017; Llewellyn et al., 2016) and data that are available in case of Pakistan.

Table 3.2: ***Weight Distribution & Results of Correlation between BE Index & Dimensions***

	Dimensions	Indicators	Correlation between BE & Dimensions
BLUE ECONOMY INDEX	***1/5 Fisheries***	Inland Fisheries Production Marine Fisheries Production Inland fishing crafts Marine fishing crafts	0.742
	1/5 Aquaculture	Aquaculture	0.992
	1/5 Shipping	International Shipping Entered at Karachi Port International Shipping Entered at port Qasim No. of vessels Deadweight tons	0.877
	1/5 Trade	Exports Cargo handled at Sea ports Imports Cargo handled at Sea ports Fish & Fish Preparations exports	0.984
	1/5	Total Co2 emission	-0.935

Environment	

Table 3.2 shows weight distribution and results of correlation between BE Index and its dimensions. The table 3.2 shows positive correlation of BE and its dimensions fisheries, aquaculture, shipping and trade and negative correlation of BE with environment.

Table 3.3: ***Weight Distribution in Indicators***

	Dimensions	Indicators
BLUE ECONOMY INDEX	***1/5 Fisheries***	1/4 Inland Fisheries Production
		1/4 Marine Fisheries Production
		1/4 Inland fishing crafts
		1/4 Marine fishing crafts
	1/5 Aquaculture	1/1 Aquaculture
	1/5 Shipping	1/4 International Shipping Entered at Karachi Port
		1/4 International Shipping Entered at Port Qasim
		1/4 No. of vessels
		1/4 Deadweight tons
	1/5 Trade	1/3 Exports Cargo handled at Sea ports
		1/3 Imports Cargo handled at Sea ports
		1/3 Fish & Fish Preparations exports
	1/5 Environment	1/1 Total Co2 emission

3.3 Explanation of Dimensions

For better understanding the chemistry of BE index, we must analyze each dimension separately and further divide each dimension in the form of indicator. As in table 3.1, we write

down the hypothesized effect. In following sections, we will discuss the dimensions and indicators mentioned in table 3.3 in detail.

3.3.1 Fisheries

Pakistan is the sixth-most populous country in the world with inhabitants of approximately 210 million people. A great share of people in Pakistan are dependent on fishery, agriculture and other natural resources (Development,S. 2018). Fisheries as a dimension is our first segment of BE index. It is production and capture of aquatic organisms in coastal, marine and inland areas. Marine and inland fisheries provide food, nutrition, sports, and recreational activities. It is also a source of employment of 820 million people around the globe. They are engaged in harvesting, processing, marketing and distribution of fishes and its related products (see: FAO, 2016). Fisheries is the main indicator of Blue economy taken in literature studied so far (like: Klinger et al., 2018; Bari, 2017; Llewellyn et al., 2016).

Only fisheries contribute about 0.4 percent of GDP. In 2015, inland capture fisheries produced 132,500 tons of fish, while marine capture and aquaculture accounts for production of 360,000 tons and 151,000 tons, respectively. Fisheries are an important economic activity for the country from employment point of view. It directly employs a reported sum of 390,000 people across the country. When alternative jobs, such as processing of fish, transporting and retailing are measured, the number of employment rises to between 900,000 and 1800,000 jobs in lump sum. In food trade community, fish is the most traded food product. World have shown increase in capture fisheries production from 1970 to 1990, then it stayed roughly constant. World capture production increased from 70 million tons to 93 million tons from 1970 to 1990 (Development,S. 2018).

Table 3.2 shows the quantitative relationship in the form of correlation between dimensions and BE index shows a high positive association between fisheries and blue economy index (0.742). Table 3.3 shows the dimension of fisheries has further four indicators i.e. a) inland fishing production, b) marine fishing production, c) inland fishing crafts, and d) marine fishing crafts) and each indicator have equal weight ¼ . In following lines, we are going to explain each indicator.

Inland fisheries are fishing operations taking place in freshwaters for commercial purpose. Some of this fishing is considered capture fishing too, where the fish is living in natural water (Gisselquist, 2014; BP, 2015). There is another type of inland fishery in which fish are raised in tanks or ponds and mostly used for food purposes. Inland capture fisheries and small scale aquaculture are found throughout the country. The data of inland fisheries are taken from (Agriculture Statistics of Pakistan, 2018). It is measured in thousand tons. The hypothesized effect of this indicator is positive on BE index. It is because; it enhances the economic activity in various food related industries.

Marine fisheries production includes the fishing operations taking place in all the oceans and seas of the world, including estuaries and bays. The marine fisheries sector is an important economic trailing for individuals living along the coastlines of Sindh and Baluchistan. Despite being an important sector, it is not performing up to the mark. Pakistan's marine capture fishery has shown a reduction in per-unit value and in its overall production since the 1990s. Pakistan's Marine fisheries are overfished and depleted. If continued with the same pace of fishing, it will harm marine fisheries production to an alarming level (FAO, 2016). There is a gradual decrease in production of fish while on the other side total fishing effort (time spent in fishing and harvest capacity of the fishing fleet) has shown massive increase. As a result, sector's profitability is undermined and costs are too high. This also has adverse impact on fishing by shrinking resource base beneath the water bed.

The capture and culture of fish and other aquatic organisms in saltwater accounts for number of fishery products that reached in the global markets. While, inland fishing crafts uses sail boats and row boats as a platform for fishing operations. It carries the basic crew and fishing gears that are important for the effective operation. The data of these two indicators are also taken from (Agriculture Statistics of Pakistan, 2018). It is also measured in thousand tons. The hypothesized effect of two indicators are positive on the BE index.

Marine fishing crafts uses sail boats, trawlers, gill netters and mechanized sail boats for fishing operations carried out in seas, estuaries and bays of World. The data is taken from (Agriculture Statistics of Pakistan, 2018) for the period from 1972 to 2018. It is measured in numbers. The hypothesized effect of this indicator is positive on the BE index.

Pakistan is having great potential for its fisheries and aquatic resources but unfortunately it's not replicated in current production, value and growth. This segment has immerse potential to show in terms of decent jobs creation generation, boosting export revenues, improving nutrition and food security, supporting livelihoods in coastal regions and decreasing important economic gender inequality issues. The government of Pakistan has finally recognized its potential and their missed opportunities. It has shown esteemed desire to work in increasing the contribution of fishery sector towards achieving the missing opportunities.

Pakistan's Marine resources are depleting at an alarming rate. If this alarming trend continues, its major commercial species groups including pelagic fish, shrimps and demersal will show substantial decline in total stock size. Indirectly it will undermine the valuable harvests that they are supposed to support. This practice could be reduced and reversed vita effective and improved management. If overfishing is controlled, the trend could be reversed, maintaining the present production quantities and growing the worth of that limited production. This will create the scenario of too many boats trying to catch too few fish, as a result overfishing will be reduced and profits will increase. Expected combine gains from increase in massive fish production and cost reduction are narrowly estimated to be somewhere around US $ 400 million and US $ 1200 million worth over 30 years (Development,S. 2018).

3.3.2 Aquaculture

It is second dimension of BE index. Aquaculture refers to the run-through of raising seafood in an artificially organized environment. This practice has been going on in the world for thousands of years. Aquaculture is another important indicator of Blue Economy as per literature (Klinger et al., 2018; Ninawe, 2017). Aquaculture is a diversified concept but in Pakistan it is limited in its variety and extent. Country has plenty of fresh and brackish water resources. Mainly the industry is dominated by carp, small quantities of tilapia and trout. Pakistan is lagging behind in aqua culture production among the south Asian nations. In fact Marine and coastal aquaculture e.g. shrimp farming have no existence at all. Though, it enjoys good agro-climatic conditions but even then ranks 28^{th} in means of aquaculture. Its two neighbors Bangladesh and India comes in the domain's top five leading aquaculture-generating countries. Despite strong global demand for aquaculture, Pakistan's aquaculture evolution rate accounts for about 1.5% per year over the past five years.

Aquaculture is a highly demanded sector globally. It has shown massive growth from less than 5 million tons in 1970 to almost 73 million tons in 2014 (FAO, 2016a), meeting the extended demand in growth, keeping the increase in demand and world's expected population rise to almost 9 billion in the near future, the demand for fish consumption by increasing incomes, this demand will continue to increase with same pace. Keeping this in mind, it can be easily predicted that this increase in population will increase opportunities for countries having proficient oceans and proficient aquaculture industries.

In modern era, among seafood production, aquaculture is on one of the fastest drive in growth, in the world. It is naturally understood that naturally fisheries production have off and on limitations on its capture and availability in some specific months of the year. So as an alternative, aquaculture can be used as a provider of great and reliable quantities of seafood and specifically fish. The current protein demand also gets fulfilled to a great extent by the aqua-cultural stocks available such as Salmons and Oysters. Aquaculture has an immense role in the economy also, as it provides thousands of jobs in operations and ancillary services. For sure aquaculture is having undeniable benefits, such as the facility of good quality and easily reachable food for the rapidly growing population, the source of job generation and export budget for the developing countries. But the action is heavily criticized worldwide. It is because of the negative environmental impacts associated to it (Martinez-Porchas & Martinez-Cordova, 2012).

For instance destruction of the Natural ecosystems by conversion of Mangrove forests to aquaculture farms, acidification of soil, water pollution for human consumption point of view, organic enrichment of water by non-consumed feed, decomposition of died organisms, and over fertilization, introduction of exotic species in natural ecosystem, inadequate medication having negative ecological impacts. Sustainable aquaculture is the best response to all negative environmental impacts associated to it. One should select correct sites for farming species; use of the best feed for species in feeding practices; use of bioremediation systems; reducing the requirement of fish oil and fishmeal; adequate effluents management; achieving compliance certificate with sustainability, improving research and legislation culture related to the evaluation and solutions for aquacultures impacts. The selection of native species instead of exotic species, best possible knowledge about the biology and the ecology of the organisms that is supposed to be cultivated, feeding habits and nutritious requirements, acceptance to environmental

parameters are important for sustainable aquaculture. Last but not the least, species from a good market, on good prices should be selected for farming purpose on commercial basis (Martinez et al., 2012). It is the farming of marine organisms, including fish, molluscs, crustaceans and aquatic plants (FAO, 2016). Farming implies intervention in the rearing process to enhance production. The data is taken from (WDI, 2018) and its unit scale is Metric tons. The hypothesized effect of this indicator is positive on the blue economy index. The quantitative relationship in the form of correlation between Aquaculture dimensions and BE index, table 3.2 shows a high positive association (0.992). Pakistan is having poor quality control and out dated processing technologies in post-harvest processing too. Lower grade products such as fishmeal are focused. A very restricted volume for the high-quality products and specialized processing inhibits its access to profitable export marketplaces of the world. Currently it is having poor Sanitary and Phytosanitary (SPS) conditions. EU has imposed ban on its imports for several years. This ban has restricted its access in markets. Exports appear to be plateau, with US $ 350 million annually in recent years (Development,S. 2018).

3.3.3 Shipping

Now, we move towards the backbone and cheap source for global trade. It refers to the process of transporting goods or cargo as a business, especially on ship or vessels. The quantitative relationship in the form of correlation between dimensions and blue economy index in table 3.2 shows a high positive association between shipping and BE index (0.877). Table 3.3 shows the dimension of shipping is further divided into four indicators (a) shipping entered at Karachi Port, b) shipping entered at Port Qasim, c) number of vessels, and 4) deadweight tonnage) and having equal weight of 1/ 4 for each indicator respectively. In following lines, we are going to explain them one by one.

International shipping entered at Karachi port refers to the statistics calculated monthly and compiled from the returns of Karachi port (Government of Pakistan, 2018). It provides information about the number of tonnage of vessels entered and cleared with cargo in Karachi port. The data is taken from (Government of Pakistan, 2018) and measured in thousand tons. The hypothesized effect of this indicator is positive on the BE index.

International shipping entered at Port Qasim refers to the statistics calculated monthly and compiled from the returns of Port Qasim. It provides information about the number of tonnage of vessels entered and cleared with cargo in Port Qasim (Government of Pakistan,

2018). The data is taken from (Government of Pakistan, 2018). It is measured in thousand tons. The hypothesized effect of this indicator is positive on the BE index.

Number of vessels refers to the number of vessels or crafts for travelling on water, used for exchange of cargo from one country to another. The hypothesized effect of no. of vessels is positive on blue economy. The data is taken from (Government of Pakistan, 2018).

Deadweight tonnage refers to the carrying capacity of vessels. The deadweight tonnage normally includes everything like cargo, passengers, crew and all the provisions except the weight of the ship itself. The data source and time spam are still same and this indicators is measured in thousand tons. The hypothesized effect of this indicator is positive on BE index as shown in table 3.1. It is one of the cheapest sources of transportation as compare to air and land transport. Blue economy is highly dependent upon shipping, keeping in view the sustainability of the environment (Niavis et al., 2017).

3.3.4 Trade

It includes the exports and imports cargo handled at the seaports by crafts, vessels or in ballast or containers at Karachi Port and Port Qasim. It includes the buying, selling or exchanging commodities, at either wholesale or retail via sea (Government of Pakistan, 2018). The relationship in the form of correlation between dimensions and BE index shows a high and positive correlation between trade and BE (0.984) as per table 3.2. Trades and commerce related to the sea and coast, and protection from natural disasters also have economic returns having great potential for enhancing blue economy growth (Sarker et al., 2018; Mohsin et al., 2015). The dimension of trade as shown in table 3.2 further contains three indicators i.e. a) exports cargo handled at seaports; b) imports cargo handled at seaports, and c) fish and fish preparations exports). Each indicator has equal weight. In following lines, we are going to explain them one by one.

Exports cargo handled at seaports is an indicator of the dimension trade. The data of exports cargo handled at Karachi Port Trust (KPT) and Port Qasim trust are included in it. The data is taken from (Government of Pakistan, 2018). It is measured in thousand tons and its hypothesized impact on the index is positive.

Imports cargo handled at sea ports is an indicator of the dimension trade. The data of imports cargo handled at KPT and Port Qasim trust are included in it. The data is taken

from(Government of Pakistan, 2018). It is measured in thousand tons and its hypothesized impact on the index is positive.

Fish and fish preparations is an indicator of trade. It includes the fish, frozen products of fish, canned fish and processed fish used for trading in between the countries and within the country (Mohsin et al., 2015). It is measured in million rupees and its hypothesized effects are positive on the index as depicted in table 3.1.

3.3.5 Environment

Environment is an important component of BE index. Since Blue economy states the sustainable socio-economic utilization of oceanic resources without disturbing the health of the ocean. In case of Pakistan, there is no exact variable available for gauging the health of the ocean. So, as proxy carbon dioxide emission is taken as environment disturber. The quantitative relationship in the form of correlation between dimension and BE shows a high and negative value between environment and BE index (-0.935) as per table 3.2. In Table 3.3 the dimension of environment contains only one indicator that is carbon dioxide emission. Carbon dioxide emissions are those pollutants emerging from fossil fuels burning and the manufacture of cement. It incorporates effect of carbon dioxide produced, consumption of solid, liquid, and gas fuels flaring (WDI, 2018).

Table 3.4 shows the average of the dimensions results into BE Index in Pakistan for the period of 1972-2018.

Table 3.4: ***Blue Economy Index of Pakistan***

YEARS	BE INDEX	YEARS	BE INDEX
1972	25.096	1996	29.715
1973	25.469	1997	30.973
1974	30.374	1998	30.777
1975	25.818	1999	31.907
1976	30.804	2000	29.114

1977	27.325	2001	36.807
1978	27.137	2002	39.054
1979	28.445	2003	39.996
1980	30.494	2004	41.952
1981	29.566	2005	43.536
1982	28.279	2006	49.228
1983	28.835	2007	53.789
1984	27.669	2008	57.842
1985	29.257	2009	57.933
1986	29.027	2010	57.470
1987	29.097	2011	54.106
1988	28.579	2012	56.244
1989	29.073	2013	56.597
1990	30.092	2014	57.038
1991	32.238	2015	57.489
1992	30.298	2016	56.453
1993	30.608	2017	56.993
1994	32.925	2018	57.269
1995	29.246		

3.4 Challenges to the Blue Economy Dimensions

Following are the challenges associated to the dimensions of Blue Economy:

1. The serious challenges in the fisheries sector include mistreatment of marine fisheries stocks. Due to this mistreatment by over exploitation, fishing convoys are overcapacity too; illegal fishing methods are in practice, and lack of surveillance and certifying. There is a gradual decrease in production of fish while on the other side total fishing effort (time spent in fishing and harvest capacity of the fishing fleet) has shown massive increase. As a result, sector's profitability is undermined and costs are too high. This also has adverse impact on fishing by shrinking resource base beneath the water bed.
2. Inland fisheries are expected to have low production, poor social and livelihood results; this is generally due to shrinking mandatory provisions between administrators and resource users.
3. The biggest encounter to the aquaculture include the systematic scarcities that are running in biosecurity: guarantee facilities, observation and limited diagnostic capacity in animal health. Unfortunately, Pakistan is not able to maintain its aquaculture industry. It has done nothing to fulfill international obligations regarding fish diseases; as a result private investors are reluctant to place funds in this industry. If post-harvest activities are considered, from landing facilities to processing facilities, all are having poor sanitary conditions in the supply chain. There is dire need of capital investment in both industries i.e. particularly in aquaculture industry, and value addition industry (Development,S. 2018).
4. Pakistan is having poor quality control and out dated processing technologies in post-harvest processing too. Lower grade products such as fishmeal are focused, hence limited access to the certified processing units. This put limits to its open access to profitable export markets. Currently it is having poor sanitary and phytosanitary (SPS) conditions. EU has imposed ban on its imports for several years. This ban has restricted its access in markets. Exports appear to be declined in recent years (Development,S. 2018).
5. Pakistan exported fish worth quiet low price in the world market because it's unprocessed or mostly it's targeted towards low-value market segments. Currently, the world's biggest seafood market includes EU, Japan and United States. Unfortunately these High-value markets accounts for negligible share of Pakistan. It hardly accounts for less than 3% percent of export earnings from fisheries sector of Pakistan (Development,S. 2018).

6. The running pitfalls in the fisheries aquaculture industry and value addition industry are greatly hampered by low budgets, institutional rivalries, and weak enforcement of legal regulatory provisions. The fisheries administration bodies and strategic planning bodies capacity is limited. Under the constitutional reform process in Pakistan, the delegation of duties from the Federal to Provincial and Territorial level has made effectiveness of execution and coordination of policies and management more difficult.

3.5 Correlation Analysis

It shows the cause and effect association between variables. In case of BE index, all dimensions having strong correlation are used. The correlation between BE and average of fisheries is 0.742 which shows that fisheries have strong positive correlation with BE index. In the same way, the correlation between average aquaculture and BE index is positive and its magnitude is 0.992, which shows significant impact of aquaculture on BE. Average shipping has correlation of 0.877 which means that shipping has significant impact on BE index. Average trade and blue economy also shares a significantly strong relationship as correlation of trade and BE index is 0.984. Last but not the least, average environment shows significant negative correlation with BE index as its magnitude is -0.935.

Table 3.5: ***Correlation Analysis***

Correlation	BE	Average Fisheries	Average Aquaculture	Average Shipping	Average Trade	Average Environment
BE	1.000					
Average Fisheries	0.742	1.000				
Average Aquaculture	0.992	0.728	1.000			
Average Shipping	0.877	0.442	0.867	1.000		

Average Trade	0.984	0.774	0.978	0.812	1.000	
Average Environment	-0.935	-0.894	-0.941	-0.732	-0.958	1.000

3.5.1 Correlation

It is a statistical tool of measurement. It measures the association between two or more variables. When two or more variables correlate with each other, it means they vary together. It shows the degree to which variables vary together. There are two types of correlation, positive correlation and negative correlation. Positive correlation indicates the extent to which two or more than two variables increases or decreases in parallel way. A negative correlation shows the extent to which two or more variables have inverse relation with each other. When one variable rises, the other variable falls.

3.6 Comparison of trends between indicators and BE index

The graphical representation of comparison of trends between indicators and BE Index via correlation of average of all dimensions is as follows:

3.6.1 Comparison of trends between Average Fisheries and BE Index

Average fisheries and BE index are positively associated with each other. Both variables are showing increasing trend. It can be said that with increase in average fisheries, BE index is also shows increasing trend. From 1972 to 1999, Fisheries and Blue Economy shows increasing trend. In year 2000 fisheries showed a sudden decrease and then increasing trend again. Same trend was shown by Blue economy too.

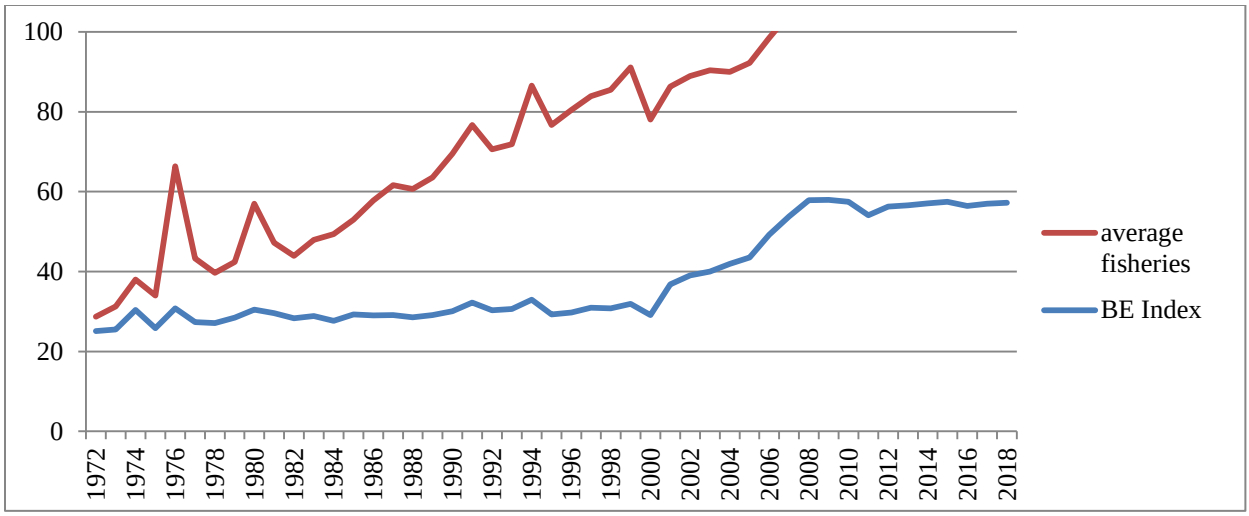

Figure 3.1: Correlation between average fisheries and BE Index

3.6.2 Comparison of trends between Average Aquaculture and BE Index

Average aquaculture and BE index are positively associated with each other. Both variables are showing increasing trend. It can be said that with increase in average aquaculture, BE index also shows increasing trend. It can be clearly seen from the graph that after 1999 average aquaculture showed gradual increasing trend and BE index also showed increasing trend after 1999. This shows positive correlation and association between average aquaculture and BE index.

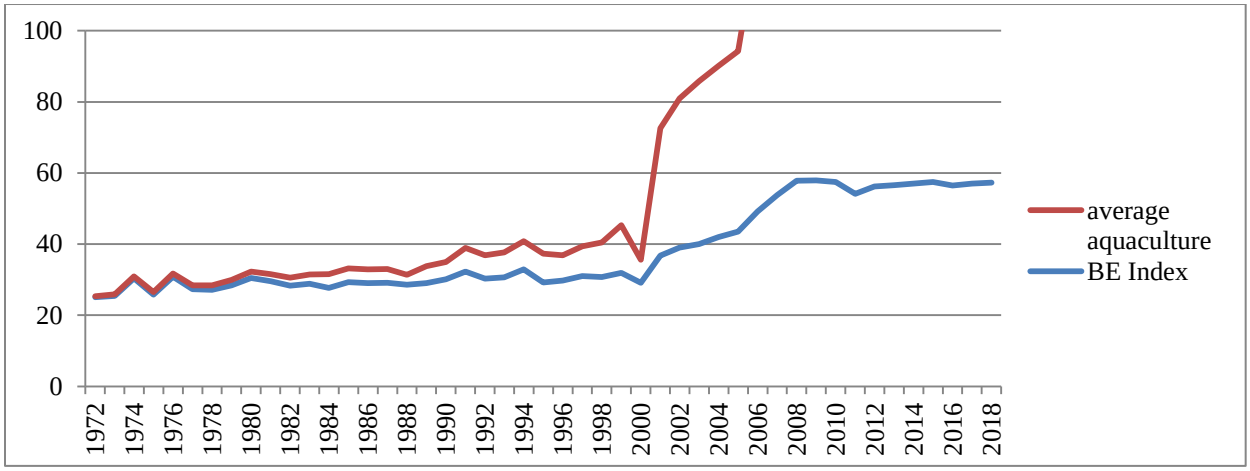

Figure 3.2: Correlation between average Aquaculture and BE index

3.6.3 Comparison of trends between Average Shipping and BE Index

Average shipping and BE index are positively associated with each other. Both variables are showing increasing trend. It can be said that with increase in average shipping, BE index also

shows increasing trend. It can be clearly seen from the graph that after 1996 average shipping showed gradual increasing trend and BE index also showed increasing trend after 1996. This shows positive correlation and association between average shipping and BE index.

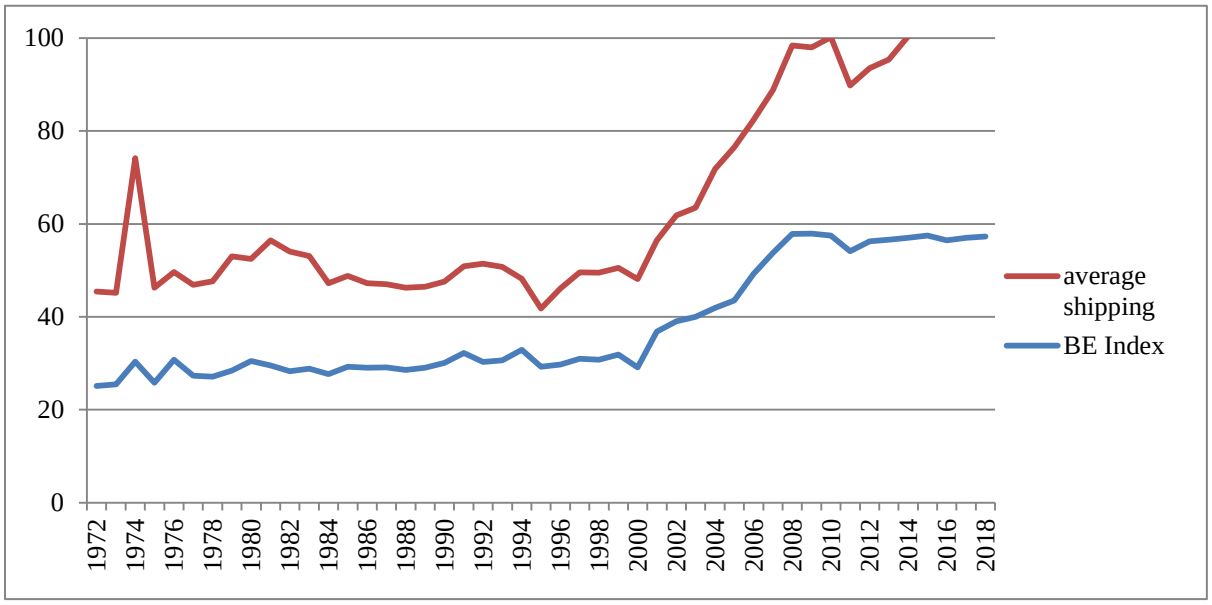

Figure 3.3: Correlation between average shipping and BE Index

3.6.4 Comparison of trends between Average Trade and BE Index

Average trade and BE index are positively associated with each other. Both variables are showing increasing trend. It can be said that with increase in average trade, BE index also shows increasing trend. It can be clearly seen from the graph that after 1999, average trade showed gradual increasing trend. BE index also showed increasing trend after 1999. This shows positive correlation and association between average trade and BE index.6

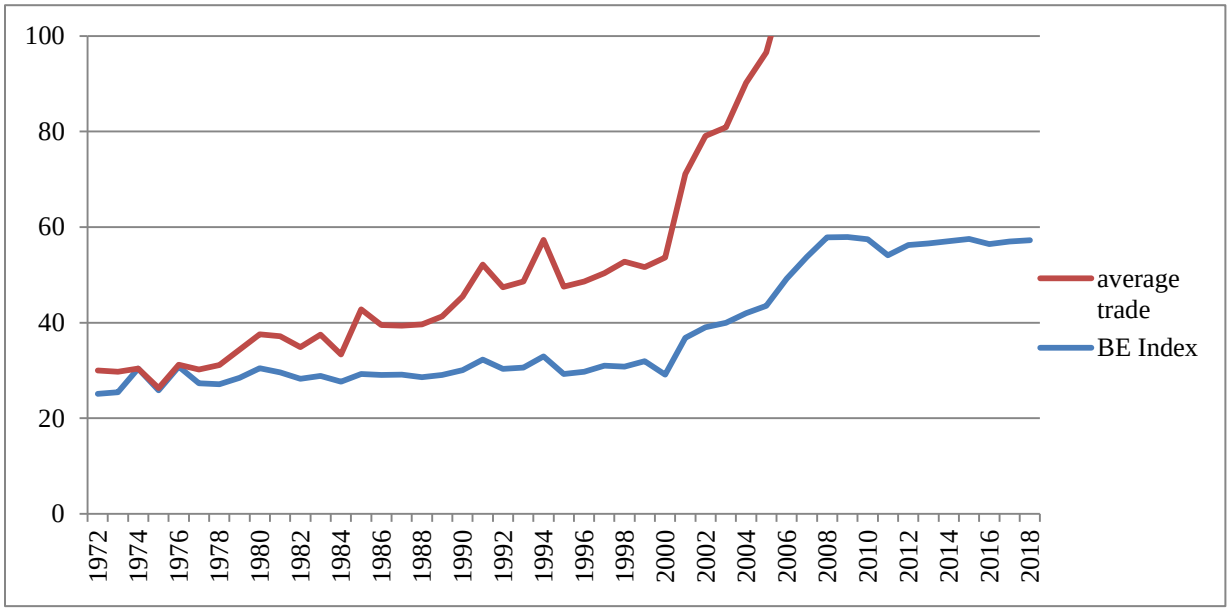

Figure 3.4: Correlation between average trade and BE index

3.6.5 Comparison of trends between Average Environment and BE Index

Average environment and BE index are negatively associated with each other. It means when one variable is showing increasing trend, the other variable will show decreasing trend. It can be said that with decrease in average environment, BE index showed increasing trend. It can be clearly seen from the graph that till 2008 average environment showed decreasing trend along with increasing trend in BE index and after 2008 it starts showing increasing trend. This shows negative correlation and association between average environment and BE index over the period of time.

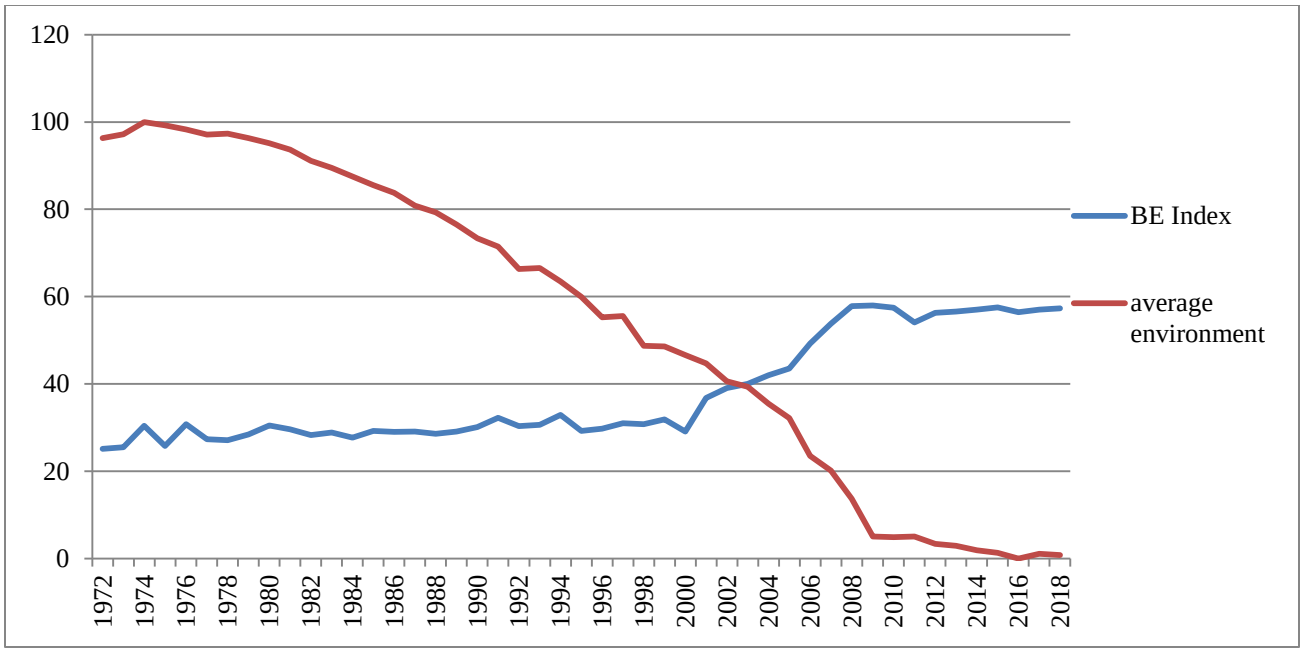

Figure 3.5: Correlation between average Environment and BE index

3.7 Conclusion

Quantification of Blue Economy is a difficult task to do. It is because of the fact that it is a new dimension in practice nowadays. In this chapter, an attempt is made to make an index of Blue Economy. While Blue Economy is a blend of five dimensions i.e. fisheries, aquaculture, shipping, trade and environment. These dimensions are chosen on the basis of their role, significance and statistics availability in case of Pakistan to some extent. In this chapter Index is composed. The dimensions taken are discussed in detail along with the challenges faced by these dimensions. In next chapter, this index along with other variables will be used to see impact of these variables on economic growth of Pakistan.

Chapter 04

Theoretical Framework and Research Methodology

4.1 Introduction

This study empirically analyzes the impact of BE on economic growth of Pakistan. As BE is having measurement issues, so, index is formed. For this purpose, secondary data set is used from 1972 to 2018. Blue Economy Index is formulated on the basis of five important dimensions discussed in detail in previous chapter. After developing the Blue Economy Index, the impact of BE, human capital, inflation and foreign direct investments are treated as independent variables while economic growth is dependent variable. Augmented Dickey Fuller and Philips-Perron tests are applied to find the level of unit root of all variables. To check the cointegration among concerning variables Johansen Cointegration test is used. Vector Error Correction Model (VECM) is applied to analyze the stability of long run relationship in short run.

This chapter consist of the following sections, 4.1 contains introduction, 4.2 explains the theoretical framework of our study, section 4.3 is about conceptual framework, section 4.4 is about data and construction of variables, section 4.5 includes description of variables, section 4.6 includes methodology of study, section 4.7 and 4.8 consist of tests of cointegration and results of Johansen Cointegration, and last section 4.9 concludes this chapter.

4.2 Theoretical Framework

Generally, a theoretical framework provides the foundation that how a particular theory evolve over-time and contribution in existing literature from contemporary study. After literature review- based on literature gap- it is easy to develop conceptual framework of study.

Thrust of economic growth is old as humans on this planet. Find the suitable engine of growth is basic question that is faced by every generation. The history of economic growth theories and model starts with Adam Smith, a classical economist who presented the idea of division of labor and notion of increasing returns in his renowned book (An inquiry into the nature and causes of wealth of nations (1776)). Later, his successors Malthus, David Ricardo,

and, Karl Marx have added up their contributions in economic growth (Piętak, 2014). The basic growth question is still under considerations in twenty first century.

Solow, (1956) developed the neo-classical theory of economic growth[10](Rebelo, 2010). It is also called exogenous growth theory. In 1980s, a new wave arise to find the new endogenous sources of growth (Young, 2006). The new growth models are based on endogenous sources of growth rather than exogenous factors (like Solow). New growth models are developed on the basis of non-decreasing returns on intermediate factors of production like human capital and research and development (R&D) (Barro,2006). Solow's model of economic growth is the baseline for inclusion of human capital in determining economic growth of a country (Bayraktar-Sağlam & Yetkiner, 2014).

Alataş & Çakır, (2016) endogenous growth literature identifies human capital role in innovation, and adoption of new technologies. It is a compilation of five categories: (1) health facilities; (2) on-the-job training; (3) organized education at different stages; (4) study packages for grown-ups; (5) migration of workers to regulate to altering job prospects. In other arguments, it refers to the skills and abilities of human resources of countries, while human capital development includes the process of obtaining and growing the number of skilled people, good health, education and experience that are actually important for economic growth. So investment in education and health are measured as vital components of human capital.

Many researchers try to resolve the basic questions of growth. But still the puzzle of economic growth is not solved although economic literatures identify various sources of growth. But many of these sources vary from nation to nation like social infrastructure, social customs etc. So, keeping in mind all this in this study, another natural source as an engine of economic growth is explored. It is blue economy that contributes in economy via economic growth. Blue economy is a source of enormous quantum of energy (Bari, 2017b). Though South Asia has insignificant gas and oil reserves but the wealth of this blue economy can lead us on the way of development and growth by the enormous treasure of energy it has. Global community may help us with cost effective expertise for harnessing enormous energy from sea too, as mostly the blue economy is in developing countries (Kowser et al., 2014).

[10]Nobel Prize in economics in 1987.

Historically, it has been a strong belief that natural resources blessed nations can grow quickly and maintain their sustained growth path in the long run by using natural resources. But in recent years, economist observes that natural resource-rich nations (e.g. some African and Latin American nations) are not performing well in field of economic growth. Such nations are categories in the list of "resource curse" nations (Abubakr et al., 2017; Auty, 2007). The term resource curse is explained in the phenomenon of an inverse relation between economic growth and natural resources. There is another term in literature that captures the same phenomenon is "oil curse" (Abubakr et al., 2017). If natural resources lead a nation into "Dutch Disease" trap then natural resources are proved as a curse rather than blessing (Gunning, 1991). Then it is (Gylfason, 2001), who explores other factors that play an important role as intermediaries to channelize the natural resources into productive resources. Natural resource dependence can be proven as blessing, if there involve invisible hands in shape of effective institutions, quality education, and social infrastructure (Gylfason, 2001). Up to now, we observed that there are thesis, antithesis and synthesis about the role of natural resources in determining the economic growth. In present study, we take blue economy as a proxy of natural resources and find its impact on economic growth of Pakistan. We just try to conform that blue economy is curse or blessing in our case.

Theoretical framework on the inflation-growth relationship has always remained a controversial one (W. Madurapperuma, 2016). The early theories of inflation-growth nexus by (Mallik & Chowdhury, 2001) have proposed an optimistic relationship between them. They justified and debated that real money balances and investment are substitutes of each other. While contrary to (Mallik & Chowdhury, 2001), study conducted by (Fischer, 1993), (Stockman, 1981) and (R. J. Barro, 1995) have proved that inflation-growth nexus have negative relation. Stockman, (1981) assumed real money balance and investments as complements of each other. R. J. Barro, (1995) emphasized on the fact that high inflation leads to reduction in investment and such reduction ultimately have opposing effect on economic growth. On the other hand, neutrality of money assumption by (Sidrauski, 1967), leads to the finding that, economic growth and inflation have no association between them (Reis, 2007).

Monetarist stances stress that when money supply raises more than economic growth rates than inflation occurs. It proposes that inflation is a monetary phenomenon and government

must practice monetary policy that decreases money supply to deal with inflation. In addition to it, decrease in money supply leads to increase in joblessness rate, which ultimately leads to having negative impact on economic growth (Hoover, 2009). The structuralists mostly claim that inflation is vital for growth especially in developing countries (W. Madurapperuma, 2016). Last but not the least, the endogenous growth theory arguments that inflation has detrimental effects on economic growth via human capital taxation (Lucas, 1988). So inflation growth nexus is a blend of controversial opinions depending upon the assumptions used, data taken, methodology used, model, nature of the study and statistical analysis employed (W. Madurapperuma, 2016).

4.3 Conceptual Framework

After discussing the importance and measurement of Blue Economy in previous two chapters, now we move towards the functional form of our model. Our model is derived from theoretical foundation. In that chapter, we explored the various engines of growth and try to link blue economy as a natural source of economic growth. For this, we amended the neo-classical production function like this.

$$Y_t = f\ (A_t, BE_t, INF_t, HC_t, FDI_t) \qquad 4.1$$

Where, Y (Economic growth) is a function of knowledge, blue economy, inflation, human capital and foreign direct investment.

$$Y = f\ (AL, K)$$

According to (Solow, 1956)-growth model also called exogenous growth theory-output is a function of labor (L) stock, knowledge or effectiveness (A) and capital stock (K). The economy has some amount of capital, labor, and knowledge. If the inputs of production change over time, then output also changes. In general the output rises over time with rise in inputs, and there is technological progress only if knowledge increases over the period of time.

Later on in 1980s, new wave of exogenous growth theory arises (Young, 2006). New growth models are developed on intermediate factors of production like human capital and research and development (R. J. Barro, 2006). But still the puzzle of economic growth remains unresolved. We explore another natural resource blue economy in this study to explore the

effects of this on economic growth. So, the production function takes the following Cobb-Douglas form:

Cobb-Douglas form

$$Y_t = ABE_t^{\propto} HC_t^{\beta} INF_t^{\gamma} FDI_t^{\theta} e^{Ut} \quad 4.2$$

Where α is share of blue economy in output (Y), β is share of human capital in output (Y), γ is share of inflation in output (Y), θ is share of foreign direct investment and U_t shows the share of variables not included in the model. A is total factor productivity/knowledge or effectiveness. Y is the total output showing economic growth in the study, t shows that its time series data.

Take natural log on both sides of equation 4.2

$$lnY_t = lnA + \propto ln\, BE_t + \beta\, ln\, HC_t + \gamma\, ln\, INF_t + \theta\, ln\, FDI_t + \mu_t \quad 4.3$$

After taking natural log of above equation:

$$y_t = a + \propto be_t + \beta hc_t + \gamma inf_t + \theta fdi_t + \mu_t \quad 4.4$$

Where, lnY_t is y_t (economic growth), lnA is a which is total factor productivity, $lnBE_t$ is be_t (blue economy), $lnHC_t$ is equal to hc_t which is human capital, while $lnINF_t$ is inf_t (inflation) (Blinov, 2017; Ahmed, 2005; Arlt, Republic, & Republic, 2015) and last independent variable is $lnFDI_t$ that is equal to fdi_t which is foreign direct investment over time.

4.4 Data and Variables

As discussed earlier, this study uses secondary data of Pakistan from 1972 to 2018. In this study, we use GDP growth (annual percentage) as a proxy of economic growth. Additional variables are blue economy, human capital, inflation and foreign direct investment. Blue economy is taken as proxy for natural resources. Blue economy and human capital are thought to be the economic growth determinant in the long run for the development of any country. The data for maximum variables is taken from World Development Indicators (WDI, 2018). Data of blue economy index and its descriptions are discussed in chapter 03.

Table 4.1: ***List of Variables and Data Sources***

Factor	Variable Name	Abbreviation	Measurement	Data Source
Explained (dependent) variable				
Economic Growth	GDP Growth	Y	Annual % in US&	WDI (World Development Indicators)
Explanatory (independent) variables				
Blue Economy	Blue Economy Index	BE	Normalized Values	Discussed in previous chapter
Human Capital (Adjusted Labor Input)	Human Capital	HC	Effective Labor in force	It is generated with an authentic formulation and data sources.
Consumer Price Index	Inflation	INF	Consumer Price Index	WDI
Net Inflows	Foreign Direct Investment	FDI	Current US$	WDI

4.4.1 Description of Variables

The dependent variable is nominal GDP growth rate which measures over the period of one year. 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. The same indicator is used in many previous studies (like: Betyák, 2012;Rece, 2009).

Blue economy is defined as the sustainable use of oceans and its water resources for economic growth, well-being of people, improved livelihood and job creation (Patil et al., 2016).

For incorporating blue economy in Pakistan, its different sectors are taken i.e. fisheries, aquaculture, shipping, trade and environment. Due to the data non-availability constraints only these sectors are taken as representation of blue economy in case of Pakistan. It is taken as an independent variable to see its impact on economic growth. Blue economy is an index which is constructed in previous chapter is also a proxy of natural resources (Laghari, 2018).

The second independent variable of our model is human capital that is proxy of labor. It is also used for effective labor in production process. The exact data of human capital is not available in any authentic data source. So, we are going to generate the human capital. Its data is generated with the help of different variables i.e. Total population (L), share of population age between 15-64 years (D), labor force participation rate (P), number of years of education per worker (S) and a parameter phi for measurement of returns to education. Following formula is used to generate data of Human capital adjustment (See also: R. Barro & Jong-Wha, 2013).

$$H = L * D * \exp (Phi * S) \qquad 4.5$$

Where, the data of these variables is taken from two authentic sources i.e. WDI and International Labor Organization (ILO). The concept of human capital was given by (Lucas, 1988). Human capital is an important determinant of economic growth (Shahzad, 2015; Alataş & Çakır, 2016). It plays vital role in the economic development of any country.

Inflation is again an index which is calculated with the help of a consumer price index (CPI). It reflects the percentage change in cost to the average consumer of acquiring basket of goods and services that can be fixed or changed at some specific intervals, such as yearly or quarterly. For its calculation generally Laspeyres formulation of index is used. High inflation has negative relation with economic growth in long run. In this study, it is taken as an independent variable (like: Arby & Ali, 2017b; Naseri & Zada, 2013).

Foreign direct investment (FDI) shows direct equity flows in the reporting economy. It is the sum of equity capital, earnings reinvestments, and other financial capital. While direct investment shows cross-border investment linked with a resident of one economy having direct control or significant influence on the economic decisions in another country. According to the criteria for determining direct investment, it is important to have ownership of at least 10 % or more of the ordinary shares of voting stocks. Foreign direct investment is taken as an explanatory

variable to see its impact on economic growth. Various studies show that FDI is one of the determinants of economic growth (Iqbal et al., 2013; Yousaf et al., 2011; Mahmoodi & Mahmoodi, 2016). The variables are also taken in line with previous studies (like: Iqbal et al., 2013; Yousaf et al., 2011; Mahmoodi & Mahmoodi, 2016).

4.5 Methodology

The core objectives of time series analysis are forecasting and dynamic analysis (Jalil & Rao, 2019). The main aim of contemporary study is to check the impact of Blue Economy on economic growth of Pakistan. For this, we have to use the dynamic modeling approach to estimate the model. In this modeling approach, testing hypothesis, investigating economic relationships, and validating economic theories are the main concerned elements. This modeling approach is further bifurcated on the basis of long run relationship among the variables taken for study. If our variables are non-stationary, then might be there are long-run relationships or cointegration exists. For long-run analysis, we use Johansen Cointegration test and error correction model. On the other side, if variables have no long-run relationship, then Granger Causality and impulse response function tests are commonly useful in time series analysis (Jalil & Rao, 2019).

4.5.1 Stationary and Non stationary Time Series

In time series analysis, the very first step is to check stationarity of variables, whether we move for forecasting or dynamic analysis (Shahbaz et al., 2015). If we ignore the checking of stationarity of variables, it may lead to spurious regression results. Stationarity of a variable deal with some statistical properties of a time series data. In simple words, stationary series have statistical properties such as constant mean and variance, and infinite covariance. So, the series show mean reverting property and long run relationship.

4.5.2 Importance of Stationarity

There are several reasons to find out the stationarity of a series. Firstly, if a series is non-stationary then it is meaningful only for the time period for under consideration. In such case, the behavior of that time series cannot be generalized on other time series due to its non-mean reversion property. Secondly, stationarity is an important concept for building effective and correct econometric model. If a series is lacking this property, then the regression will give us spurious outcomes. Technically such model will give misleading results and any conclusion

drawn on that model will be technically wrong. This is the very reason of giving utmost importance to the stationary test for time series analysis (Jalil & Rao, 2019).

4.5.3 Test of Stationarity

Testing stationarity of the time series is the first step to deal with it efficiently. For this, many tests can be considered. But in the ongoing study, for checking stationarity of data, two tests are used. These two tests are Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) test. Both tests deal with higher order of autocorrelation efficiently in small data sets.

4.5.4 Augmented Dickey Fuller Test

The most suitable and widely used test in literature is ADF. The null hypothesis of the ADF test is that there is unit root in present series and alternative hypothesis is present series doesn't suffer from unit root.

For better understanding, let we consider the following autoregressive AR (1) model. It may suffer from unit root. In time series analysis, AR model contains one or more lagged values of the dependent variable along independent variables it is called an autoregressive model (Ng & Perron, 2001).

$$Y_t = \propto_0 + \rho Y_{t-1} + \mu_t \qquad 4.6$$

The above equation (4.6) is AR (1) process, it implies that Y_t depend on its previous value. Where, (ρ) is the coefficient of interest for the determination of unit root. According to (Engle & Granger, 2015), if the value of ρ is less than one, shocks in Y_t will be transitory and will die out over the passage of time. In this scenario, the series will be stationary. Secondly, if the value of ρ is equal to one, shocks in Y_t are permanent in nature. In this situation, the series suffer from unit root. It is greater than the one, and then the series will explode (Ratha, 2003). The problem with this equation is that the upfront assumption is the presence of stationary, which is the very reason that equation has been estimated at level. Therefore, we can rewrite the model by the first difference, and the model will be as follows:

$$y_t - y_{t-1} = \propto_0 + \rho Y_{t-1} - y_{t-1} + \mu_t \qquad 4.7$$

$$\Delta Y_t = \propto_0 + (\rho - 1) Y_{t-1} + \mu_t = \alpha_0 + \delta Y_{t-1} + e_t \qquad 4.8$$

Here, we assume that series is non-stationary, so, the model is estimated in differences form. The same procedure was given by Dickey and Fuller (Mushtaq, 2011). The conventional Dickey and Fuller test only deal with AR (1) process. It is limitation of this method. Here δ is the coefficient of gross output for determination of unit root or stationarity. If value of δ is less than zero, shocks in Y_t will be transitory and will die out with the passage of time (Pesaran et al., 2001). In that case, the series will be stationary in nature. Secondly, if the value of δ is equal to zero, shocks in Y_t are permanent in nature and do not die out over the passage of time (Pesaran et al., 2001). In such scenario, the series is characterized as unit root. This is called unit root hypothesis.

$$\Delta Y_t = \propto_0 + (\rho - 1)Y_{t-1} + \mu_t = \alpha_0 + \delta Y_{t-1} + e_t \qquad 4.9$$

$$\Delta Y_t = \propto_0 + a_1 t + (\rho - 1)Y_{t-1} + e_t$$

In above equation, $a_1 t$ is time trend. Dickey Fuller test only deal with AR (1) process but mostly time series are suffering from AR (ρ) process. To incorporate such high order of autocorrelation, the most suitable approach is Augmented Dickey Fuller (ADF). The equation of ADF is as follows.

$$\Delta Y_t = \propto_0 + a_1 t + \delta Y_{t-1} + \Sigma_{j=2}^{\rho} \alpha Y_{t-j} + e_t \qquad 4.10$$

Equation (4.10) is basically Augmented Dickey Fuller (ADF) (Engle & Granger, 2015). One can argue that if trend and intercept of above equation are ignored then estimated equation not provides robust results. This is true and logical criticism and needs a careful review. Therefore, we can add intercept and trend, and the models also mention in equation (4.9) and (4.10).

To be clearer, ADF test is preferred because it parametrically corrects the higher order correlation by taking higher number of lags on the right hand side of the equation. Moreover addition of more number of lags on the right hand side is generally considered a practical approach in above equation. Applied econometricians generally advice that researcher should include sufficient number of lags in model to remove autocorrelation in the residuals (Jalil & Rao, 2019). But sometime it is not useful because with inclusion of lags, loss of degree of freedom happens. The other limitation of ADF is that it does not incorporate any structural changes in the data series under consideration.

4.5.5 Phillips-Perron Test

This test is used for non-parametric methodology to deal the issue of autocorrelation and it is developed by (Phillips & Perron, 1988). PP test deals with non-parametric correction to the t-test statistics and generate more robust results with respect to unspecified autocorrelation and heteroscadasticity in the disturbance term of the equation. When we have small data and high order of autocorrelation then more regressors affect the power of degree of freedom. In such case, PP performs better relative to ADF. So, this test is the well-known and standard test for detection of unit root in time series data analysis but recent literature shows that it has poor performance in presence of structural break or structural changes or any sudden change in the underlying time series data.

4.6 Test of Cointegration

Once the issue of stationarity is dealt in time series analysis then the next step is to test the cointegration. Cointegration shows the long run relationship of variables among them. There are different cointegrations methods decided mainly on the basis of unit root test analysis. The unit root results naturally guides us towards the next step mostly. For instance if data set is stationary, then we can call it integrated at level, that is I (0). If the data set is non-stationary at level, then we may take its first difference to make it stationary data. If we get stationary data set at first difference it will be called integrated at first level that is I(1). The series that could be stationary at second difference is called integrated at second order, that is I(2).

If all the series in underline analysis are I(0), then simple OLS or a linear regression can be run like a conventional analysis. Short run and long run coefficients coincide in this particular case. If in data series taken for analysis, some are I(0) and some are I(1), Then we can apply Autoregressive distributed lag (ARDL) Model. If all variables in a data series are integrated at the same level, i.e. at the first level apply Engel-Granger cointegration for bivariate case and apply Johansen-Juselius cointegration test procedure in case of Multivariate analysis. If all variables in a series are integrated of order I(2) then (Toda & Yamamoto, 1995) long run causality could be estimated.

If we are unable to get the cointegration among the underlying series, then estimation can be done via unrestricted VAR and estimate the Granger causality or impulse response function

for short run analysis of series under consideration. As in the ongoing study all variables are integrated of order (1) are stationary at 1st difference.

4.7 Johansen Cointegration Test: Cointegration in Multiple Equations

As in the ongoing study we have multivariate analysis so Johansen Cointegration is the most appropriate technique applied. So this procedure is discussed in detail. The variables taken in the study are stationary at 1st difference so this quality implies the use of this method.

4.7.1 Step 1: Detecting the order of Integration

To detect the long run relationship between economic growth and blue economy index, human capital development index, inflation and foreign direct investment, order of integration needs to be checked. For this purpose ADF test and PP test is used. To proceed further with Johansen Juselius cointegration test is mandatory that all the series variables must be cointegrated of order I(1) as an ideal condition (Engle & Granger, 2015). In nutshell, applying unit root test is mandatory to go further for cointegration testing. The equation for the ADF is given below:

$$\Delta y_t = a_0 + a_1 y_{t-i} + \Sigma_{j=2}^{\rho} a_j \Delta y_{t-j} + \varepsilon_t \qquad 4.11$$

4.7.2 Step 2: Choosing the lag length

Second most important step is the selection of appropriate lag length. Stability of all AR models depends on the optimal lag lengths. Moreover, appropriate number of lags addition ensures the Gaussian error. Gaussian error is free from all sorts of econometric issues such as heteroscadasticity, autocorrelation, and non-normality. On the other hand the major reason of econometric issues is due to non-Gaussian error which is due to omitted variables bias, an important part of hypothesis testing literature. Moreover, including and excluding unnecessary lags cause the omitted variable or redundant variable bias (Jalil & Rao, 2019). Generally researchers select optimal lags via grid search procedure. The researchers estimate a VAR model by hit and trial method following descending order in inclusion of number of lags until zero lag. It is decided on the basis of AIC or SBC as per researchers' choice. This step is an integral part of the model selection.

4.7.3 Step 3: Appropriateness of the Model

It is important to discuss the issue of entering the intercept and trend in the short run and long run equation for estimating the model. Johansen, (1995) discussed five possible ways. First one is deterministic trend in which there is no intercept and time trend. This model is preferred when there are no deterministic components in the time series data. Practically, it's a rare case reported. Second possibility is that there should be restricted intercept and no deterministic trend in a cointegration equation. Third is a common case which includes unrestricted intercept and no deterministic trend in cointegration equation as well as in VAR model. Fourth possibility postulates includes an unrestricted intercept and restricted trend in cointegration equation and in VAR model. Last but not the least; fifth one includes an unrestricted intercept and quadratic trend in the cointegration equation in VAR model. As per (Johansen, 1995) first and fifth postulates are the rare possibility to happen in time series empirical literature. Therefore, for efficient results researchers has to decide between the three possibilities left for appropriateness of the model. So according to (Johansen, 1995), researcher mostly relies on pantula principle to select appropriate model for the research going on.

4.7.4 Step 4: Determining the number of cointegrating vectors

In this step, researcher has to determine the number of cointegrating vectors or the long run linear relationships. There is a genuine possibility of 'n-1' number of cointegrating vectors where 'n' is the number of variables of the model. Johansen, (1995) suggests practical and feasible steps to know the number of cointegrating vectors. To be more specific, long run coefficients and speed of adjustment is calculated. Error correction term generally shows speed of adjustment and the number of cointegrating vectors is determined through the set of two test statistics. These test statistics are called the Trace test and Maximum Eigen Values.

4.7.5 Step 5: Estimating the Error Correction Model

Consider a multivariate model, and make sure that all variables are integrated of order I (1), that is, stationary at first difference level, by using appropriate lags and testing the presence of long run relationship among series. The error correction model (ECM) shows the short run dynamic with long run relationship. ECM (-1) determine the long run relationship and the negative sign ensure the stability of the model. It is called as the adjustment parameter. The error correction model (ECM) describes the short run dynamics with the long run relationship. ECM (-1) is the adjustment parameter which tells about the speed of convergence towards the

equilibrium (Shahbaz et al., 2013). It shows that how much disequilibrium of the previous year will be corrected in the next year. This sign of the error correction term should be negative (Ajide & Lawanson, 2012). The negative sign denotes the convergence towards the equilibrium.

4.8 Conclusion

In this chapter, we discuss the conceptual framework between BE, human capital, inflation, foreign direct investment and economic growth. If used the Cobb-Douglas production function, BE, human capital, inflation and foreign direct investment as factors of production. Data is collected from World Development Indicator and Economic Survey of Pakistan. First of all, in this chapter Unit root test is discussed. After that we identify the stationarity of each series by Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test. After confirmation of unit order, the second step is checking cointegration between the variables by Johansen Cointegration. Johansen Cointegration is applied to see the long run impacts of Blue Economy, human capital, inflation and foreign direct investment on economic growth of Pakistan. Johansen Cointegration identifies the long run relationship between variables. Lag order criteria is applied to know the lag order. After confirmation of long run association between variables, Vector Error Correction Model (VECM) is applied to see short run and long run coefficients.

Chapter 05

Results and Discussion

5.1 Introduction

In this study, we try to evaluate the impact of Blue Economy on economic growth of Pakistan. Blue economy is measured by an index. This chapter is about quantitative results of our model and discussions in the form of interpretations. Most suitable methods and tests are discussed. Section 5.2 is simple correlation analysis of variables. Section 5.3 is about unit root results of two methods while section 5.4 contains the results of lag length criteria. The most important section is 5.5 that explain the Johansen Cointegration (long run) coefficients.

Table 5.1: ***Correlation Analysis***

	lnGDP	**lnBE**	**LnHC**	**lnINF**	**lnFDI**
lnGDP	1.00				
LnBE	0.89	1.00			
LnHC	0.99	0.91	1.00		
LnINF	-0.30	-0.14	-0.29	1.00	
LnFDI	0.93	0.79	0.94	-0.23	1.00

5.2 Correlation Analysis

It is a statistical tool to measure relationship between two variables. Correlation analysis gives better understanding of data. It shows change in one variable that is associated with change in another variable. The coefficient of correlation lies between -1 to 1. As correlation coefficient approaches to near one, it implies variables are having positive linear association with each other. When we have zero value of correlation coefficient, it means both variables are independent. Positive correlation shows the extent to which two variables have positive linear association between each other, while negative correlation is vice versa. In a statistical literature, there are various methods to measure the correlation between variables, but here we use Pearson correlation technique. The results of correlation are presented in Table 5.1. Correlation

coefficient of lnBE is 89 which show positive linear association between lnGDP and lnBE. The correlation between these two is positive with magnitude 0.89. It means strong positive correlation exist between lnGDP and lnBE. On same pattern, lnHC and lnGDP are also positively associated with each other. Correlation coefficient of lnHC is 99 percent which shows positive linear association between lnGDP and lnHC. The correlation between these two is positive with magnitude 0.99. They have linear association with each other. The two variables show high correlation also. lnINF and lnGDP have negative correlation. Correlation coefficient of lnINF is 30 percent which shows negative linear association between lnGDP and lnINF. It means negative correlation exist between lnINF and lnGDP. Last variable, lnFDI correlation coefficient is 93 percent which shows positive linear association between lnGDP and lnFDI. The correlation between two is positive with magnitude 0.93. It shows high positive correlation between the two variables.

5.3 Unit Root Testing

Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are applied (see also: Bank, 2015; Faridi & Murtaza, 2013). Generally, the ADF and the PP test provide similar findings in case of large data. But in case of small data PP gives relatively better results (Faridi & Murtaza, 2013). However, we include both tests to ensure about the accuracy of results regarding the unit root level conclusion. So, each series is individually tested to ensure about the non-stationarity at levels of data, and stationarity at first difference ensures I(1). Null hypothesis of ADF and PP test is presence of unit root and alternative hypothesis is no unit root/ stationary presence.

Table 5.2: ***Unit Root Result***

Variables	**Augmented Dickey-Fuller Test Statistics**					
	Level (Intercept)			**1st Difference (Intercept)**		
	t-statistics value	**t-critical value**	**P value**	**t-statistics value**	**t-critical value**	**P value**
lnGDP	-2.07	-2.93	0.16	-5.12	-2.93	0.00*

lnBE	-0.52	-2.93	0.88	-12.07	-2.93	0.00*
lnHC	-0.98	-2.93	0.75	-3.81	-2.93	0.00*
lnINF	-2.44	-2.94	0.14	-8.14	-2.93	0.00*
lnFDI	-1.31	-2.93	0.62	-7.81	-2.93	0.00*

Note: *indicates variable is stationary

The results in table 5.2 shows that lnGDP, lnBE, lnHC, lnINF and lnFDI have unit root at level, the t-statistics value is greater than t-critical value and P value is greater than 0.05. So, we cannot reject the null hypothesis. It means variables are non-stationary at level. The same variables show that t-statistics value is smaller than t-critical value at 1st difference and P value is less than 0.05. So, we can safely reject the null hypothesis. It means acceptance of alternative hypothesis. It clearly shows the fact that all variables are stationary at first difference. Our results are significant at 5 % significance level. PP test includes an automatic correction to the Dickey-Fuller for residuals auto-correlation. This test has a more comprehensive theory of unit root non-stationarity.

Table 5.3: ***Unit Root Results***

Variables	**Phillips-Perron Test Statistics**					
	Level (Intercept)			**1st Difference (Intercept)**		
	t-statistics value	**t-critical value**	**P value**	**t-statistics Value**	**t-critical value**	**P value**
LnGDP	-2.06	-2.93	0.12	-5.03	-2.93	0.00*
LnBE	-0.19	-2.93	0.93	-12.06	-2.93	0.00*
LnHC	-1.10	-2.93	0.71	-3.77	-2.93	0.01*
LnINF	-2.39	-2.93	0.11	-8.14	-2.93	0.00*
LnFDI	-1.38	-2.93	0.63	-7.86	-2.93	0.00*

Note: *indicates variable is stationary

The null hypothesis for PP test states the presence of unit root and alternative hypothesis states that there is no unit root in data. The results from table 5.3 presents variables in lnGDP, lnBE, lnHC, lnINF, and lnFDI at level shows that t-statistics values are greater than t-critical values and P value is also more than 0.05 which means we cannot reject null hypothesis (Bank, 2015). On the other side, the data shows that at first difference the t-statistics value are smaller than t-critical value and P value is also less than 0.05, so we can safely reject null hypothesis. It means that variable data is stationary at first difference. So the results of ADF and PP test shows that our data is stationary at first difference, which is an important condition for Johansen Cointegration Method.

5.4 Lag Length

For determining lag lengths for the Johansen's procedure, different lag lengths are available but we chose the Schwarz's Criterion (SC). Each criterion has different merits and demerits. In the cointegration analysis the optimal number of lags is selected on the basis of AIC or SC (Jalil & Rao, 2019). In our study, the lag order selected is 1 as per maximum lag order criteria by SC.

Table 5.4: ***VAR Lag Order Selection Criteria***

Lag	LogL	LR	FPE	AIC	SC	HQ
0	103.12	NA	0.00	-4.56	-4.36	-4.49
1	295.41	330.92	0.00	-12.34	-11.12*	-11.89
2	326.14	45.74	0.00	-12.61	-10.36	-11.78
3	354.74	35.93	0.00	-12.78	-9.50	-11.57
4	405.21	51.64*	0.00	-13.96*	-9.66	-12.38*

Note: * indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike Information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

5.5 Johansen Cointegration Test

This study uses Johansen Cointegration method. So, it involves prerequisite unit root test to ensure that all variables of the model should have integrated level I(1). In (Johansen, 1995) cointegration test two different test statistics i.e. the Trace test and the Maximum Eigenvalue are reported. The trace test is a joint test telling about the cointegration in longer run. The null hypothesis of trace test is of no cointegration and alternative hypothesis states that cointegration exist (Bank, 2015).

Next test of cointegration is of Maximum Eigenvalue which conducts test on each Eigen value separately. The null hypothesis of maximum eigenvalue states that the number of cointegrating vectors is equal to r against the alternative hypothesis of r+1 cointegrating vectors.

$$\lambda_{\text{trace}}(r) = -T \sum_{i=r+1}^{n} \ln\left(1 - \hat{\lambda_i}\right) \quad 5.1$$

$$\lambda_{\max}(r, r+1) = -T \ln\left(1 - \hat{\lambda}_{r+1}\right) \quad 5.2$$

Where r = no. of cointegrating vectors under the null hypothesis, $\hat{\lambda_i}$= estimated i^{th} ordered eigenvalue from the $\alpha\beta'$ Matrices, normally a significantly non-zero eigenvalue shows a significant cointegrating vector.

The (Johansen, 1995) process is a maximum likelihood method that find out the number of cointegrating vector in Vector Auto Regression (VAR) with some restrictions imposed known as a vector error correction model (VEC). Estimation of model is as follows:

$$\Delta X_t = \mu + \sum_{i=1}^{p} T_i \Delta X_{t-i} + \alpha\beta' X_{t-i} + \varepsilon_t \quad 5.3$$

Where X_t = (n * 1) vector of all the non-stationary indices in our study, T = (n * n) matrix of coefficients, α = (n * r) matrix of error correction coefficients, r is the number of cointegrating relationships in the variables, so that 0 < r < n. This gauge the speed at which the variables after fluctuations adjust to their equilibrium. This is also known as the adjustment parameter. B = (n *

r) matrix of r cointegrating vectors, so that 0 < r < n. This represents long-run cointegrating relationship between the variables taken for study.

Table 5.5: ***Johansen's Cointegration Test and Results (Trace Test)***

Hypothesized No. of CE (s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**	Significance at 5 % level
None*	0.58	94.48	69.82	0.00	Yes
At most 1*	0.49	55.59	47.86	0.01	Yes
At most 2	0.32	25.35	29.79	0.15	-
At most 3	0.19	8.06	15.49	0.46	-
At most 4	0.07	3.39	3.84	0.07	-

Notes: Trace test indicates 2 cointegrating eqn(s) at the 0.05 level.

*denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 5.6: ***Maximum Eigenvalue Test***

Hypothesized No. of CE (s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**	Significance at 5% level
None*	0.58	38.89	33.88	0.01	Yes
At most 1*	0.49	30.23	27.58	0.02	Yes
At most 2	0.32	17.29	21.13	0.16	-
At most 3	0.19	4.67	14.26	0.78	-
At most 4	0.07	3.39	3.84	0.07	-

Notes: Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level.

*denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

5.5.1 Johansen Test Results

The result of the trace test either rejects the null hypothesis of no cointegration among the variables taken for study or does not reject the null hypothesis that there is at least one cointegration relation between the variables. Table 5.5 shows the existence of 2 cointegrating equation at 5% significance level; this means the results shows the rejection of null hypothesis that there is no cointegration. The results from the table shows the presence of two linear combination between the variables taken for study that forces these indicators to have long run relationship over the time period, though in the short run, there might be some potential deviation from equilibrium level.

To further confirm the results of the Johansen's trace test, the Maximum Eigenvalue test is also seen, which confirms 2 cointegrating equation at 5% level of significance. Ultimately, confirming the trace test results. In other words, these two tests ensure the presence of long-run relation between the variables taken in series. In such situation, we will proceed to estimate the VECM model after performing Johansen Co-integration test.

Table 5.7: ***Long Run Estimates***

lnBE	**lnHC**	**LnINF**	**LnFDI**	**C**
-3.065	-4.441	0.799	-0.681	-25.324
(0.593)	(0.661)	(0.137)	(0.115)	
[-5.163]	[-6.719]	[5.829]	[-5.934]	

Note: Standard errors in ( ) & t-statistics in [ ]

Table 5.8: ***Short Run Estimates (VECM)***

ECM	D(lnBE)	D(lnHC)	D(lnINF)	D(lnFDI)	C
-0.446	-0.204	-0.340	0.289	-0.31	0.009
(0.182)	(1.121)	(3.282)	(0.169)	(0.140)	(0.054)
[2.448]	[-0.182]	[-0.104]	[1.712]	[-0.220]	[0.173]

R squared	0.339	Sum sq.resids	1.676
Adj.R-Squared	0.224	S.E.equation	0.210
F-statistics	10.114	Mean dependent	-0.003
Log likelihood	10.172	S.D.dependent	-0.003

Note: Standard errors in ( ) & t-statistics in [ ]

The results of table 5.7 confirm that there is dynamically stable long run relationship between Blue Economy and economic growth of Pakistan. So we can safely apply VECM in order to evaluate the short run properties of the cointegrated series in the study. In case of no cointegration, VECM was no longer required. The negative and significant coefficient of ECM shows that an exogenous shock will be fizzle out in long-run and economy will maintain the long-run stable path. In table 5.7, all the coefficients are significant at 1% significance level. Our variables are in logarithm form so; the interpretation of coefficients is just like elasticity.

The impact of Blue Economy on economic growth is positive and statistically significant. Our findings are in line with the previous studies (like: Mollona et al., 2019; Bari, 2017a; Son & Ninawe, 2017). On average one percent increase in BE will lead to 3 percent increase in GDP in long run. The coefficient of Blue Economy is significant in long run. Blue economy is a phenomenon of long run. In table 5.8, Vector Error Correction Estimates in short run are showed. The ECM value is -0.446 which shows that an exogenous shock will run out in long-run and economy will attain stable path again. It shows that the variables have shown some deviation in the short run for some period of time. But in the long-run, the variables will come back to their equilibrium state. In the ongoing study, ECM value is negative and significant. The short run

coefficient value also show positive relation between blue economy and GDP. The coefficient of Blue economy in the short run is insignificant.

Similarly human capital and GDP are having positive relation with each other. The results of the study are in coherence with the study of (Alataş & Çakır, 2016). The coefficient -4.441 shows that when there is increase in human capital by 1 percent, it brings change in GDP by 4.441 percent in long run. The coefficient of human capital is significant in the long run. In the short run, the coefficient of human capital shows positive relation with GDP but the value of coefficient is insignificant.

In the same way, inflation and GDP are negatively related to each other. These results are supported by the other studies like (Stockman, 1981; R. J. Barro, 1995). These studies have proved that inflation-growth nexus have negative relation, as proven by this study too. 1 percent increase in inflation leads to 0.799 percent decrease in GDP in the long run. The coefficient of inflation is significant. In the short run, the coefficient of inflation shows negative relation with GDP and its value is insignificant. Inflation is a short run phenomenon.

Foreign Direct Investment (FDI) and GDP are positively related to each other. This is exactly in line with the findings of other studies taken case study of Pakistan (see also: MM, S, & M, 2016; Iqbal et al., 2013). 1 percent increase in FDI leads to 0.681 unit increase in GDP in the long-run. The coefficient of foreign direct investment is significant. In short run, coefficient of FDI shows positive relation with GDP. The coefficient of FDI in short run is insignificant.

5.6 Serial Correlation

The null hypothesis of serial correlation is that there is no correlation. While alternative hypothesis states the presence of correlation in residuals. As probability value is 0.384 which is greater than 0.05. So, we cannot reject null hypothesis.

Table 5.9: *Serial Correlation*

Null Hypothesis: No serial correlation at lag order

Lags	LM-Stat	Prob
1	26.441	0.384

Chapter 06

Conclusion and Policy Recommendations

6.1 Introduction

This section contains conclusion and policy suggestions for improvement in the economy of Pakistan. Section 6.2 discusses the conclusion of the research carried on and section 6.3 has some proposed recommendations to improve its situation, on the basis of findings of this study.

6.2 Conclusion

The prime goal of this study is to investigate the impact of blue economy and its economic implications on the economic growth of Pakistan. Being a developing country, we are facing many economic challenges but blue economy can boost newly emerging sectors like, fishing, tourism, mineral extraction, electricity generation via tidal waves and blue carbon (Steven et al., 2019;Klinger et al., 2018).

Blue Economy is not a clear indicator, there are many measurement issues. The dimensions fisheries, aquaculture, shipping, trade and environment need to be focused more for achieving long run economic growth. As economic growth is an important phenomenon of 21st century. Economist has been trying hard to find out the factors of economic growth. Here in this research blue economy is used as a proxy for natural resources (Bari, 2017a). First of all, we construct an Index of Blue economy on the basis of major dimensions i.e. fisheries, aquaculture, shipping, trade, and environment. These dimensions are further divided into different proxy variables that show the performance of its dimension. The correlation coefficients of BE index indicate that all dimensions taken are playing vital role in BE. Pakistan has comparative advantage in BE over other regional nations. It is God-gifted natural physical capital due to its potential. If BE is utilized properly to extract maximum benefits from it. It can be a game changer player of Pakistan. Although Blue Economy is an underutilized concept and there are grave issues in data availability plus some proper policy making to use it effectively. But even then, Sindh province is the main contributor in BE development.

Secondly, the research uses Johansen cointegration technique to analyze the impact of BE (along other variables like: human capital, inflation and foreign direct investment on the

economic growth of Pakistan. To check stationarity of the variables, unit root test is applied at level and first difference. All variables (BE, Human capital, inflation and foreign direct investment) used in the study were stationary at I (1). Lag length criteria showed different criteria results but we chose lag length 1 as per the Schwartz's Criterion (SC). Johansen Cointegration test includes two test i.e. Trace test and Max Eigenvalue test. Trace test results showed 2 Cointegrating equations and Max Eigenvalue test confirmed 2 Cointegrating equations. Johansen Cointegration test confirmed the long run relationship between variables taken for study. These results help us in proceeding further by applying VECM.

VECM results showed us the behavior of variables in long and short run path. The coefficient of BE is statistically significant which reveal the positive impact of BE. Keeping this result in mind, investment in BE will ultimately lead to increase in economic growth of Pakistan (Mollona et al., 2019; Laghari, 2018; Zafar, 2016). So, this is one of the most beneficial investments one could do. As blue capital is a naturally blessed asset for Pakistan. Its systematic and careful utilization can lead us on the way of development. Literature identifies the role of human capital in the process of economic growth too. Human capital is a combination of few variables i.e. population, share of population age 15-64, labor force participation rate, No. of years of education per worker and a parameter phi for the measurement of returns to education (R. Barro & Jong-Wha, 2013). The results of the research show that human capital and economic growth have positive long run association. The coefficient of the research shows that human capital and economic growth have positive long run association (Alataş & Çakır, 2016; Shahzad, 2015). The coefficient of human capital is significant too. Keeping these results in mind, it can safely be concluded that Blue Economy and human capital are having significant impacts on the economic growth of Pakistan. Blue Economy and human capital are issues of long run growth. These two variables play vital role in accelerating economic growth. The coefficient of inflation is significant but positive which confirms its negative association with the economic growth. The negative relation between inflation and growth nexus is supported by literature too (see: (R. J. Barro, 1995; Stockman, 1981)). Foreign direct investment is showing positive relation with economic growth. Coefficient of foreign direct investment is significant in long run. The results of the study are supporting the results of previous studies (Iqbal et al., 2013).

The VECM results in short run shows that all variables (BE, human capital, inflation and foreign direct investment) have no significant impact in short run. The coefficients of BE, human capital and foreign direct investment have positive relation with economic growth of Pakistan but inflation shows negative relation. On the basis of our findings following recommendations are proposed.

6.3 Recommendations

It is confirmed from our findings that Blue Economy is an important factor in shaping Pakistan economy. Pakistan has to do a lot for the improvements of BE sector to perform up to the mark according to the potential that it has. Following are proposed measures to tackle the issues in Blue Economy of Pakistan to boost economic growth in the long run.

1. **Formation of supportive environment for sustainable growth**
    - The outcomes of the study suggest intelligent and judicious use of Blue Economy for economic development. Here, growth of Blue Economy is clearly dependent on quality of aquatic life, aquaculture, efficient shipping, rational trade and sustainable environment. In short quality of aquatic life and sustainability of the environment are keys to achieve significant Blue Economy potentials.
    - Efficient governance and coordination among stockholders and institutions is need of the time to achieve economic development. The strategy report of 2007 is still not implemented (Development, 2018). Updating the strategy report will provide suitable road map for adoption and effective implementation of the national policy.
    - Financial support should be made by concerned institutions for structural adjustment and value-added activities to boost up the pace of Blue Economy especially in relevant provinces. Fisheries Development Funds (FDFs) should make rational strategic public investments along the value chain to gain maximum benefits. Investments should be market-driven, yet social goals could be promoted due to eligibility criteria.
    - Blue Economy requires investment in humans, in the form of technical trainings as a pre-requisite for achieving growth. This can be positively accomplished through funding from existing provincial, territorial and fisheries development funds (FDFs) to give support to new partnerships with the private sector to ensure vocational

readiness. Private investment in the sector will create new avenues of research and potentials for efficient utilization.

2. **Marine capture fisheries management for long-term sustainability**
    - Improvement in marine capture fisheries is important for the future of Blue Economy. Keeping in view, the success stories of many other countries (Like: Mauritius, Seychelles), it is need of the hour to set specific targets of fish catching to avoid overfishing and exploitation of the blue capital. In addition to it, there should be restrictions on timing, areas and quantity of fishing. It can positively ensure protecting the key habitat and stock recovery of fisheries sector. Though it is a very technical approach to tackle it but a new research framework of Fisheries Management Plans (FMPs) should be opted. Hence, enhancing improvement in fisheries sector as a social goal.
    - Monetary value of fish exports from Pakistan to the rest of the World is very low. Because we never processed the fish according to the international standard set for it. The only labor is a source of value addition in our case, but value additions should come from modern technology. EU, Japan and United States are players of seafood market. The market share of Pakistan's fisheries exports to these markets is less than 3% even. With little efforts and sea food processing techniques, Pakistan can easily capture bigger share of their high-value markets. This could be done only when Pakistan received the international certification for its fish quality. In this way Pakistan's export earnings from fisheries can be increased to great extent.
    - Improvements & investments in fisheries sector would benefit both groups i.e. enormous export-oriented firms and the small-scale operators. In this way, the policies will disproportionately provide benefit to poorer households and woman.

3. **Ensuring sustainable inland capture fisheries**
    - Inland fisheries are expected to have low efficiency production, underprivileged social and livelihood outcomes; this is generally because of the narrowing effective communication between administrators and reserve handlers. So incentives should be created by management scheme for efficient inland capture fisheries in the state.

Policies should be developed for management system via consultative approach as part of the review.

- Further degradation of freshwater resources could be prevented by improved ecosystem management. For instance, in Pakistan, the two largest lakes yielding maximum fisheries are in endanger. They have been continuously diminishing and shrinking due to pollution and resources mismanagement. This can be practically addressed with better data collection techniques, research and development and public awareness to reduce water pollution.

4. **Sound improvement of aquaculture sector**

- It seems a risky sector for the private investors to play their part. First of all, it should be averted to encourage private investors to ensure them that cost does not outweigh benefits of growth in this sector. Along with it, a system of spatial planning could decrease risk ratio. It needs a comprehensive and thorough planning about its permitted areas to avoid environmental degradation.
- Biosecurity hazards should be reduced by developing strong quarantine and certification systems. This would apply better inspection facilities at ports of entry. Along with it, there should be a nominated and empowered principal-point biosecurity institution at the Federal level. It is highly recommended to deal issues like aquaculture, biosecurity and food safety risks by grander commitment and meeting with international organizations.
- The success stories of the other countries suggest that deeper extension services can accelerate efficiency of this sector. In case of Pakistan, it takes place at the provincial and territorial level, but unfortunately the institutions are not linked effectively. Upgraded curricula, with organized planning and learning can increase production capacity of aquaculture. This can be supported by private and public sector by undertaking joint research in it.

5. **Sustainable coastal management**

- Sustainable coastal management is the cry of hours. Policy should be adopted to tackle coastal management. This could be positively tackled by planting mangrove trees along the coastline. As mangrove trees remain steadfast in swamp waters, salty sea waters and fresh river waters. In addition to it, they have deep roots embedded

deep down in the soil. In this way, it can act as a natural hindrance against any sort of disasters like floods and tsunamis. Besides this, it will secure people living in coastal areas. It will provide them basic food available there; like fish and other seafood. This step would be beneficial from economic point of view too as many commercially important crustacean and fish live in mangroves. This will promote fisheries and generate huge revenues with potential tourism facilities. The best suitable port for this practice will be Gwadar port of Baluchistan. It is because of its popularity from industrialization point of view.

- Pakistan's ports efficiency should be improved by improving the road and rail infrastructure via China & Pakistan Economic Corridor project (CPEC). Ultimately improving blue economy through seaports efficiency.

6. Tourism Development

- The most important and economically beneficial sector of Blue economy is Tourism. Long term plans could include restaurants, underwater aquarium and beach resorts, which are popular worldwide.
- Pakistan clearly lacks in beach and tourist attraction in coastal areas. So, to add attraction to our beaches, projects should include interesting activities and water sports like water-skiing. These steps will attract the national as well as international tourists. Hence, boosting the tourist industry of Pakistan as well.

7. Policy Development

Most importantly, the marine policy of Maritime transport needs grave attention. There is dire need of working on formulating marine policy and then implementing it accordingly. It's still not late; we can take benefit of former policy created but not applied. The 2007 National Policy, largely targeting strategies for development in fisheries and aquaculture sectors need thought provoking implementation. Though, the policy did not go under implementation due to political evolution. It's still not late to implement it. If carefully adopted and updated, such a policy can ensure efficient fisheries in partnership with private investors. For instance, aquaculture has strong possibility of growth in short and medium run. This could be a good revenue source for rural households. It will also improve food security and nutrition welfares for the community. Marine fisheries could be target for improvement in long run. As it can prevent dwindling harvests, ecological progress in jobs and growth value addition. In this

way, good policy development with effective implementation will improve integrated sectors overall. Lastly, a national policy outline is required to systematically manage complementarities and utilizes them intelligently.

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