A BLUE ECONOMY AND ACCOUNTING FOR ECONOMIC GROWTH: A COMPARATIVE STUDY OF PAKISTAN AND INDIA

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A Blue Economy and Accounting for Economic Growth: A Comparative Study of Pakistan and India

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In the Name of Allah, the most

Beneficent, the most Merciful

DEDICATION

I dedicate this humble effort to

my parents, Rashid Ahmed Khawaja (late) & Farida fardous who taught me

that It's never too late to try for achieving your goals

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ABSTRACT

Blue economy is an emerging pillar of modern and sustainable economy. Present study is an attempt to empirically examine the impact of the blue economy on the economic growth of Pakistan and India because the quantification of the blue economy is a key component of the current study. The ongoing study is a time series analysis from the period 1980 to 2018. This quantitative analysis is used to evaluate how much economic growth may be predicted from shifting economic activity to the blue economy. So, a multidimensional blue economy index is constructed for this purpose. Twelve proxy variables constitute the six pillars of BE for each country. After tackling the measurement issues of blue economy, an amended form of neo-classical production function is used for econometric model in this research which introduced the blue economy as an engine of growth to solve the growth puzzle. Other variables gross fixed capital formation (GFCF), total labor force (TLF) and blue economy (BE) are selected as independent variables while GDP as a dependent variable. After checking the unit root or order of integration of all variables with the help of Augmented Dickey-Fuller Test and Philip-Perron unit root tests, study estimates the neoclassical production function with the help of autoregressive distributed lag (ARDL) model. The findings highlight the fact that there is a statistically significant impact of BE, GFCF and TLF on economic growth of Pakistan in the long run. However, in the short run BE and TLF has a positive but insignificant impact on GDP. In case of India, GFCF, TLF and BE positively and significantly influence the economic growth in the long run. However, in the short run TLF are positively but statistically insignificant. Study finds natural resource (blue economy) as a blessing for both economies in the long run. It means BE is an engine of growth. By comparing the results of both countries in growth accounting framework, share of growth due to capital, labor, blue economy and total factor productivity increase the economic growth of India more than that of Pakistan. 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.

Key words: Gross Domestic Product (GDP), Blue Economy (BE), Total Factor Productivity (TFP), Growth Accounting (GA)

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
ASP	Agriculture Statistics of Pakistan
BE	Blue Economy
BEI	Blue Economy Index
CPEC	China Pakistan Economic Corridor
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
ESs	Ecosystem Services
ESP	Economic Survey of Pakistan
EU	European Union
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
FVCB	First Value Carried Forward
FY	Fiscal Year
GDP	Gross Domestic Product
GMP	Gross Marine Product
IORA	Indian Ocean Rim Association
IOR	Indian Ocean Region
KPT	Karachi Port Trust
LDCs	Least developed Country
LVCF	Last Value Carried Forward
MDA	Maritime Domain Awareness
MDG	Millennium Development Goals
MPAs	Marine Protected Areas
MSP	Maritime Spatial Planning
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
SIDS	Small Island Development States
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nation Development Program
UN	United Nation

CHAPTER 1

INTRODUCTION

The blue economy and ocean civilization are the dominant themes of the twenty-first century and these two concepts have immense importance in human history. Oceans comprise almost 70% of our planet's total surface area, while blue water makes up nearly 97 percent of the entire water reservoirs. Given the rapid pace of urbanization, climate change, population growth and other land-based issues, the focus of global policy discussions is shifting gradually toward the world's blue resources. Currently, oceans generate employment in shipping, tourism, fishing, aquaculture, and energy generation. Moreover, oceans are persistent source of minerals, food, and oxygen. Blue water helps to protect the ecosystem by absorbing greenhouse gases, maintaining temperature, managing groundwater levels, and serving as highways for sea-borne trade and commerce (Roy, 2019). Human survival is intertwined with the existence of blue economy. Each year, the blue economy contributes between $3 and $6 trillion in global economy. About three billion people depend on fish as major protein supplement, and ten to twelve percent of the world's population relies on seafood for their livelihood (Mulazzani & Malorgio, 2017)[1].

Pauli is a pioneer who introduces the term blue economy in 1994 (Pauli, 2011). According to Pauli, the blue economy is a source of long run sustainability. The growth of the blue economy is a basic concept that is substantially less expensive to implement in order to achieve the aims of long run growth (Graziano et al., 2019). It is worth noting that there is no universal or uniform definition of this concept. So, scholars and policy makers define blue economy by their own geography, knowledge communities, investor situations, and institutional frameworks (Bond, 2019). The "Economist" discusses the working definition of blue economy. According to this magazine blue economy is an economic activity with the long run ability to maintain sustainability (White & Rahill, 2021). In the same vein, blue economy in larger sense, is described as long run socioeconomic growth based on the utilization of ocean resources. It also refers to the strategic use of both above and below the surface of the blue water's natural

[1] The idea of research is an extension of previous research done by (Azad, 2020).

resources (Bolton, 2021). The main goal of the blue economy is to maximize resource efficiency while minimizing waste and environmental degradation. Other economic potentials that are associated with blue economy include the creation of new jobs, the production of new social capital, the improvement of living standards, and, most importantly, the preservation of the ecosystem (Pauli, 2011).

The blue economy is comprised of a variety of interconnected sectors that harness the ocean's resources to generate economic growth and development. The World Bank also recognize these interconnected sectors as fisheries, tourism, maritime transport, aquaculture, renewable energy, seabed extractive industries, and marine biotechnology as components of the blue economy (Bhattacharya & Kumar, 2020).

South Asian countries have just lately begun to focus on the blue economy. India and Pakistan are both marine nations. Furthermore, these countries are considered as less developed countries (LDCs). South Asian nations have 173,000 kilometers of coastline, and their seas include 35 percent of mangroves, at least 18 percent of sea grass beds, and approximately 30 percent of the world's coral reefs. The blue economy is the source of income for most of South Asian countries e.g., Bangladesh, Sri Lanka etc., (Zafar, 2016).

Pakistan is undeniably one of the most important marine states with immense potential. It has 1050 kilometer (km) total coastal area that includes the continental shelf and exclusive economic zone (EEZ). EEZ encompasses approximately 240,000 square kilometers area. Pakistan is ranked at 74th out of 142 coastal states in terms of "coastline length”. Sindh province presently contributes in Pakistan's blue economy but paradigm will shift to Baluchistan in near future as Baluchistan province will be on driving seat especially after the successful projection of China Pakistan Economic Corridor (CPEC) (Usman Askari et al., 2020). CPEC will play an integral role in shaping the future of blue economy of Pakistan. The fundamental goal of CPEC is to foster regional integration and economic growth for Pakistan's prosperity, as well as China's dominance in the ocean’s resources. These marine zones present Pakistan with numerous potentials to exploit ocean-based resources, as well as much-needed business and employment opportunities for the country's population. However, due to a variety of administrative, operational, and technical barriers, the maritime industry continues to be overlooked. It accounts

for a very small percentage of the gross domestic product (GDP), with the maritime industry estimated at US$ 240 million, or almost one percent of GDP. To fully realize its potential and achieve economic growth, it merely requires effective marine policies and practices (Sakhuja, 2015).

If we talk about the situation of blue economy of India that is next to Pakistan, an Indian blue economy contributes many times more than the Pakistan in all economic terms. As India is a big economy in South Asia, with 7500 km long coastline and 2.019-million-square-kilometers EEZ. According to Government of India's Vision of New-India by 2030, the blue economy is highlighted as one of the 10 essential pillars of growth. Marine and ocean research has been focusing for India, and the country has made important scientific and technological achievements in this field. It has developed several numbers of research and development laboratories and institutes to improve sustainable exploitation of sea-based resources. India is in a unique state in terms of its maritime location (Roy, 2019). As 95 percent of India's trade by volume transits by ocean, the country has 12 major ports and 187 minor ports that handle around 1400 million tons of cargo each year. India's EEZs, which cover over two million square kilometers and has considerable recoverable crude oil and natural gas resources. Over 4 million fishermen and other coastal populations rely on the coastal economy. India shares a coastline border with six nations, giving great prospects for economic expansion through maritime development, export–import trading, and the utilization of natural minerals and energy resources to meet local requirements (Alharthi & Hanif, 2020). With such huge marine interests, India's blue economy is strongly intertwined with the country's economic development (Trishala, 2016).

The contributions of Pakistan and India's blue economies may be found in the preceding lines. In nutshell, the Indian blue economy contributes far more to economic and social aspects than the Pakistan's blue economy. But after CPEC initiative, the relevance and potential of Pakistan's blue economy will increase many times in comparison to India, because CPEC will be utilized by the world's largest producer economy. Furthermore, Pakistan's strategic location is another factor that will increase the relevance of blue economy of Pakistan.

Quantification of the blue economy is a need of the hour. There hasn't been single research in the context of Pakistan that has taken a quantitative approach to address the issues of the blue economy. This quantitative analysis is used to evaluate how much economic growth may be predicted from shifting economic activity to the blue economy, particularly in emerging nations such as Pakistan and India. Contemporaneous study try to critically evaluate the blue economy contributions to the economies of Pakistan and India. Furthermore, it compares the results of both economies to determine which has benefitted more with blue economy paradigm. Fisheries, aquaculture, tourism, environment, trade, and marine shipping are among the sectors that will be closely investigated in this research. The contribution of the aforementioned sectors to the country's GDP will be investigated by first developing a model to gain a better understanding of the current situation. The question arises here why to compare with India, both nations are comparable in a sense that they gained independence at the same period. Both have same geographic or demographic conditions and institutional frameworks. Therefore, examining and understanding the contributions of the blue economy to both emerging nations (Pakistan and India) economic progress is essential.

1.1 Significance of the Study

The contemporary study will add to the existing literature in three ways. First, it will be foremost study that try to examine the role of the blue economy with the help of time series data. There hasn't been a single empirical attempt to the best of our knowledge, that has examined the impact of the blue economy in both countries. Secondly, present study develops a multidimensional index of the blue economy for India and Pakistan by using same indicators of blue economy. lastly, the present research also tries to calculate the growth contributions from blue economy for both nations by using Solow residual or total factor productivity (TFP) approach of growth accounting.

1.2 Rationale of the Study

The blue economy has enormous potential for South Asia especially Pakistan and India, which serves as a global trading hub. The primary goal of present research is to examine the status of the blue economy and its economic consequences in form of GDP for both countries. Because the idea of the blue economy is an emerging field and it requires proper assessments and

strategies to change the lives of people. Both countries are suffering by and large with same socio-economic challenges so there should be exploration new avenues of growth. In this situation, a blue economy provides a solution to deal with some of these issues.

1.3 Objectives of the Study

- The first objective of present study is to develop an index of the blue economy that provides comprehensive assessments associated to the status of the blue economy overtime in case of Pakistan and India.
- The second objective is to find the dynamic relationship amongst the blue economy and economic growth for both nations.
- Third and important objective of the present study is to empirically examine the role of the blue economy in the growth accounting framework of both countries.

1.4 Problem Statement

Developing economies face a dilemma in which they need to harness natural resources to escape poverty, but they also need to safeguard the environmental sustainability. Blue economy structure of Pakistan is underdeveloped, but it has an immense potential. Keeping all these considerations in mind, the impact of blue economy in Pakistan's economic growth in this research will be observed. When comparing the growth of the blue economy in Pakistan to that of other countries in the region, particularly with India and even Bangladesh, Pakistan lags in having the benefit of the blue economy and its position is not remarkable.

1.5 Organization of the Study

This study is organized into following chapters. The second chapter is a review of literature of blue economy and economic growth in broader way. Chapter three consists of blue economy index regarding Pakistan and India. Chapter four enlightens the theoretical framework and estimation methodology and also elaborates the data sources of variables that are employed in this study. The result and discussion present in chapter five, also with in depth analysis of growth accounting framework. The study's conclusion and policy recommendations for planners and policymakers are included in the last chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The term "blue economy" refers to a new discipline of economics. It serves as a green economy alternative in the twenty-first century (Pauli, 2011). In the previous literature, the terms "blue growth" and "blue economy" are commonly employed. The blue economy is a type of economic system that aims to increase people's social and economic well-being with minimizing negative environmental consequences (Lee et al., 2020). According to the World Bank "blue economy" is defined as "the sustainable use of ocean resources for economic growth, better livelihood and jobs creation, and ocean ecosystem health". As a result, this chapter is devoted to an assessment of national and worldwide blue Economy literature.

BE research is primarily focused on generating employment and growth in maritime economies by supporting new sectors of economic activity (such as ocean or blue energy, marine or blue biotechnology, and seabed mining) while also bolstering incumbent businesses (i.e., maritime transportation and coastal or blue tourism). The most pressing difficulty for policymakers is deciding which blue economy sectors to encourage in order improving oceanic sustainability. Through policy creation and execution, marine sectors with comparative advantages have delivered significant successes to particular emerging countries. China, for example, has implemented a wide range of policies aimed at restoring and developing marine fisheries resources. Through smart governmental interventions, India has reduced barriers to marine transport growth.

2.2 Review of International Literature

Mitra et al., (2021) stated that the blue economy has the potential to improve the country's GDP by adding a new dimension to sectors such as marine biodiversity, fisheries and aquaculture, coastal tourism, seabed mineral-based enterprises, non-conventional energy, and so on. Because it is connected with low carbon footprints, the blue economy can ensure the long run viability of marine and estuarine ecosystems. However, to protect the living and non-living resources of

oceans, seas, bays, and estuaries from overexploitation, a well-defined strategy must be developed.

Qi et al., (2020) blue economy research is primarily focused on generating employment and growth in maritime economies by supporting new sectors of economic activity (such as ocean or blue energy, marine or blue biotechnology, and seabed mining) while also bolstering incumbent businesses (i.e., maritime transportation and coastal or blue tourism). The most pressing difficulty for policymakers is deciding which blue economy sectors to encourage in order improving oceanic sustainability. Through policy creation and execution, marine sectors with comparative advantages have delivered significant successes to particular emerging countries. China, for example, has implemented a wide range of policies aimed at restoring and developing marine fisheries resources. Through smart governmental interventions, India has reduced barriers to marine transport growth.

Lee et al., (2020) summarized that the blue economy is becoming a popular notion as a method for conserving the world's ocean and water resources. It may arise when economic activity is balanced with the long run potential of ocean environments to sustain the activity. The concept "blue economy" has been used in a variety of ways, while related concepts like "ocean economy" and "marine economy" have been used without precise definitions. As an ocean economy, the blue economy intends to "increase human well-being and social equity while considerably lowering environmental dangers and ecological scarcities". Although the sea has traditionally been a source of economic growth in various regions of the world, study on the economic worth of the blue economy has faced limitations.

The economic impact of blue economies is calculated for Finland's Gulf of Bothnia (GOB) area in this study. This research examines the state of the blue economy in the GOB, with the goal of establishing ways to assess the blue economy's economic benefit and addressing the method's use and limits. When doing a study on the current state of the blue economy in a specific location, the topic of blue growth is likely to shift to a practical and local level. Oceans and seas have a lot of potential, and they might be used in a more effective and practical way to support local economies. It can also assist in the development and expansion of marine business opportunities. Shipping, aquaculture, and coastal tourism are the largest jobs in the European Union.

More detailed data on the blue economy is needed in the GOB in order to understand its future development and hence guide planners, policymakers, and decision makers. There's also a need to standardize procedures to make cross-regional comparisons easier. Data also revealed that the number of enterprises indicates very little about the importance of a sector in terms of employment or income for the region.

Atmanand et al., (2019) highlighted those oceans, with their immense wealth represent the ultimate frontier in the transformation of society's economy from scarcity to abundance. India's Ocean jurisdiction now equals its land jurisdiction due to the expanded Exclusive Economic Zone. For India to establish a sustainable blue economy, an integrated strategy with long run vision, technology, management, monitoring, and time-bound legislative reforms is required. The developing blue economy will undoubtedly act as a development engine for India's powerful economy, which is expected to exceed US$ 10 trillion by 2030. The pillars necessary for transitioning the old "Ocean and marine economy" into a "Blue" or "Sustainable" economy are adequate governance, vision, technology, management, monitoring, and time-bound regulatory changes in the continued use of the ocean, coastal, and marine industries. Mineral resource development along the coast and off shore is beneficial to industrial and economic growth.

Wenhai et al., (2019) introduced the notion of the blue economy from a global viewpoint**.** Because China is undergoing a significant transition from quick to quality development**,** it was chosen as the study's focal point for blue economy analysis. It adopted a firm stance in the future. As the world's population and industry grew it was imperative to invest in a renewable resource that could meet the rising demand. As the value of blue growth became more widely recognized, the world began to take notice. Globally, all research institutions and policymakers have become worried about the ocean and the coastal regions that are related with it. They urged that the blue economy be better understood. States made decisions based on their own requirements. Because the world is increasingly intertwined, a lack of consensus was pushing the need for discourse in order to reduce humanity's potential issues.

Case studies were used in this study to identify and explore the core principles of the blue economy. The study demonstrated the ocean monitoring group's outstanding determination of knowledge and technical practice, which was gathered from all through the world. With the

support, inspiration, and assistance of all interested supporters, it was completed successfully. The current research focuses on the blue economy's three conceptual components: stable macroeconomic policy management, regulatory frameworks, and strategic planning. Science and service-based goods were among the application cases for creating the blue economy. Support for the maritime industry, pollution control, disaster monitoring, nature conservation, and system platform were all separated into four areas in the report. Even though being a nascent field of research, they have confirmed auspicious results in a number of areas where they predict a bright future. They provided some excellent recommendations for the development of the blue economy. Massive examples were among the suggestions such as sharing global responsibilities to maintain the maritime environment and improving global communication. Only by engaging in developing skills and fostering the building of a universal blue alliance will it be achievable. However, there will always be potential for improvement and progress in terms of comprehending the extent and wisdom of collaborative analysis and comprehension. The authors argue that now is the moment to join forces and work in the smart management of these resources in order to prevent our seas from collapsing.

Childs & Hicks, (2019) proponents of the blue economy make bold predictions to increase human well-being and fairness, minimize environmental hazards and shortages, and build national and regional collaboration. The 'Blue economy' and 'blue growth' agendas have been mobilized as a conceptual frame, policy discourse, and set of practices throughout the world, describing the potential contribution to human flourishing afforded by aquatic and marine regions (especially seas, oceans, and their resources). The 'securing' of the ocean as a space for certain economic, environmental, and military goals and actions is done through the blue economy framing of the ocean. The authors suggested that eco-civilization technique be used to offer stability and balance to environment friendly management and economic development. If these rules are implemented successfully, they will have a tremendous impact on China's maritime environment, with worldwide implications. The report made a number of recommendations for improving MPA performance in China. Conservation and enhancement of maritime capability, increased resourcing, and a complete and efficient economic value of ecosystem commodities, facilities, and natural capital were all part of the plan.

Keen et al., (2018) did examining to build a blue economy theoretical framework. The investigation looked at how the governments of the Pacific Islands and the Solomon Islands, as well as other regional institutions, are striving to promote sustainable ocean management through proactive policies. The data was studies through a wide range of review reports, researches, and geographical statements delivered by leaders from the same region. As important aspects of the blue economy, the research attempted to achieve financial sustainability, ecological integrity, facilitating technological capacities, policy structures, and social inclusion. The findings revealed a disparity in the attention given to key blue economy modules, as well as a potential for coherence across time, size, and participants. Finally, the conceptual framework developed was valuable for assessing the exercise and concentrating on essential areas of ocean sustainability that were previously overlooked. Aside from that, the growing use of blue economy terminology adds to the complications.

Sarker et al., (2018) emphasized the blue economy possibilities of Bangladesh. For empirical analysis, the study used data from primary and secondary sources. Primary data was collected through interaction with many stakeholders involved in blue development. Through personal interaction, secondary data was compiled through policy review reports, research journals, and news sources from government entities. They came to the conclusion that, in the case of Bangladesh's economy, shoreline and oceanic resources are the key components of the blue economy. On the sea and on land, trade and commerce provide financial and commercial benefits. Such activities have a lot of potential for the blue economy to expand. To achieve sustainable growth of the blue economy in Bangladesh, strategic planning focused on prospective areas of the blue economy such as knowledge creation via ocean governance, research, and development is necessary. Furthermore, they claimed that in order to fulfill the SDGs, there must be a balance between the two. The problems and potential of cross sector governance in the Blue economy for the European Union were emphasized by Alharthi & Hanif, (2020).

A core element of blue growth is the comprehensive and organized management of numerous sectors, as well as the socially optimum utilization of ocean natural resources. However, the execution of integrated management has long been a source of concern. The research examined

at current sectors such as fisheries, transportation, and offshore hydrocarbons, as well as developing sectors such as tourism, aquaculture, and seabed mining, as well as the inter-sectors relationships between them. As the worldwide usage of natural resources grew, so did global exploitation. Many different sectors interacted with one another, necessitating integrated interactions between them in order to get maximum advantages and minimize the problems that come with it. Different quantification approaches for interconnections of sectors relevant to growth of blue economy were emphasized in the study. Cross-sector interactions should be recognized and included into the governance structure, by author recommendation. In this manner, the prospects of the blue economy becoming a reality will undoubtedly improve.

Voyer et al., (2018) used Australia as a case study. The confluence and interdependence between marine safety and blue economy in the Indian Ocean Region was the study's objective. The finding revealed two major links amid maritime security and the blue economy. Navigation routes will be secured by focusing on maritime security. Important oceanographic data will be made available to interested enterprises in this way. As a result, the maritime jurisdiction of a specific country was used to protect and acknowledge privileges over valuable aquatic resources and marine activities. Second, marine security has served as a source of revenue for the blue economy. The study came to a conclusion depending on the techniques used in earlier investigations. The author reviewed at how marine protection in the Indian Ocean aided blue economy activity. It comprised four types of ocean use: non-living resource mining, living resource mining, ocean commerce and trade, and ecosystem safety. The researcher came to the conclusion that ocean protection and the blue economy are deeply intertwined in the Indian Ocean.

Clark Howard, (2018) attempted to illustrate the importance of contributors in the blue economy’s development of US. Stakeholders had a vital part in sustainable development, which was sometimes perceived as a political or scientific issue. As a result, it is the activities of stakeholders that create or break the international organizations’ and UN's aims for achieving sustainable development. The author conducted research in which he interviewed a number of key actors to learn how they thought a "blue economy" might be built through collaboration. The research covered elements such as fishing, aquaculture, transportation, and a healthy

environment. According to the study, blue economy is an adaptable framework that countries may use in whichever way they want depending on their blue potential. However, one key aspect of the blue economy was growth and maintenance of the marine environment, as well as the economic assistances that came with it, which resulted in the degradation of the maritime ecosystem. According to the study, it was best time for customers, businesses, scientists, and other stakeholders to bargain and remodel for optimum economic advantage. The study emphasized solvable challenges such as poverty reduction, employment opportunities, food security for a rising population, and coastal environment conservation. Without inherent sustainability, the waters' economy will not exist forever if ignored. As a result, every industry should come up and play a constructive part in marine economy conservation, as it is predicted to dual by 2030. Things must be meticulously recorded in order to be used for scientific purposes. So, the "blue economy" is becoming more popular as a technique for protecting the world's seas and water resources.

Bari., (2017) goal of the study was to emphasize the blue economy while balancing its social, commercial, and environmental advantages. The influence of the blue economy to the GDP of South Asian nations was also examined. Furthermore, according to the study, this region benefits greatly from the Bay of Bengal. India, Bangladesh, Sri Lanka, Myanmar, and Indonesia encircle it on all sides. According to the study, an absence of statistical data is a problem in the South Asian region, notably in Bangladesh. Oceans, according to the results, are economic centers that generate more economic activity and all attempts should be in accordance with the blue economy concept. Bangladesh, as a significant part of South Asia, has immense prospective and opportunity for putting the blue economy into practice, but it urgently needs strong governmental dedication, investigation, awareness campaigns, and a strategy to increase the necessary advantages in order to ensure long run success.

Trishala, (2016) stated that the Indian government plays a vital role in supporting the ports industry, allowing up to 100% foreign direct investment in port and harbor building and maintenance projects under the automatic route. Competition within Indian and international ports is identified as a significant aspect in bringing the sector up to international standards. India has to improve its ports if it wants to increase its international trade transactions. The

development of the inland waterway system will help to propel this port forward. Despite the fact that Indian ports are not as advanced as their global counterparts, they have an edge when it comes to meeting rising domestic demand. Investing in Indian ports in line with market trends might thus be advantageous in the coming years.

The importance of marine transportation for society, the environment, and the economy was assessed by (Niavis et al., 2017). The goal of the research was to investigate at the construction and management of legislative framework for marine transportation. The research focused on the Adriatic-Ionian Region and was conducted on the basis of current policy and value estimate methodologies (AIR). As a result, a comprehensive evaluation methodology was developed to assist in the relative valuation of maritime transportation and other area drivers. To assess the intensity of indicators utilized for sustainability and integration, various indicators were employed.

Kathijotes., (2013) advocated that society switch to blue economy model, which would transform resources from scarcity to abundance. Malaysia was the subject of the author's investigation. Only when the world begins to value what it currently has and begins to address the barriers to environmental sustainability will the intended objective be achieved. The author investigated nutrient contamination, maritime transportation, coastal leisure industry, blue energy, and blue biotechnology. If the global wants to keep reaping the advantages of natural assets, the research concluded that administrative policies and investments that emphasize the wellbeing of the blue water and mankind are desperately required. Many maritime natural resources have been deteriorated due to unsustainable utilization, placing them in danger. Though implementing the 'blue economy' idea in the present context will be a significant phase, it would be on the correct track. 'Innovation' is the key term to focus on and work on in the current situation. The world's marine ecology supplies essential nourishment to millions of people all over the world. It will not only assist to harness the blue resources, but it would also help to alleviate poverty by reducing ocean deprivation.

Sakhuja., (2005) investigated that the sea provides vital livelihood and job opportunities, as well as contributing to the national economy. Marine and ocean research has long been a focus for India, and the country has made important scientific and technical achievements in this field. It

has established a number of research and development facilities and institutes to improve technologically in the study and sustainable exploitation of sea-based resources. The National Institute of Ocean Technology (NIOT) provides technical services and solutions for ocean resource management and environmental protection. The Indian government has endorsed the blue economy, with a focus on improving existing capacity to harness the seas through fishing, the exploitation of non-living resources, the modernization of maritime infrastructure such as ports, as well as shipbuilding and the ancillary industry, all of which are funded by the private sector and other sources. India and Bangladesh are cooperating closely to promote the blue economy concept.

2.3 Literature About Pakistan's Blue Economy

Gill & Iqbal, (2021) aims to explore the qualitative study of the blue economy and sustainable development in the contextual settings of Pakistan. Pakistan is blessed with immense blue potential that mostly remained untapped. Despite making reasonable efforts, the country is not making headway towards sustainability. Drawing upon Triple Bottom Line Theory, the study adopted an interpretive research paradigm and collects primary data through semi- structured in-depth interviews with the blue economy expert through non-probability purposive sampling. The study confirms that the blue economy and sustainable development are compounding, and Pakistan can't afford their mutual exclusivity. While calling attention to several socio-economic, political, institutional, legal, security, and environmental challenges, the study informs that Pakistan's geostrategic location and blue economy potential enable it to turn the tide towards sustainable development. To this effect, the study suggested that country needs to put in titanic efforts across all spheres to bear out its national and international commitments towards both.

Usman Askari et al., (2020) stated that the blue economy, also known as the ocean economy, having an important impact on economic growth and development. Pakistan's governments have not paid sufficient attention so far to the increasing of marine sector. The Sino-Pak blue collaboration, which is a key component of CPEC's flagship project, aims to boost Pakistan's marine industry. In this article, the potential of the blue economy is examined, as well as the limitations that may impede the growth momentum in Pakistan. The author described those blue resources include the seas, oceans, rivers, and lakes, among others.

These blue resources can also contribute to the resolution of significant economic issues or concerns such as sovereignty, security, development, food and energy access, natural resource management, and so on. Though Pakistan has begun to pursue a blue economy, long run growth and development would be realized only if the political elite show great commitment and seriousness to this sector. This sector requires both intellectual and material resources from Pakistan. Poor infrastructure, systematic red tape, bureaucratic bottlenecks, regional instability, notably a bad law and order situation, and a lack of collaboration and expertise across departments and ministries all need to be addressed. All-encompassing policies should be enacted, and large-scale and small-scale efforts should be undertaken to promote the blue economy idea. These areas are rich in marine living and nonliving resources, and their geographic location makes them more strategic in terms of maritime transportation, allowing countries to grow more quickly.

Laghari, (2018) discussed the issues and prospects in Pakistan's fishing sector. Secondary data is employed, which is derived from a variety of reliable sources such as the Pakistan Fisheries Department and the United Nations Food and Agriculture Organization. Variables from marine fisheries, inland fisheries, and aquaculture production were included in the research. Fisheries are a significant sector that contributes to food production, national macroeconomic consolidation, and employment generation. Unfortunately, overfishing, natural catastrophes, industrialization, climate change, and pollution have all had a negative impact on this industry. As a result, aquaculture species are rising in order to supply the growing public demand for aquatic protein. Though aquaculture has serious challenges such as temperature changes, environmental degradation, worldwide ecological change, and marine feed, it is the only method to meet the rising demand for fisheries. The author stated that the government and policymakers must take immediate action to address this sector's critical performance and take appropriate steps to make it a competitive and profitable area.

Zafar, (2016) used Pakistan as a case study that how the blue economy has impacted economic success. The goal of this article was to demonstrate the blue economy and its linkages to other market segments by identifying water as an economic resource. Its goal was to draw attention to the issues that are impeding the expansion of the blue economy in some way. For blue capital

generation in Pakistan, the author used secondary data from 1992 to 2015. Water is used in almost all of Pakistan's industries, either directly or indirectly. It means that water is an important factor for Pakistan's blue economy to reach its full potential. Water quality degradation, overexploitation of organic coastal resources, an absence of research and innovation and knowledge about how to effectively utilize coastal ecosystems, an inadequate infrastructure, inefficient water usage in agriculture, a lack of a reliable water ruling regime, and a damaged and degraded coastal ecosystem are just a few of the challenges. Among the author's recommendations are make subsequent, strategic planning, beneficial agriculture, political unrest, to boost energy and technological industries, available and affordable blue capitals for the society's poor and underprivileged people, and a beneficial ruling framework to reduce synchronized gaps among all assessment, examining, and attempting to control departments. In the case of Pakistan, all of these ideas are critical for attaining blue economic development.

Iftikhar, (2016) emphasized Pakistan's strategic importance in the marine sphere, notably in the current 'Port of Gwadar' project. The study's goal was to demonstrate the regions and the world's evolving economic architecture. It mostly focused on China's Gwadar port development as part of the CPEC. The key goal of this research was to promote regional connectivity throughout the region and also to determine whether there was a need to improve maritime security administration, especially in relation to Gwadar Port and the 21st-century Maritime Silk Road. To access the importance of maritime security administration and evaluating both theoretical empirical data. Current study employed a combination of analytical and descriptive methodologies. The study's recommendations were designed to help policymakers and scholars better understand maritime security leadership as a well-coordinated strategy to collaboration and security enhancement. The strategic location of Gwadar port on the Indian and Arabian seas reflects its growing importance in the area. The Arabian Sea serves as a vital economic artery for the region. It is where the world's major business transactions take place. By combining primary and secondary data, this study adopted a mixed method approach. Speeches, arguments from naval and diplomatic officers, conference proceedings, and newspaper articles were used to gather primary data. To enhance theoretical understanding of maritime security and current international attitude on the topic, secondary data sources included relevant literature and journal publications. Oceanic security supremacy is a subjective term assessed by a multi-perspective

method that includes previous maritime occurrences, transitional maritime crimes, and regional collective security measures.

After evaluating global and regional research on the blue economy, current study identified the literature gap in the existing literature. Without a doubt, all of the studies contributed significantly to the literature of this nascent field of economics. None of the aforementioned studies, however, have attempted to perform the growth accounting analysis and an empirical assessment of the determinants of the blue economy which creates the indexes of blue economy through time with several aspects or dimensions and other related indicators, as the current study has conducted to do. Many of that research were completely qualitative in nature. Furthermore, we investigate the influence of the blue economy on Pakistan's economic growth and conduct a comparison with India. This type of empirical analysis of the determinants of the blue economy will enable policymakers in identifying the primary driving forces behind the growth of blue economy activities. This research opens new research opportunities. The success of CPEC projects will determine the future of the blue economy. Pakistan's blue economy has the greatest potential for economic growth. Furthermore, its strategic relevance for the future of human well-being cannot be denied.

CHAPTER 3

MEASUREMENT ISSUES OF BLUE ECONOMY

3.1 Introduction

The lack of adequate data, particularly in developing countries, make it tough to measure the blue economy. South Asian nations generally and Pakistan especially have begun late to pay attention to the blue economy. First and foremost, the definition of "blue economy" is not categorically clear. In recent decades, the blue economy and its long run viability have emerged as one of the most important study issues, and it has been considered a buzzword among policymakers in this sector. Mulazzani & Malorgio, (2017) described the blue economy and related impacts, with a particular focus on bringing cohesion between scholarly literature on the blue economy and ecosystems. In the next sections of this chapter, the statistical components of quantifying the blue economy will be explained. Although a lot of studies have attempted to analyze the blue economy from various viewpoints, but to the best of our knowledge no research has empirically explored the factors that lead to the growth of the blue economy. By focusing on Pakistan and India, the current study attempted to investigate the factors and construct the index that has influenced on blue economic activities. The underlying issue with the blue economy is the way it is measured. First and foremost, to distinguish the blue economic activity from other forms of economic activities, to assess whether the blue economy is diminishing or growing over time, and reaching or moving from the ideal balance of economic and environmental uses (Colgan, 2016). The purpose of this research is to contribute to the existing literature by examining the role of the blue economy on economic growth in case of Pakistan and India. Now, study is going to discuss the construction of an index or composite variable with the help of many available proxy variables of blue economy. The blue economy (BE) index will be created in this study by combining several indicators that have been utilized in the literature (Bari, 2017; Larik, (2017); Laghari, 2018). The multidimensional blue economy index depicts in Table 3.1. The index consists of 12 indicators corresponding to the study's six dimensions. The hypothesized impacts of these variables on dimensions are also included in the table.

Table 3.1: Indicators of Multi-Dimensional Blue Economy - Pakistan

Dimensions	Indicators	Hypothesized Effects	Data Sources
Fisheries	Inland Fisheries Production (metric tons)	+	ASP[2]
	Marine Fisheries Production (metric tons)	+	ASP
	Inland fishing crafts	+	ASP
	Marine fishing crafts	+	ASP
Aquaculture	Aquaculture	+	WDI[3]
Shipping	No. of Vessels	+	PNSC[4]
	Deadweight tons (Million Rupees)	+	PNSC
Trade	Exports Cargo handled at Karachi and Qasim port	+	KPT[5]/PQA
	Imports Cargo handled at Karachi and Qasim port	+	KPT/PQA[6]
	Fish and fish preparation exports (Million Rupees)	+	ESP[7]
Tourism	Tourism	+	WDI
Environment	Total CO2 emissions	-	WDI

[2] Agriculture Statistics of Pakistan 2018 (various issues)
[3] World Development Indicator
[4] Pakistan National Shipping Corporation 2019
[5] Karachi Port trust
[6] Port Qasim Authority
[7] Economic Survey of Pakistan

Table 3.2: Indicators of Multi-Dimensional Blue Economy - India

Dimensions	Indicators	Hypothesized Effects	Data Sources
Fisheries	Inland Fisheries Production (metric tons)	+	HFS[8]
	Marine Fisheries Production (metric tons)	+	HFS
	Inland fishing crafts	+	HFS
	Marine fishing crafts	+	HFS
Aquaculture	Aquaculture	+	WDI[9]
Shipping	No. of Vessels	+	ISS[10]
	Deadweight tons (Million Rupees)	+	ISS
Trade	Exports Cargo handled at Mumbai and Kolkata port	+	MPT[11]/KPT
	Imports Cargo handled at Mumbai and Kolkata	+	KPT[12]/MPT
	Fish and fish preparation exports (Million Rupees)	+	HFS[13]
Tourism	Tourism	+	WDI
Environment	Total CO2 emissions	-	WDI

[8] Handbook on Fisheries Statistics 2018 (various issues)
[9] World Development Indicator
[10] Indian shipping statistics 2019
[11] Mumbai Port Trust
[12] Kolkata Port Trust
[13] Handbook on Fisheries Statistics 2018 (various issues)

Table 3.3: Indicators Weight Distribution Criteria of Blue Economy Index

Dimensions	Indicators
1/6 Fisheries	¼ Inland fisheries production
	¼ Marine fisheries production
	¼ Inland fishing crafts
	¼ Marine fishing crafts
1/6 Aquaculture	1/1 Aquaculture
1/6 Shipping	½ No. of Vessels
	½ Deadweight tons
1/6 Trade	1/3 Exports cargo handled at seaports
	1/3 Imports cargo handled at seaports
	1/3 Fish and fish preparation exports
1/6 Tourism	1/1 Tourism
1/6 Environment	1/1 Total CO_2 emissions

3.2 Description of Dimensions

To further comprehend the phenomenon of the BE index, the dimensions and indicators listed in Tables 3.1 and 3.2 will be discussed in detail in the following sub-sections.

3.2.1 Fisheries

Fisheries is considered as core dimension of blue economy and same dimension is widely used in literature related to blue economy (Bari, 2017; Alharthi & Hanif, 2020; Sarker et al., 2018).

Tables 3.1 and 3.2 depict that the fishery sector has further divided into four underlying indicators and all are divided by the equal weight of 1/4.

Fisheries are the valuable species, and they have been assisting humans throughout the human history as fisheries are resourceful creatures in term of food moreover fisheries can be used to boost the economy. Around 820 million population of glob is directly and indirectly earning their livelihood. This labor force is engaged in the fishing industry in form of catching, producing, selling, harvesting, and distributing the fish (Babar et al., 2018). From 1970 to 1990, worldwide fisheries production is increased then from 1990 to onward it is remained near to constant. During the period of 1970 to 1990, global fisheries output is grew from 70 million to 93 million tons (Attri, 2016).

Inland fisheries are commercial fishing activities that are taking place in freshwaters. Most of this fishing is also classified as capture fishing, as the fish is caught in natural water (Sandilyan, 2016). This indicator is considered a positive impact on the BE index. Because it boosts economic activity in a variety of food-related sectors. On the other hand, fishing activities throughout of the World's oceans and seas, as well as estuaries and bays, fall under the category of marine fisheries production. For people who live along the coasts, the marine fishing industry is a significant source of income for them (Bolton, 2021).

Fish and other aquatic species are captured and cultured in saltwater, which accounts for the majority of fisheries goods that reach worldwide markets. Inland fishing vessels, on the other hand, employ sailboats and rowboats as platforms for fishing activities. It transports the essential workforce and fishing equipment required for a successful operation.

Pakistan is the 6th largest most populated state, with a population of over 210 million people. A large portion of Pakistan's population is reliant on fisheries, agribusiness, as well as other natural resources. Aquatic creatures are produced and captured in coastline, maritime, and inland regions. Food, nourishment, sports, and leisure activities are all provided by terrestrial and marine ecosystems fisheries (Ali Kalhoro et al., 2015). Despite this, Pakistan's fisheries industry is slowing down, and there is a significant need for reforms. Overfishing, on the other hand, has put a huge strain on marine fisheries. In Pakistan's fisheries industry, effective strategic planning practices are lacking. Lack of cold storage facilities, poor sanitary conditions in fish warehouses,

insufficient communication linkages, pollution, and environmental deterioration are all hurdles to the fisheries sector's economic development. International regulations and standards on fish marketing, handling, shipping, processing, storage, and sales procedures are not followed at the local and provincial levels in Pakistan (Ameen, 2017).

Many researches have already explored the fishing sector in depth in numerous ways. However, the existing research focuses mostly on biology, ecology, toxicology, and other related subjects, there is no comparative study on the economic significance of this sector in Pakistan and India. This study attempts to fill the gaps by providing adequate suggestions for improving, promoting, and extending the dimensions of blue economy sector with economic potentials. In this regard, the following table depicts the graphical representation of fisheries sector of both nations. The source of data has been acquired from Agriculture statistics of Pakistan and Handbook on Fisher statistics of India (Ministry of Fisheries, 2019) from 1980 to 2018. It is also measured in metric tons. The hypothesized influence of this dimension is considered as positive for the BE.

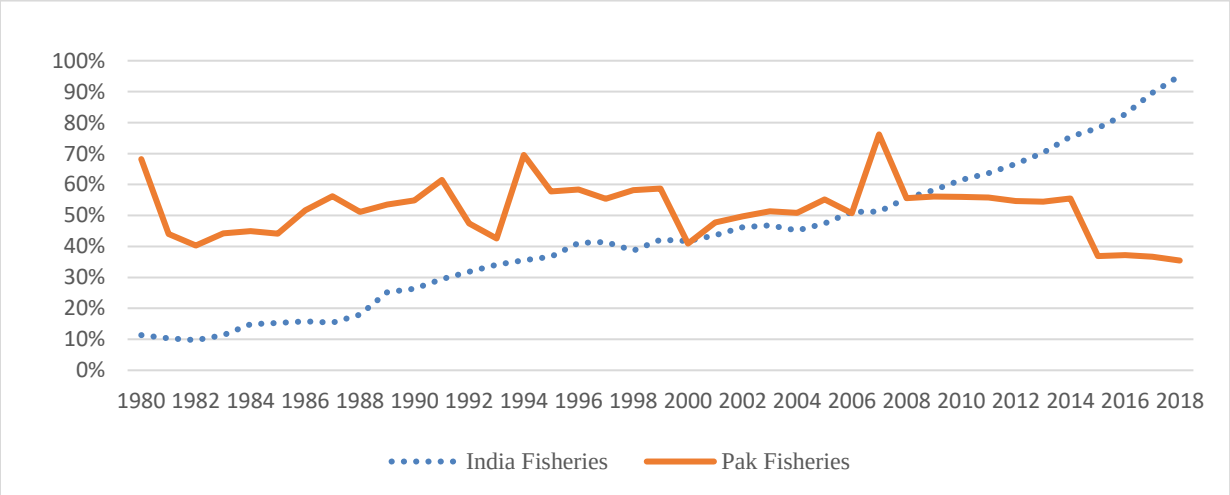


Figure 3.2.1 Production of Fisheries between Pakistan and India

Figure 3.2.1 contains the year-wise trend of the fisheries production between Pakistan and India. The above figure shows that India's fisheries production during the period 1980-2018 is on increasing mod. But the situation is very pathetic in case of Pakistan. The bold line

indicates the rise and fall of fisheries production with its underlying indicators and the trend is not consistent. It can be observed that the highest fisheries production is in 2007 hereafter it is gradually decreases.

There has been a progressive drop in fish yield, although overall fishing effort (time invested fishing and harvesting capacity of the fishing vessels) has increased massively. As a result, the productivity of the sector has been harmed, and expenditures have become high. This has a negative influence on fishing by reducing the resource base under the water's surface (Mohsin et al., 2017). Fishermen's living circumstances have remained mostly unchanged throughout the years, although wholesalers and middlemen have profited handsomely from this industry. As a result, fishermen continue to employ outdated methods and technology that not only degrade the harvest but also make fishing more difficult. Furthermore, because of high expenditures, the marine capture industry is not as lucrative as it could be. If fishing continues at its current rate, fisheries' productivity will be severely harmed (Chancellor, 2021).

In contrast with India, India's maritime resource base is vast and diversified, and this industry makes a major contribution to economic prosperity by employing a larger population. India is one of the world's most populated countries and ranks third in world fish production, with over 2.4 lakh fishing boats, six main fishing harbors, 62 minor fishing harbors, 3432 fishing villages, 1511 landing stations, and a population of 4 million fishermen. During the past six decades, India's fisheries sector has been growing by an impressive 11-fold, bringing the country to the forefront of the world's fish producers. Fish and shellfish items from more than 50 distinct species are shipped to 75 countries. The sector accounts for 1.1 percent of national GDP and generates around $5 billion in yearly export revenues. Marine fish provide 3 million tones to the overall fish output of 6.4 million tones, with 3.4 million tones coming from around 73,000 km of inland water bodies (Vedachalam et al., 2019).

Pakistan's fisheries and aquatic resources have immense prospects, but it isn't being realized in present output, worth, or growth. This sector has a lot of potential in creating employment, increasing export earnings, improving nutrition-related security, assisting coastal communities, and reducing major economic gender inequality concerns. Pakistan's government

has finally realized its potential and wasted possibilities. It has expressed a sincere intention to strive to increase the fishing sector's contribution to attaining the missing possibilities.

3.2.2 Aquaculture

Aquaculture is next dimension of the BE index. According to the existing literature, aquaculture is another major indication of the blue economy for instance Bari, 2017; Kathijotes, 2013). The process of growing seafood in an artificially structured environment is referred to as aquaculture. For thousands of years, this technique has been practiced all across the world. Aquaculture is now one of the most prolific businesses and a center of economic activity within the agricultural economy, and it is playing an increasingly vital role in food security. Aquaculture currently fulfills more than half of the World's seafood demand, with much of it taking place on land. Aquaculture have significant potential to meet the demand of basic protein of the two billion people by 2050 (Spalding, 2016). Problems and inconsistencies, on the other hand, obstruct its progress, particularly at the turn of the twenty-first century, when new sustainability related issues are emerged.

Figure 3.2.2 Situation of Aquaculture in Pakistan and India

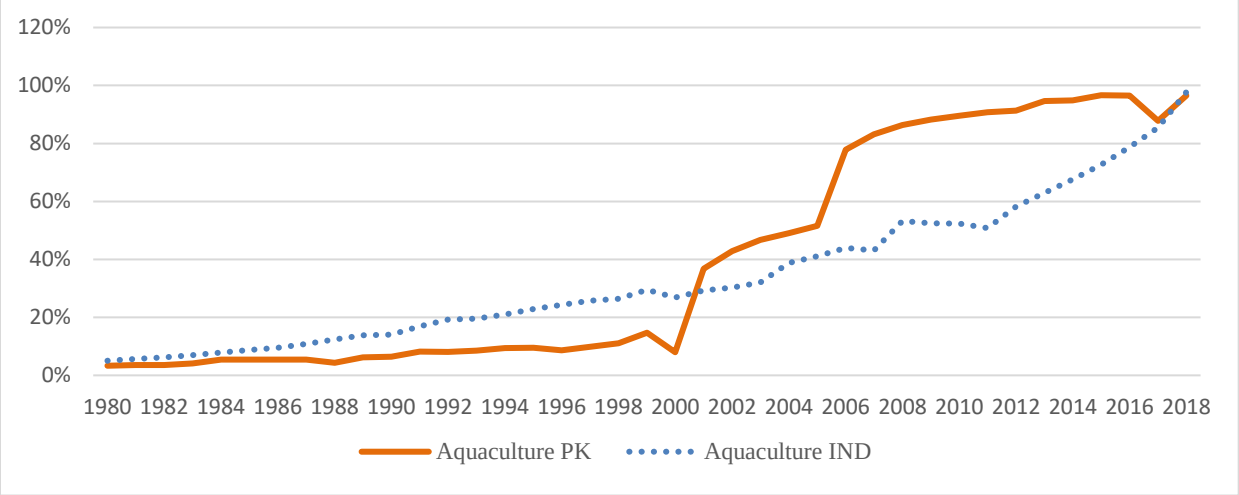


Figure 3.2.2 depicts the contribution of total aquaculture production during the period 1980 to 2018. Data has been collected from World Development Indicators (WDI). From above figure it can be clearly seen that the aquaculture production contributed to the initial period was very low in both nations. The highest contribution of aquaculture production recorded is 96 % in

the year of 2016 in case of Pakistan. There is a significant growth observed during the period of 2001 to 2016 and after 2016 there is slightly downward trend and then again rise. In case of India, initially the contribution of total aquaculture production is low and with the passage of time it significantly improved. The highest total aquaculture production is recorded in 2018.

Pakistan's aquaculture industry is thriving and this sector has enormous potential for growth. Bangladesh and India are two of the world's top five aquaculture producers. Aquaculture development has accounted for 54 percent of all investments in Bangladesh's fisheries industry (Laghari, 2018). During the last two decades, Indian aquaculture has grown by six-and-a-half-fold growth, with freshwater aquaculture accounting for over 95 percent of total aquaculture production. India has 3.15 million hectares (ha) of reservoirs, 2.36 million hectares of ponds and tanks, and 0.19 million hectares (ha) of rivers and canals. Freshwater aquaculture, which had a 34 percent share of inland fisheries in the mid-1980s, has risen to around 80% in recent years. Several organizations, government departments, and financial institutions have lent their assistance (Jayasankar, 2018).

Aquaculture is the finest alternative for eradicating hunger while also having the capacity to improve economic conditions. Despite the fact that Pakistan's aquaculture business is increasing with the passing years, the average growth is still modest. Pakistan has a vast variety of aquatic resources, but fisheries productivity is extremely effective. In addition, maritime culture is still in its infancy (Mohsin et al., 2017).

3.2.3 Shipping

Shipping is another core dimension of blue economy as well BE index. Table 3.1 and 3.2 shows that there is a positive hypothesized effect of shipping in BE Index. Data has been taken from Pakistan national Shipping Corporation and Indian shipping statistics from 1980 to 2018. Shipping dimensions are further split into four underlying indicators as shown in table 3.3.

Shipments are the most cost-effective means of transportation which delivering 80 percent of worldwide cargo trade volume. It denotes to the commercial procedure of moving commodities or cargo, particularly by ship or vessel. For emerging economies, such as South Asia, in which the majority of commodities are put on board, shipping becomes even more vital (Bari, 2017). The worldwide shipping container industry was valued around 4.6 billion dollars in 2016, and it is predicted to grow to 11 billion dollars by 2025. The market size of this industry is

expected to increase at an annual compound growth rate of 8.3% (Rachman, 2018). The rate of growth in the South Asian sector is substantial, but it is not enough to keep the region out of poverty (Mitra et al., 2021).

The number of vessels represents the number of ships or other watercraft used to transport merchandise from one region to another. The number of vessels is thought to have a positive influence on the blue economy. The data is gathered from Pakistan national shipping corporation and Indian shipping statistics (2019).

The term "deadweight tonnage" denotes to a ship's carrying capacity. The deadweight tonnage generally comprises all such as freight, passengers, personnel, and all foodstuffs except the ship's own weight. The source of data and time spam remain same, and this indication is measured in thousands of tons. As demonstrated in table 3.1 and 3.2, the hypothesized effect of this indicator on the BE index is positive both in Pakistan and India. In comparison to air and land transit, it is one of the most cost-effective modes of transportation. With the environment's long run viability in mind, the blue economy is heavily reliant on shipping (Niavis et al., 2017).

Figure 3.2.3 Overview of Shipping sector between Pakistan and India

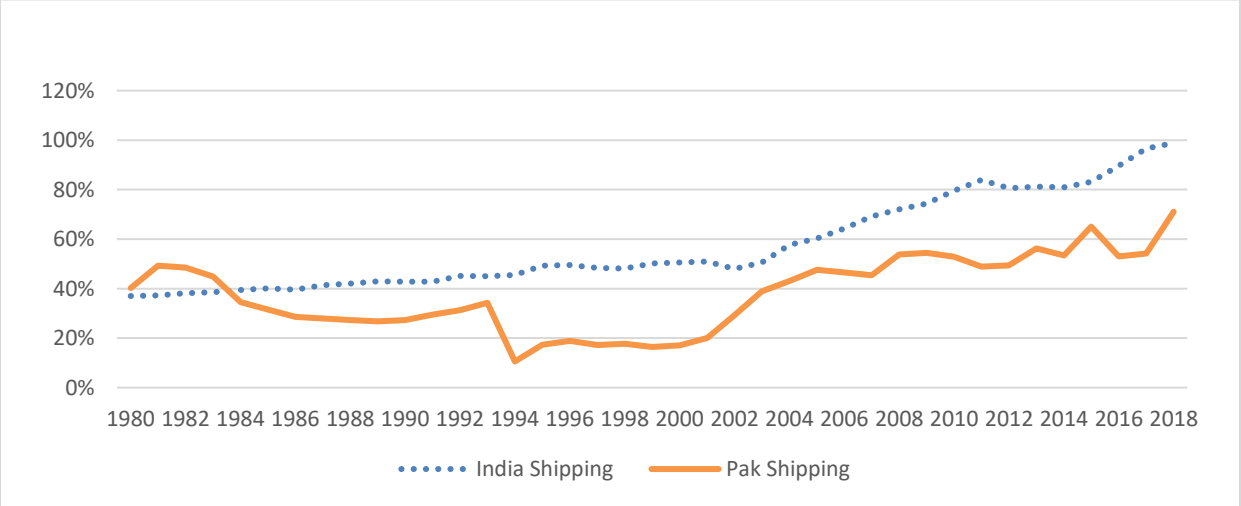


Figure 3.2.3 demonstrates the comparison trend of shipping sector between Pakistan and India from the period 1980 to 2018. It can be seen that Pakistan shipping sector is not at stable pace as compared to India. In 2018 the highest growth rate of shipping sector is 71 % and 98 % in case of Pakistan and India respectively.

Most of Pakistan's marine industry is regulated by the Ministry of Maritime Affairs, which is the leading governing authority. Pakistan National Shipping Corporation (PNSC) is Pakistan's biggest and only flag Shipping Corporation, transporting just 10-11 percent of the country's cargo. Only 10% of Pakistan's shipping industry is handled by Pakistan's national shipping corporation, with the remaining 90% handled by international shipping corporations. Pakistan pays international shipping corporations millions of dollars in freight costs. This is a significant setback for national economy, as well as imports and exports. If national shipping firm expands its fleet of ships, it can prevent this loss. It will contribute millions of dollars to the economy as a result of this, as well as provide additional work opportunities for seafarers, particularly recent graduates who are experiencing a serious labor shortage (Rachman, 2018).

Pakistan has seven oil tankers, five bulk carriers, and a total fleet of 57 ships in the Southern Asian region as of 2021, which is the smallest among regional countries even with Bangladesh and Srilanka. In contrast, India has a total of 1801 ships in its navy with 36 oil tankers, 63 bulk carriers, 587 general cargo, 22 container ship and 993 is other types of ships. Not only that, but Pakistan lacks any general cargo or containerships. The comparison of regional countries highlights Pakistan's fleet's vulnerability. Because Pakistan is reliant on oil imports, the responsible government should prioritise procuring oil tankers and bulk cargo vessels in the first phase (PIDE policy view point, 2020).

PNSC, as Pakistan's sole shipping corporation, must take urgent remedial efforts to regain its lost identity and fight effectively in this severe competition. The government should also encourage the private investor to establish their business in Pakistan and launch their own fleets in order to enhance the local shipping industry, which would benefit both Pakistan and the rest of the world (Yousaf and Ali, 2020).

3.2.4 Trade

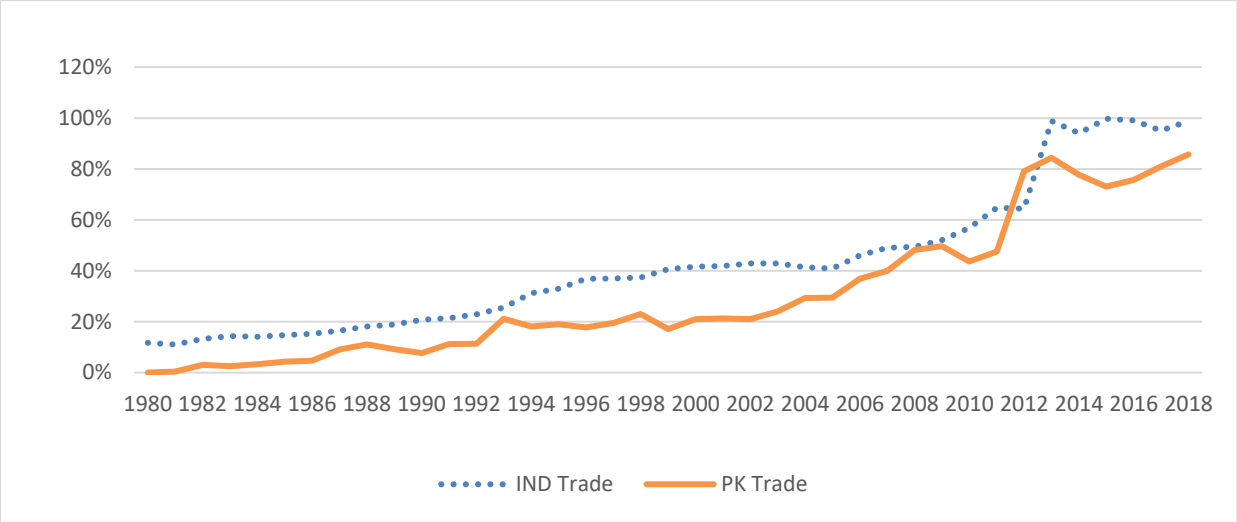
The main dimension of BE index is trade which plays a pivotal role in any economy. Coastal ports and seaborne transportations handle the majority of world trade. Trade and transportation associated to the ocean and sea, as well as protection from natural catastrophes, offer enormous potential for boosting the blue economic growth of the country (Nicholls et al., 2018). According to reports, roughly 80% of global trade by volume and 70% by value is transported by sea and handled by ports all over the world. These percentages are often greater

for developing economies on a national level (Hussain et al., 2018). Table 3.1 and 3.2 demonstrates that the dimension of trade is further divided into three indicators which include imports and export cargo handled at Karachi, Qasim, Kolkata and Mumbai Ports and fish and fish preparation export. The data source of export and import cargo handled at Karachi and Qasim ports has been acquired from Karachi Port Trust and Port Qasim trust respectively. Karachi Port is recognized as Pakistan's largest and busiest port. It transports around 60% of the country's cargo. Every year, more than 1700 cargo ships dock at Karachi. Pakistan's second-largest and busiest port is Port Qasim. It transports almost 40% of all freight in the country. Port Qasim's infrastructure is well-organized, with connections to six railway tracks and a motorway that is approximately 15 kilometers distant. This marine port is around 22 kilometers from the airport. Port Qasim is home to Pakistan's first privately owned petroleum terminal (FOTCO). This port receives almost 1500 ships every year (Usman Askari et al., 2020).

In the same manner the data source of export and import cargo handled at Kolkata and Mumbai ports has been acquired from Kolkata port trust and Mumbai port authority respectively. These two indicators are measured in thousand tons and their hypothesized effect is seems to be positive in both index of Pakistan and India.

The third indicator of trade is fish and fish preparation export. It comprises fish, frozen fish products, canned fish, and processed fish that are traded between nations and within countries (Mohsin et al., 2017). It is expressed in million rupees, and its hypothesized impact on the index are positive, as shown in table 3.1.

Figure 3.2.4 Comparison Trend of Trade between Pakistan and India



As shown from figure 3.2.4 the highest share of trade in Pakistan is 85 % in 2018 and India's highest share of trade is 98 % in the same period. From the above graph both variables show gradual increasing trend. Pakistan major share of trades has been done by shipping. Foreign ships transport about 85% of Pakistan's entire international trade (around 100 million tonnes), for which it spends nearly $6 billion annually. Every year, the volume of trade by sea is growing, but the PNSC's proportion of that growth declines. Pakistan's overall seaborne trade was 100.247 million tons in 2018, with PNSC accounting for around 12.76 percent of that.

According to government sources, the PNSC imports just 26% of the country's liquid cargo and 3% of its dry bulk cargo, with the rest coming from foreign ships. In 2020, Pakistan's total trade volume was 94.321 million tonnes, with the PNSC accounting for 9.33 percent of that amount. Pakistan pays $5 billion in freight charges to foreign shipping each year as a result of this (Pide polic view point, 2020). The seafood sector in Pakistan has $1.2 billion revenue potential. Fish exports have brought Pakistan a lot of revenue. However, due to a lack of supervision and attention, around 200 unique fish species are smuggled on a daily basis. As previously said, Pakistan has enormous resources in various areas especially in Sindh and Baluchistan, but a lack of administration and focus has led to its deterioration also the absence of shipping administration, lack of funding in the shipping sector, and the shipping sector not operating according to international standards are all factors contributing to the low export value.

The capacity of seafood processing plants is underutilized. The efficiency of the trade sector is being harmed by ineffective trade facilitation laws and methods, a lack of financing facilities, an increase in working capital requirements, and a rise in default payments. There is no such thing as a public-private collaboration. Different disjointed departments are poorly coordinated, ports lack the capacity to handle large amounts of cargo, and ports are not completely equipped with sophisticated and updated technology (Ameen, 2017).

Under the CPEC, Gwadar port may become a regional hub for marine exports, will contribute significantly to Pakistan's GDP. Over 86 percent of Pakistan's exports are done by sea. CPEC would improve railway and road connection between Karachi and Gwadar, as well as other rural parts of Pakistan. The interconnectivity of the Gwadar port would not only improve the competitiveness of existing businesses, but it will also encourage exports (Zia Rehman et al., 2017).

In India, major ports with a capacity of 1.45 billion tons handled 0.7 billion tons, while non-major ports handled 0.5 billion tons in 2018. With a total vessel fleet of 1400 boats with a gross registered tonnage (GRT) of 10 million tons, 451 vessels with an 88 percent capacity are employed for international trade, while 938 coastal vessels transport products within the country. Domestic transportation over inland waterways is cost-effective. In India, waterways account for less than 1% of domestic transportation, compared to 24% and 6%, respectively, in China and the United States. National marine development plans totaling $11.8 billion are being developed in order to speed up ocean trade and transportation. By 2035, the Indian government plans to invest US$ 22 billion in 189 port modernization projects under the Sagarmala Programme (Atmanand et al., 2019).

3.2.5 Tourism

Tourism is one of the top five earning industries and a key source in generating foreign exchange in half of the developing nations. Small islands and developing countries have vast untapped potential regarding ocean-related tourism to create job opportunities and earn foreign exchange. Sustainable tourism takes account of the social, environmental, and future economic impacts while addressing the needs of visitors and host communities (Bunghez, 2015). Pakistan has immense Maritime tourism potential with a long coastline of 990 Kilometres which is blessed with diversified natural, religious, and cultural tourism resources. Pakistan must develop

a vast spectrum of marine tourism activities like harbors cruises, recreational fishing, maritime museums, sailing yachting, beach activities, windsurfing, scuba diving, snorkeling, sea kayaking, and many more. Investors should be motivated with incentives like tax reliefs, high-profit expectations, ease of documentation process, and security guarantee. On the other hand, awareness and a friendly environment should be provided to local communities and visitors. The development of international tourism will pave the way to revenue generation and foreign exchange reserves. (Asaf Humayun & Naghmana Zafar, 2014).

Figure 3.2.5 Comparison Trend of Tourism between Pakistan and India

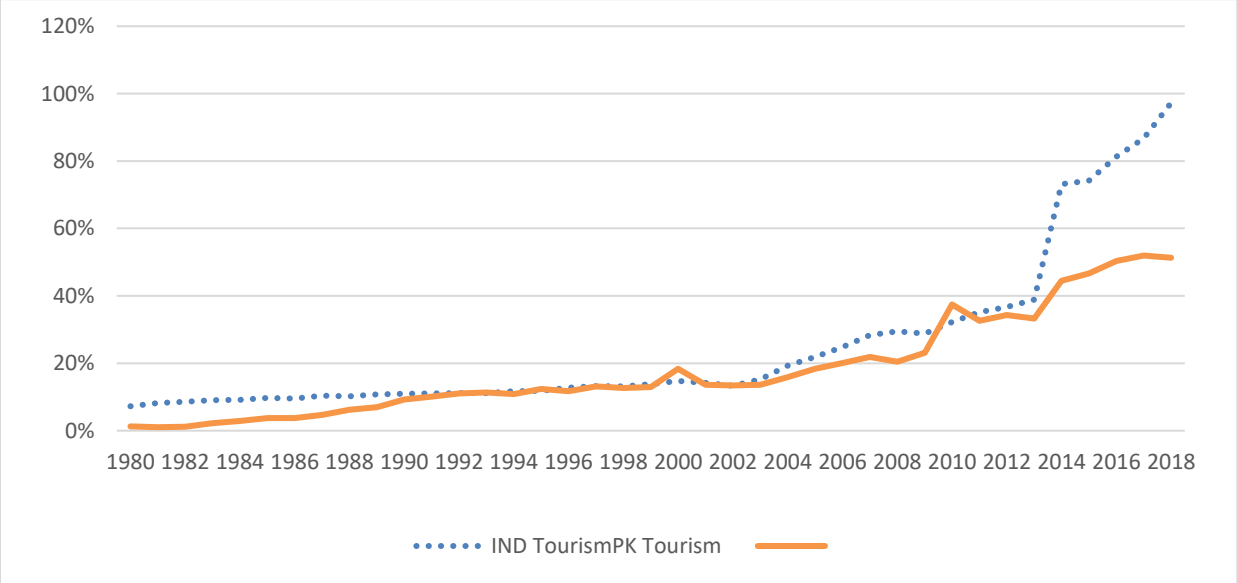


Figure 3.2.5 demonstrates the comparison trend of tourism between Pakistan and India from the period of 1980 to 2018. Data source of tourist sector has been taken from World development indicator (WDI). When the contribution of tourism in Pakistan's GDP is compared to that of its neighboring nation, India, it becomes clear that Pakistan is trailing in the development of the tourist sector. The highest share of tourism in GDP is 51% and 97% in case of Pakistan and India respectively. Pakistan now ranks quite low in terms of global tourist revenue. South Asia's portion of worldwide tourist income of US$ 1,075 billion is US$ 24,156 million, including Pakistan's contribution of only US$ 341 million, or 0.1 percent of global and 1.41 percent of South Asian share (Iqbal et al., 2017).

However, there is no thorough assessment of the prospects of coastal and marine tourism in Pakistan. It is confined to the local population and has never been regarded as a viable source of revenue by the governmental or corporate sectors (Asaf Humayun & Naghmana Zafar, 2014). Tourists from all over the globe are drawn to beautiful regions, particularly seashores with abundant biodiversity and appealing beaches. The coastline areas of Baluchistan and Sindh provinces are extensive in Pakistan. If the government develops the locations properly, they can generate more than $4 billion in revenue for the country. Pakistan's coastline is lined with magnificent beaches. Coastal locations are important for tourism because they attract visitors to spend their vacations in resorts that provide a variety of recreational activities, such as scuba diving, recreational fishing, snorkeling, sea kayaking, and many more and sailing, (Usman Askari et al., 2020). Incentives such as tax relief, large profit margins, simplicity of documentation, and security guarantees should be used to entice investors. Local communities and visitors, on the other hand, should be supplied with information and a welcoming atmosphere. The growth of international tourism will pave the path for income creation and the accumulation of foreign exchange reserves (Bunghez, 2015).

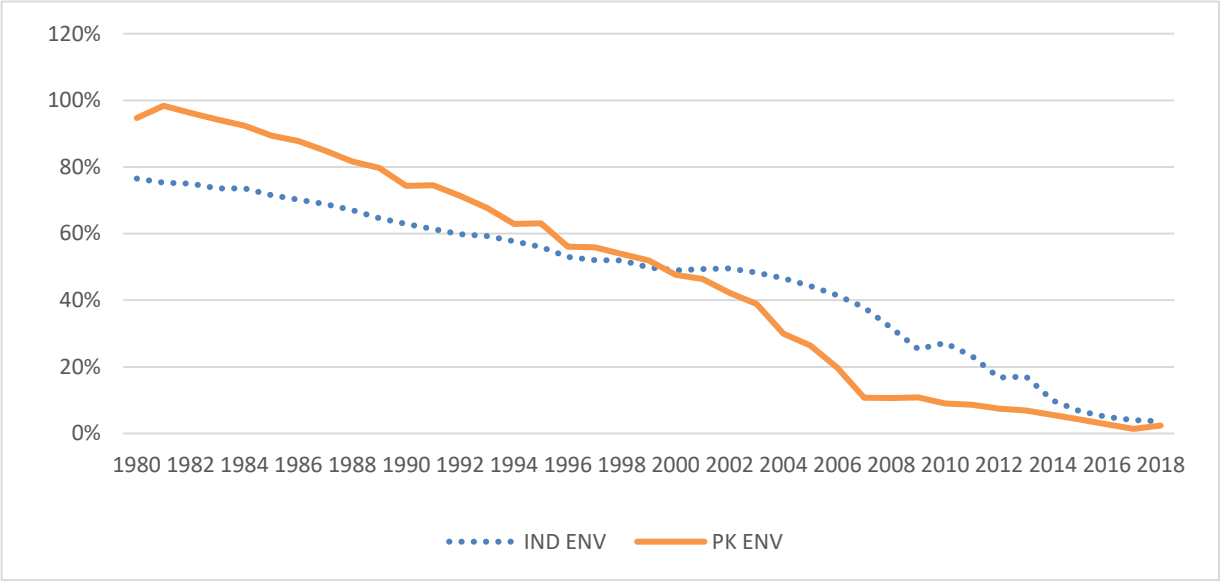
In India the 43% of coastline with sandy beaches, 11 percent with rocky terrain, and 31 mangrove regions are potential tourism hotspots. In India, the tourist industry contributed 2% of total GDP and is expected to grow to 6.4 percent by 2023. In 2017, around 10.4 million international visitors visited India, largely to visit coastal areas, earning $27 billion. In the last four years, the government has launched 17 coastline development projects around the country (Atmanand et al., 2019). Kerala has developed tremendously in terms of foreign exchange, income rise, and people's living conditions related with tourist operations. Kerala saw a 17.19 percent gain in foreign exchange and a 24.14 percent growth in tourism earnings (direct and indirect) in 2019 (Ameen, 2017).

3.2.6 Environment

The environment plays a significant role in the BE index. Meanwhile the term "blue economy" refers to the sustainable socio-economic use of marine resources that does not threaten the ocean's health. It is commonly known that the world's climate is continuously changing, and this will have a serious influence on blue resources. The earth's temperature is highly dynamic,

resulting in sea or ocean acidification. As a result, serious environmental changes may occur as a result of pollution created primarily by humans. It has the possibility to devastate the fishing industry, as well as minerals that have yet to be discovered (Askari et al., 2020).

Figure 3.2.6 Comparison Trend of Environment between Pakistan and India



In Figure 3.2.6 shows the total CO_2 emissions in both cases of Pakistan and India. There is no precise measure for assessing the ocean's health. As a result, carbon dioxide emissions are considered an environmental disrupter as a proxy. Data is taken from WDI from 1980 to 218. Table 3.1 and 3.2 shows only one indicator for the environmental dimension: carbon dioxide emissions which have negative hypothesized impact on BE index. Carbon dioxide emissions are contaminants released as a result of the combustion of fossil fuels and the production of cement. It takes into account the amount of CO_2 generated, as well as the use of solid, liquid, and gas fuels.

To ensure long run viability, the government should enhance public awareness about the importance of cleanliness and the consequences of pollution. The nation's ability to prevent its resources from being exploited is a big prospect. As the environment grows, everyone should be aware of its negative features and consider how they might be mitigated. Waste dumped in the water depletes marine resources and puts Pakistan's seafood industry in risk. The marine sector is

being forced to follow guidelines for "Eco-friendly" operations as a result of international treaties and laws (Wells, 2003).

3.3 Methodology

Methodology is very simple and clear to develop a composite variable of blue economy (BE). The BE index's design has originally been built around six major dimensions of the blue economy which are mentioned in Table 3.1 and 3.2. There are 12 indicators that constitute these six dimensions of BE for each for Pakistan and India. The composition of BE index is created by combining data from various sources. Each dimension assesses several aspects of the blue economy. The problem of data discrepancy is linked to aggregate data. As a result, we never consider the data discrepancy problem and proceed the data as it is. Finally, adding more variables and their discrepancies will very certainly exacerbate the index problem.

3.3.1 Dealing with Missing values in Data

There are some missing observations in certain indicators of BE. It is important to infer the values to assure continuity. The formula which is given below is used to produce the inner missing values because the interpolation method is used to fill the gap. A prior observation from that time period is regarded as the best estimate for an external missing data of a time series. As a result, the last value carried forward (LVCF) or the first value carried backward (FVCR) reused to produce external missing vale with the closest observation (Blu et al., 2004).

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

Where x_2 signifies the value of a variable in yeart_2, where t_1 and t_3 are the years that are closest to t_2, with the characteristics that $t_1 < t_2 < t_3$.

3.3.2 Data Normalization

Effective research is coupled with accuracy of data set; if data are not well structured then outcomes may be spurious. Normalization is a pre-processing step, a scaling approach, where someone can locate a new range based on an existing one. Normalization approach is an essential to maintain the significant fluctuation in prediction and forecasting (Gopal et al., 2005). To take this into account, the min-max approach is used to normalize each variable. Min-max

normalization is a basic approach for fitting data into a pre-defined boundary. The advantage of this technique is that it preserves the linear change of the dataset while providing an order. In such a way that the series' greatest value receives the top score, and the series' smallest value receives a lowest score (Arpit et al., 2016).

As BE index includes 12 different indicators for both country's index with different scales and patterns. In this regard, the first step is to normalize the data sets in order to create a uniform unit scale for the blue economy index. The final values of each dimension have been carried out by taking an average of underlying indicators. The following two formulas are used for the data normalization technique.

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

$$X_t^i = \frac{x_t^i - Min x_t^i}{Max\ x_t^i - Min x_t^i} \qquad Benefit \qquad (3.1)$$

The formula must also be changed to equation 3.2 if the polarity of the raw data is 'greater score is worse.' Because high numbers indicate strong performance and low values indicate good presentation for others, subtraction from the entire amount from 100 has been done. As a result, the top performers will always achieve the maximum values, while the worst performers will receive the lowest. This strategy has been employed, since the blue economy will be positively affected by the majority of variables as time passes on, some will have an adverse influence (for example, inland fisheries production with a higher score is beneficial, while Co_2 emission with a higher score is detrimental).

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

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

Where capital X_t^i is normalized value and x_t^i is actual value of x variable at year 't' and 'i' signifies indicators (i.e., i=1, 2, ….14) in equation (3.2). The adjusted and normalized variable X_t^i has a value of 0 to 1 and it is unit scale and dimension free. This normalizing approach enables all values to be expressed in unit less form and then multiply the indicator by a hundred once it has been normalized. As a result, its value now ranges from 0 to 100, where 0 represents the lowest performance and 100 represent the highest performance. Meaningful evaluations across variables, dimensions, and even sub-dimensions may be established this way (Arpit et al., 2016).

3.3.3 Indicators Weight Distribution Criteria of Blue Economy Index

The next step is to assign weight to each of the indicator. There are different viewpoints about assigning the weights. There are a variety of methods for allocating weights. However, it varies from research to research, and there is no universally accepted criterion for aggregation in compound indices. After distributing equal weights, the overall index value is calculated using the linear aggregation technique. The equal-weight approach is employed because of its gains in terms of clarity, transparency, and availability (Greco et al., 2019). Furthermore, giving equal weight to the six dimensions of the blue economy index implies that they are equally important. This study employs equal weights to six dimensions of blue economy index. In this regard, the next step is assigning the weight to each indicator of dimensions, for this purpose, equal weight strategy is opted as also shown in following Table 3.3.

3.4 CONCLUSION

There are numerous measuring issues with the blue economy; hence it is not a clear indicator. By looking at both South Asian countries Pakistan and India, the current study attempted to examine the factors that influence blue economy activities and do the comparative analysis. To begin, a blue economy index of both countries has been created which is based on important factors of blue economy. These dimensions are further subdivided into various proxy variables that show how well each dimension performs. Coming figure shows the average of all the aforementioned indicators which is discussed earlier in details.

In Pakistan, the condition of the blue economy is not promising. The blue economy is an underappreciated idea, data availability are serious challenges, as well as the need for good policymaking to make it effectively. If BE is used appropriately, it can yield optimum benefits. It has the potential to be a game-changer for Pakistan.

According to experts in the blue economy and maritime affairs, there has been little progress in Pakistan in this area due to a lack of knowledge and the absence of basic infrastructure, government lack of concentration, and an absence of adequate large investments.

When compared to other nations in the neighborhood, Pakistan's standing in the blue economy is unremarkable. India is well ahead of Pakistan. Pakistan has a GMP of $1.5 billion in the blue economy, whereas Bangladesh has a GMP of roughly $6 billion and India has a GMP of about $6 billion. It has surpassed the six-billion-dollar mark. India had devised a 15-year master plan, termed "Sagar Mala," to transform itself into a "Blue Nation," through which he could boost different sectors of the blue economy.

CHAPTER 4

THEORETICAL FRAMEWORK, MODEL, AND METHODS

4.1 Introduction

In this study the comparative analysis is presented of blue economies of India and Pakistan. Moreover, impact of the blue economy and its contributions via growth accounting are also investigated. As there are issues involved in measurement of blue economy and it is a challenging task to construct a composite variable. The blue economy index is based on six key dimensions that are explained with details in the previous chapter. The impact of BE, gross fixed capital formulation (GFCF), and total labor force (TLF) on economic growth is estimated. The ARDL bound testing approach is applied to determine the long and short run impact of the aforementioned variables on the economic growth of Pakistan and India. ARDL is the most appropriate technique of integration after evaluating the stationarity of data through the ADF and PP tests. Where ECM models are built for short-run analysis and the bound testing approach is used for co-integration to determine the presence of long-run relationships among variables (Yurtkuran, 2021).

The sections that make up the structure of this chapter are as follows: The introduction appears in Section 4.1. The theoretical framework is found in Section 4.2. It combines findings from previous studies to explain the significance of the blue economy in economic growth and to connect this research to them. This analysis serves as the foundation for this study's theoretical model. The conceptual framework is depicted in Section 4.3. Following the previous part's construction of the conceptual framework limits, Section 4.4 sheds a light on the many components of data, as well as the data sources and variables employed in this research. The model and estimation strategy that adopted in the study is explained in Section 4.5. The co-integration test and the relevance of the ARDL model to the cointegration test are explained in Sections 4.6 and 4.7, respectively. The growth accounting framework is iscussed in Section 4.8, and the chapter is wrapped up with conclusion in section 4.9.

4.2 Theoretical Framework

In general, a theoretical framework lays the groundwork for how a theory evolves through time and contributes to existing literature from an ongoing process. It is simple to build a conceptual framework of study after doing a literature review based on the gaps in the literature.

Many scholars are attempting to answer the fundamental issues of growth. Despite the fact that economic literature identifies different drivers of growth, the mystery of economic growth remains unsolved. However, many of these sources, such as social infrastructure and social practices, differ from country to country. So, with all of this mind, another natural resource as a catalyst of economic growth is investigated in this study which is also discussed in the literature. It is the blue economy that contributes to the growth of the economy. The blue economy is a massive source of energy (Bari, 2017). Despite the fact that South Asia seems to have little gas and oil resources, the richness of this blue economy, owing to its massive energy reserves, may direct us on the route to prosperity and expansion. Because the blue economy is largely found in developing countries, the international community may be able to help with low-cost techniques for extracting massive amounts of energy from water (Kowser et al., 2014). However, in this study, it is tried to confirm whether the blue economy is a curse or a blessing so the blue economy has been used as a proxy for natural resources and examine its influence with a comparative analysis of Pakistan and India’s economic growth.

The neoclassical theory of economic growth is created by (Solow, 1956). Exogenous growth theory is another term used for it (Rebelo, 1990). His study is a watershed moment in the development of growth accounting. The growth accounting paradigm has been extensively utilized in economic literature to shed light on the ultimate sources of growth and to forecast productivity trends. Economists have been concerned with the issue of economic growth since Adam Smith's time (Haouas et al., 2021). The major goals of growth accounting are the estimation of numerous significant variables and the testing of various propositions or alternative specifications of the growth theory. In general, the accounting exercise is regarded as the first stage in understanding economic growth's core drivers. The final stage is determining the relationships between factor growth rates, factor shares, and technological change (the residual) such as government policies, advances in knowledge or technological progress, efficient resource

allocation, improved organizational and human resource management, information technology enhancement, and natural resources (R. Barro, 2015).

4.3 Conceptual Framework

After looking at the blue economy's importance and how to measure it in the previous two chapters, now the study is moving to the functional form of the model and same functional form will used for analysis. The underlying model is based on a theoretical framework. Current study is based on the Solow and Swan (1956) growth model, which is a well-known and widely used a growth model in economic literature. The basic form of the model is given below.

$$Y_t = A_t F(K_t, L_t) \qquad (4.1)$$

According to neoclassical economic theory, output Y_t (output) is a function of capital and labor, with A_t denoting total factor productivity/knowledge or effectiveness, as well as any technological advances. The capital stock is K_t, while the labor force is L_t. Solow, (1956) stated that the function has constant returns to scale, and technical change has the Hicks'-neutral form. Equation (4.1) shows the technology factor presents in a form that is Hicks-neutral way (Hulten, 2010).

The basic purpose of this study, as indicated in the objectives, is to investigate the role of blue economy in fostering economic growth of Pakistan and India. For this, the following amendments has been made to the neo-classical production function is,

$$Economic\ Growth\ =\ f\ (capital, labor,\ blue\ economy)$$

$$Y_t = A_t F(K_t, L_t, BE_t) \qquad (4.2)$$

Whereas,

Y_t = Gross domestic production

K_t = Gross fixed Capital formation

L_t = Total Labor force

BE_t= Blue economy

The Cobb Douglas form for the production function is:

$$Y_t = \mathrm{A}K_t^{\alpha} L_t^{\beta} BE_t^{\gamma} e^{\mu t} \quad (4.3)$$

Whereas α is the share of capital investment in output (Y_t), β is the share of labor in output (Y_t). γ depicts the share of blue economy in output(Y). A is the total factor productivity or Solow residual. Y_t represents the overall output in the study indicating economic growth, the proportion of variables not included in the model is shown by μt and t denotes that the data is time series.

On both sides of the equation (4.4), use natural log,

$$lnY_t = lnA_t + \alpha\, lnK_t + \beta\, lnL_t + \gamma lnBE_t + \mu_t \quad (4.4)$$

After considering the natural log of the equation above, the econometric form of the proposed model can be given as follows:

$$y_t = \beta_\circ + \beta_1 k_t + \beta_2 l_t + \beta_3 be_t + u_t \quad (4.5)$$

Whereas,

y_t = lnY_t

k_t = lnK_t

l_t = lnL_t

be_t = $lnBE_t$

$\beta_\circ$ = Total factor productivity

β_1 = α

β_2 = β

β_3 = γ

μ_t = Error term

4.4 Data and Variables

To assess the impact of the blue economy in economic growth, a comparative study has been conducted between Pakistan and India with growth accounting analysis. Study uses GDP growth (annual percentage) as a proxy of economic growth and the blue economy is also considered as a proxy of Natural resources. In the long run, blue economy is regarded to be the economic growth determinant. The other two variables are labor, gross fixed capital formation which has been taken from World Development Indicators (WDI).

The following table is further containing the summary of model related variables.

Table 4.1: Source of Variables

Name of Variables	Abbreviation	Measurement	Data Sources
Dependent Variable			
GDP growth	Y	Annual % in US $	WDI
Independent Variables			
Gross fixed capital formation	GFCF	% of GDP	WDI
Total labor force	TLF	Measured in millions	WDI
Blue Economy	BE	Normalized value	Discussed in chapter 3

4.4.1 Description of Variables

The investment variable (Gross capital formation as a percent of GDP) is considered for input 'K'. The term used here to examine the influence of capital growth on the GDP, is also used extensively in other literature (Alharthi & Hanif, 2020) and (Faridi & Murtaza, 2013). Capital stocks are constructed using the perpetual inventory method, one of the most widely used methods to estimate capital stock. Gross capital formation gives a detail assessment of capital

created during a given time period, generally in a year. It comprises an economy's expenditures on fixed assets as well as the net increase in stocks. Fixed assets include a wide range of infrastructural expenditures (railway, road, dams, commercial and public buildings etc.) purchased plant and machinery, as well as renovations to the land and equipment. Material or completed items retained in inventories/stock are kept by firms in case of unforeseen demand or a temporary change in supply due to natural catastrophes. GFCF encompasses all types of financial investments, as well as stock/inventory management and replacement cost/depreciation. Capital goods include finished commodities or supplies in hand, as well as work-in-progress materials (Alharthi & Hanif, 2020).

The other independent variable of econometric model is labor force. As India and Pakistan contain high population stocks and both nations are labor abundant. So, the role of labor force is different from developed nations. The labor force is defined as the portion of the population willing to do the work at the present wage rate. It comprises all workers who are seeking employment and willing to engage in the production of goods and services, as well as those who are seeking employment and willing to take part in the production of goods. Seasonally or naturally unemployed persons who are looking for paid work based on their acquired skills and competence are also included in the labor force. Labor force is measured in millions, and it is supposed that labor force contributes positively to economic growth of India and Pakistan. In literature the term workforce and labor force are interchangeable. Variables are also chosen in accordance with prior studies like (Sethi & Kaur, 2013; Nkoro & Uko, 2019; Mahmoudi, 2021).

The third and most important variable of present study is blue economy. The basic concepts and terminologies of blue economy are discussed in detail in previous chapter of study. It is treated as a separate variable in order to examine its influence on economic growth. The blue economy index, which was created in the preceding chapter, also serves as a proxy for natural resources (Laghari, 2018).

4.5 MODELS AND METHODS

One of the objectives of the current study is to measure a dynamic relationship between blue economy and economic growth. So, the study deals with only the dynamic analysis part of

time series data analysis instead of forecasting. Check the stationarity level of all series of the model is basic requirement for both dynamic and forecasting time series analysis (Mubasher Hassan & Mirza, 2021).

There are two main branches of time series analysis, these are forecasting and dynamic modeling. The former approach deals with the prediction of future values based on the distributional properties (mean, variance, skewness, and kurtosis) of previous data (information). The latter approach is a widely used branch of time series analysis. The dynamic modeling is purely applied in nature in which researchers test hypotheses, investigate economic relationships, and confirm economic theories (Jalil et al., 2019). The core side of dynamic analysis is cointegration among or between the variables of model. In literature there are various types of approaches to test cointegration.

Many strategies or techniques of cointegration have been proposed in the literature, including the Engle-Granger residual based test and the Maximum Likelihood based test (Gregory & Hansen, 1996). There are some limitations involved in these techniques. Both techniques are performing well in case of large numbers of observations, but outcomes are not robust in case of limited observations. In case of small data and several variables of model are integrated at level where as others are integrated at the first difference then the Auto-Regressive Distributed Lag (ARDL) technique to cointegration suggested by Pesaran is considered as most reliable. ARDL is the finest econometrics approach currently available, with benefits over other cointegration techniques (M. K. Khan et al., 2019). In the following sections, we briefly explain the road path of methodology to estimate the model.

4.5.1 The Concept of Stationary and Non-stationary Time Series

Whether dealing with forecasting or dynamic analysis, econometric models focus primarily on the data's stationary feature in order to produce a useful model; otherwise, misleading regression findings may occur (Jalil et al., 2019). Erroneous regression results might be got if one cannot check the stationarity of variables. The statistical features of time series data are addressed by the stationarity of a variable. In layman's terms, stationary series contains statistical attributes like constant mean and variance, as well as infinite covariance which also known as white noise process. As a result, the series implies mean-reverting property and short

memory (Nkoro & Uko, 2016). Find the stationarity level is basically trying to find the data generation process (DGP). If we come to know the DGP then it is easy to forecast and predict the future outcomes.

4.5.2 Importance of Stationarity

In the discipline of time series analysis, stationarity is a key notion that has a big impact on how data is analyzed and interpreted. To begin with, if the time series is not stationary, the analysis of the series is only relevant during the time period under discussion. Due to its non-mean-reversion feature, the behavior cannot be applied to other time series. As a result, the nonstationary time series will not provide useful forecasting. Second, many valuable analytical tools and statistical model tests presume data to be stationary by nature. Regression model may produce erroneous findings if any condition of stationarity in the time series is violated. Indeed, such a model will deceive us, and any findings derived from it will be technically incorrect. This is why, in time series analysis, data stationarity is essential (Jalil & Feridun, 2015). There are various types of tests to check the stationarity level or unit root tests. The following section discusses the selected tests to test the unit root level.

4.5.3 Stationarity Tests

The initial stage in time series analysis is to manage with it effectively, which is stationarity testing. There are various methods of testing which includes Dickey-Fuller (DF) test (1979), Augmented Dickey-Fuller (ADF) (1981) test, Philip-Perron (PP) (1988) test, among others (Nkoro & Uko, 2016). ADF and PP tests are used to check the stationarity of series**.** In smaller data sets, both tests efficiently cope with higher order autocorrelation (Chandio et al., 2019).

4.5.4 Augmented Dickey Fuller Test

In the field of time series, Dickey & Fuller, (1979) In the field of time series, Dickey and Fuller augment the higher order lags to detect the unit root and this test also recognized as the ADF test. The ADF test is a commonly and extensively used in time series data-based research. The ADF tests are used to establish the order of integration of a series and verify the unit root (Faridi & Murtaza, 2013). The ADF test necessitates the use of the following equation.

$$y_t = \alpha_\circ + \alpha_1 t + \theta y_{t-1} + \sum_{i=1}^{k} w_i \Delta y_{t-1} + e_t \quad (1)$$

Where Δ is the difference operator and y_{t-1} indicates the number of lags to be examined. Where e_t denotes the error term for pure white noise (Javaid, 2017). On the independent side, a realistic technique is to include the number of lags. In general, a significant number of lags should be included in an ADF test to remove autocorrelation in the residuals. Due to loss of degree of freedom, it is not always helpful. ADF test contains some technical drawbacks like; by default, it is developed for large data set, and the critical values of ADF test are also based on some pre assumption of data. Another major flaw of ADF test is that it does not take structural changes and data shifts into consideration. (Nkoro & Uko, 2016). So, the other test that is generally used for small data set is Phillps Parren test.

4.5.5 Phillips-Perron Test

When checking for a unit root, the nonparametric way to manage the problem autocorrelation is provided by (Phillips & Perron, 1988). To evaluate the unit root, we estimate an augmented DF equation and then adjust the coefficient inferences to compensate the impact for autocorrelations. The PP test is a nonparametric adjustment to the t-test statistic that delivers more robust findings in the disruption phase of the test equation due to undefined autocorrelation and heteroscedasticity. When there is a series loss of degree of freedom due to a small number of observations with upper-order autocorrelation, this test is commonly used (Perman, 1991). After dealing with the problem of stationarity in time series analysis, the next stage in multivariate analysis is to determine cointegration test.

4.6 Cointegration Test

Cointegration depicts the long run relation among the variables of model. Granger (1981) and Engle & Granger, (1987) were the first to formulate the concept of cointegration, presenting tests and estimate procedures for determining the presence of a long-run relationship between a collection of variables within a dynamic specification framework. Cointegration testing is required to determine if a model empirically demonstrates significant long run relationships. In order to estimate the model, an appropriate cointegration strategy needs to be selected based on

the unit root findings. For example, if all of the model's variables are stationary at level, then it can be classified as integrated at level (0).

If a series is non-stationary at the level, the first difference is used to make it stationary, and the series is then referred to as stationary at first difference or I(1) and the series that is said to be stationary at second difference is known as integrated at second order that is I (2) (Sari et al., 2008). If all of the series in the underlying analysis are I(0), then the model may be estimated using basic Ordinary Least Square (OLS), which yields reliable results. In this scenario, both the short and long run coefficients are equal. If in some of the data set being analyzed are I(0) and some are I(1), the Autoregressive Distributed Lag (ARDL) technique yields good predicted coefficient values in the short and long run (Goh et al., 2017).

The ARDL approach is more applicable in the ongoing research, because the variables in this research are stationary at the level and 1st difference, this characteristic recommends that this approach should be used.

4.7 Autoregressive Distributed Lag (Bound Testing Approach)

Pesaran et al., (2001) presented the ARDL technique of cointegration or bound test for a long-run relationship, when the underlying variables are being I(0) and I(1), or a mix of both. In this case, using the ARDL technique of cointegration will provide reliable and accurate estimations. In contrast to traditional cointegration methods, the Autoregressive Distributed Lag (ARDL) approach to cointegration aids in the identification of co-integrating vectors (Nkoro & Uko, 2016). In addition, because this estimation approach just includes one equation, interpreting the results is very simple and easy. Furthermore, numerous lag structures may be applied to various variables based on their optimality.

Following main steps are involved in an ARDL approach and each step of ARDL is equally important for better understanding the dynamic analysis.

Step 1: Testing the Unit Root

The unit root testing is a logical course of action when looking at time series data. This methodology shall not be utilized if the data series is I(2) or above. The unit root test is being

used depending on the data series' nature. ADF and PP tests can be employed if the data series has structural breakdowns. The next step is to ensure that the order of integration is correct.

Step 2: Run a bound test/autoregressive distributed lag cointegration test

The bound test or cointegration test in the context of ARDL is addressed in this step to explain how to perform it. The present study is using ARDL modeling approach. The following is the ARDL conceptual model equation:

$$\Delta lnY_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta lnY_{t-i} + \sum_{i=1}^{q} \beta_i \Delta lnK_{t-i} + \sum_{i=1}^{k} \Omega_i \Delta lnL_{t-i} + \sum_{i=1}^{l} \pi_i \Delta lnBE_{t-i} + \lambda_1 lnY_{t-1} + \lambda_2 lnK_{t-1} + \lambda_3 lnL_{t-1} + \lambda_4 lnBE_{t-1} + e_t \quad (2)$$

The expressions from λ_1 λ_4 in the preceding equation describe long-run relationships among variables, whereas the summing symbols from α_i to π_i correspond to the short-run dynamics of the variables. However, α_0 denotes a constant drifting and e_t indicates white noise Gaussian (Adeel-Farooq et al., 2017).

Technically, the F-test will be used to assess the null hypothesis H_0: (λ_1=$\lambda_2 = \lambda_3 = \lambda_4 = 0$) against with the alternative hypothesis H_1: ($\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq 0$). The null hypothesis states that the variables have no long run association. It suggests that if the null hypothesis is not rejected, there will be no long run association between the variables. Instead, the variables may have a long run association (Jalil et al., 2019).

The critical values for I (0) and I (1) were computed by (Pesaran et al., 2001) at various degrees of significance. There will be no cointegration if the computed value is less than I (0). If the computed values exceed I, while there is a long-run association (1). There will be no result concerning cointegration if the computed values remain between I (0) and I (1) (Iqbal et al., 2017).

Step 3: Selection of Appropriate lags

The usefulness of lags in autoregressive models has been extensively addressed. In the empirical studies of time series, a number of criteria are accessible. The Akaike information criteria, the Schwartz-Bayesian information criteria, and the LR criteria are among the most popular (Ozturk & Acaravci, 2011).

Step 4: Estimating the long-run model

If the variables are cointegrated or there is a long-run relationship, we will proceed to estimate the long-run model as well as the short-run dynamics using the ECM term. The ECM depicts the short-run dynamic with long-run relationship. The long run relation is specified by ECM (-1) and the negative sign ensures the model's dynamic stability. It is also known as the adjustment parameter (Hedi & Shahbaz, 2013).

The following is an estimate of the (ECM) based on our variables.

$$\Delta Y_t = \beta_0 + \sum_{i=0}^{p} \delta_i \Delta Y_{t-i} + \sum_{i=1}^{p} \varphi_i \Delta K_{t-j} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-1} + \sum_{i=1}^{p} \varpi_i \Delta L_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-1} + \sum_{i=1}^{p} \lambda_i \Delta BE_{t-1} + \sigma ECM_{t-1}\, \mu_t + e_t \quad (3)$$

The short-run dynamism is defined by the long run relationship, which is defined by the (ECM). The adjustment parameter EC (-1) indicates the convergence speed towards equilibrium. The error correction term should always be negative (Hedi & Shahbaz, 2013).

Step 5: Specification of Unrestricted Error Correction Model

The error correction model is then unrestricted in the second phase. Pesaran et al., (2001) used the phrase unconditional or unrestricted error correction term since the coefficients are not restricted. The Unrestricted Error Correction Model (UECM) allows for lags to be accommodated while capturing the data generation process within a general to specific framework (Javaid, 2017).

Step 6: The error must be serially independent

In ARDL approach, a Gaussian error is required. As a result, it's essential that the error is serially independent. Because serial independence might influence the amount of lags used, heteroscedasticity, autocorrelation, functional form, and normality are all checked to assure Gaussian error (Adeel-Farooq et al., 2017).

Step 7: Dynamic stability

As the autoregressive model is highly sensitive to number of lags, Brown et al., (1975) suggest the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUM) sq tests are applied for checking the strength of the model.

4.8 Growth Accounting Analysis

The neoclassical growth accounting approach, that was originally developed by Solow, (1956), is used in current study. Growth accounting paradigm has been extensively utilized in economic literature to shed light on the ultimate sources of growth and to forecast productivity trends (Amjad Chaudhry, 2009). Economists have been concerned with the issue of economic growth since Adam Smith's time. The major goals of growth accounting are the estimation of numerous significant variables and the testing of various propositions or alternative specifications of the growth theory. Growth accounting, in reality, aids in gaining a better knowledge of economic growth (Haouas et al., 2021). Input-driven growth is achieved by increasing factors of production, whereas productivity-driven growth (which can't be explained by greater total inputs) is attributed to advances in knowledge or technological progress, efficient resource allocation, improved organizational and human resource management, information technology enhancement, and so on (Sethi & Kaur, 2013).

Total factor productivity is a measurement that is used to examine into technological, institutional, and productivity changes, as well as their long run consequences for the economy. This measurement is so essential for evaluating a country's past and future economic growth. A production function, which shows how inputs are integrated to produce output, is the beginning for estimating TFP (Pyo et al., 2007). This study considers blue economy as a natural source that boosts the economic growth. For this, study uses neo-classical production function and same function is widely used in empirical literature like (Kumar et al., 2008; Sethi & Kaur, 2013; Henri, 2018).

The extended version of the functional form of model could be written as follows.

$$Economic\ Growth = f\ (labor, capital, blue\ econoy)$$

$$Y_t = A_t F(K_t, L_t, BE_t) \quad \text{Hicks- neutral technology} \qquad (4.6)$$

Let differentiate the equation (4.6) with respect to time to get growth accounting. Then multiply by $1/Y_t$ on both sides.

$$\frac{Y_t^o}{Y_t} = \frac{\partial Y}{\partial K}.\frac{K_t}{Y_t}.\frac{K_t^o}{K_t} + \frac{\partial Y}{\partial L}.\frac{L_t}{Y_t}.\frac{L_t^o}{L_t} + \frac{\partial Y}{\partial BE}.\frac{BE_t}{Y_t}\frac{BE_t^o}{BE_t} + \frac{A_t^o}{At} \quad (4.7)$$

Where $\frac{Y_t^o}{Y_t}$ is the growth of output over time, $\frac{K_t^o}{K_t}$ is the capital stock's growth, $\frac{L_t^o}{L_t}$ is the total labor force growth, $\frac{BE_t^o}{BE_t}$ is the growth of blue economy and $\frac{A_t^o}{At}$ is the technological progress at a Hicks-neutral rate of change.

$$\frac{A_t^o}{At} = \frac{Y_t^o}{Y_t} - \frac{\partial Y}{\partial K}.\frac{K_t}{Y_t}.\frac{K_t^o}{K_t} - \frac{\partial Y}{\partial L}.\frac{L_t}{Y_t}.\frac{L_t^o}{L_t} - \frac{\partial Y}{\partial BE}.\frac{BE_t}{Y_t}\frac{BE_t^o}{BE_t} \quad (4.8)$$

For this particular study, we utilize the growth accounting framework and assume a Cobb– Douglas production function with fixed factor shares, i.e., constant returns to scale and technical progress is assumed to be Hicks-neutral. So, the equation (4.8) is rearranged into growth form and TFP can be estimated as

Or

$$TFP_A = gY - gK - gL \quad (4.9)$$

$$TFP_B = gY - gK - gL - gBE \quad (4.10)$$

$$TFP_A - TFP_B = gBE \quad (4.11)$$

Or

$$\text{Growth drag} = gY - \alpha gK - \beta gL - (1 - \alpha - \beta)gBE \quad (4.12)$$

"TFP_A" on left hand side of eq (4.9) and TFP_B on eq (4.10) is Solow residual or productivity. The difference between "gA" in both equations is the growth accounting (drag) of blue economy. gY denotes the growth rate of output, gL denotes the growth rate of labor, gA denotes the growth rate of TFP, and gBE is the growth rate of BE. α is the share of capital in output, (1-α) is the share of labor in output. $(1-\alpha-\beta)$ is the share of blue economy in output. The calculation of factor contributions helps us to identify which factor is more important for growth, and which has a higher contribution. Based on this, the government can take measures to increase the efficient use of resources and factor inputs.

4.8 CONCLUSION

The comprehensive description of research technique and conceptual framework used for this research study has been examined in this chapter of the study. Various data stationarity tests, such as unit root and others were used, as well as cointegration tests to assess long and short-term associations. Furthermore, the proposed variables for this study were thoroughly explored. In the research appropriate econometric methodologies for data assessment were addressed. In this manner, the ARDL model is used to investigate the blue economy's log run implications on economic growth. After the long-run relationship between variables have been proven, ECM is being used to examine the short run coefficients. As it is mentioned above that the important objective of the present study is to empirically explore the role of the blue economy in the growth accounting of both countries, so the detailed analysis of growth accounting through Solow residual is also discussed.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 Introduction

Based on a comprehensive review of study's estimating approach, this chapter focuses on the model's quantitative results and interpretations. The influence of the blue economy on economic growth is empirically examined in the underlying study. Based on the empirical findings of this study, we make some conclusions to investigate these concerns. Following is a breakdown of the findings.

5.2 Descriptive Analysis

Statistics is the science of data, and it is divided into two categories. Descriptive statistics are the first component, while inferential statistics are the second. Each country's descriptive data are shown in the tables below. Descriptive statistics is a collection of processes for summarizing the features of a set of data (Faridi & Murtaza, 2013). Mean value, variance, standard deviation of data, and range of data, skewness, and kurtosis values of variables are some of these properties. In other words, these data qualities are also causes of data distribution (Marshall & Jonker, 2010).

Table 5.1: Descriptive Statistics of Pakistan

	Mean	Variance	St.D	Min	Max	Kurtosis	Skewness
Ln GDP	6.57	0.04	0.20	6.01	6.84	0.65	-0.94
Ln GFCF	6.88	0.08	0.28	6.39	7.35	-1.26	0.04
Ln TLF	3.92	0.00	0.08	3.70	4.02	0.25	-1.15
Ln BE	6.20	0.02	0.14	5.89	6.41	-1.19	-0.28

Source: Authors' calculations

Table 5.1 shows the descriptive analysis of Pakistan. The current study covers a period of 38 years, from 1980 to 2018, and is based on yearly observations. The mean value of lnGDP is 6.57, with a variation of around 0.04. The mean of a variable is a measure of central tendency, or it tells us where the Centre of a value distribution is (Nicholas, 2013). The skewness co-efficient and the kurtosis of LnGDP are -0.94 and 0.65, respectively. Skewness is a metric for symmetry, or more accurately, the lack thereof. If a distribution or data set appears symmetric to the left and right of the Centre point, it is said to be symmetric. The skewness value can be either positive or negative, or it might be indefinable. The data is considered to be fully symmetric if the coefficient of skewness is equal to 0 (Owen, 1991). The distribution is severely skewed if the skewness is less than -1 or larger than 1. The distribution is significantly skewed when skewness is between -1 and -0.5 somewhere between 0.5 and 1. The distribution is roughly symmetric if skewness is between -0.5 and 0.5 (Blanca et al., 2013).

It reveals from the table that the skewness coefficient of LnGDP is -0.94, indicating that the series is moderately skewed. The basic concept for kurtosis is that if the value is greater than ± 3, the distribution is excessively peaked. A kurtosis of smaller than ± 3, on the other hand, suggests that the distribution is excessively flat. Nonnormal distributions have skewness and/or kurtosis that exceed certain limits. (Schlegel et al., 2012). Similarly, the mean value of the co-efficient of lnGFCF is 6.88 with variance 0.08. The kurtosis value is -1.26 which means distribution is flat and skewness value is 0.04 which demonstrate that data is normally distributed. Furthermore, the mean value of lnTLF and lnBE is 3.92 and 6.20 percent respectively. The skewness value of lnBE is -0.28 which is negatively skewed. Negative value of skewness indicates that data is skewed left (Cox, 2010).

Table 5.2: Descriptive Statistics of India

	Mean	Variance	St.D	Min	Max	Kurtosis	Skewness
Ln GDP	7.22	0.06	0.24	6.65	7.54	-0.54	-0.90
Ln GFCF	7.09	0.27	0.52	5.94	7.68	-0.08	-0.83
Ln TLF	4.07	0.01	0.10	3.85	4.23	-0.47	-0.23
Ln BE	7.41	0.11	0.34	6.89	7.94	-1.21	0.41

Source: Authors' calculations

In the instance of India, Table 5.2 gives descriptive data for the same indicators. The value of ln GDP is 7.22 on average, with a variance of 0.06. The kurtosis value is -0.54, indicating that the data is light tailed. Kurtosis is a metric that determines whether data is heavy-tailed or light-tailed in comparison to a normal distribution (Shi & McLarty, 2009).

The skewness is -0.90, indicating that the data is skewed negatively. Ln GFCF, ln TLF, and lnBE, on the other hand, have average values of 7.09, 4.07, and 7.41 respectively. All of these key variables' kurtosis values are negative, indicating that the data is light-tailed, as we stated before. Because symmetric data should have zero skewness, the skewness value of ln BE is 0.41, which is exactly symmetric (Sujata et al., 2016).

These statistics present a summary of the data's many features. Normality may be tested statistically using two numerical metrics of form skewness and kurtosis. If the data is not normally distributed, non-stationarity of data may be a concern. Because the skewness and kurtosis values in both Pakistan and India are not under perfect conditions, our data is not normally distributed. As a result, in the upcoming phase of the study, several stationarity tests will be used to determine which is the best match for the data.

5.3 Unit Root Testing

It is essential to evaluate the ordering of integration of the model's variables before moving further with the ARDL model. Because the ARDL cannot be performed if the variables are stationary at second difference I(2), it is necessary to do the unit root test solely to ensure that the variables are not integrating of the second order, i.e. I(2) (Khandelwal, 2015). To put it another way, it may state that a unit root test in the ARDL approach might be required to verify that no variable is integrated at order 2 (I(2) and even beyond). The (ADF) unit-root has been used to determine the order of integration of the variables in the research for this purpose (Javaid, 2017). In most cases, the ADF and the PP test produce similar results when dealing with large amounts of data. However, when dealing with small amounts of data, PP produces superior outcomes (Faridi & Murtaza, 2013).

Table 5.3: Unit Root Test Results of Pakistan

	ADF test						
Variables		**At level**			**1st difference**		
	t. stats	**critical value**	**P value**	**t. stats**	**critical value**	**P value**	**Remarks**
Ln GDP	-3.65	-3.54	0.04*	-3.35	-2.94	0.01	I(0)
Ln GFCF	-0.623	-2.94	0.866	-5.34	-2.94	0.00**	I(1)
Ln TLF	-3.98	-2.94	0.00*	-3.44	-2.94	0.01**	I(0)
Ln BE	-3.35	-2.95	0.02*	-3.89	-2.94	0.00**	I(0)

Note: Results are based on authors' calculations

Above Table 5.3 explains the summary statistics of Augmented Dickey-Fuller Test statistics in Pakistan case. The test findings show that certain variables are stationary at the level and rest at the first difference. The lag length in ADF test is based on Akaike information criterion (AIC). In Table 5.3 LnGDP, lnTLF and lnBE is stationary at level means that the t-

statistics value is greater than its t-critical value at level and P value is less than 0.05, it is mandatory to mention that the values are seen in absolute term. These variables have no unit root or in other words series are stationary at level I (0). Yet LnGFCF has unit root, which at 1st difference of this series becomes stationary I (1), so the difference of this series has been taken. The null hypothesis may now be safely rejected, which means the alternative hypothesis is accepted (Dickey & Fuller, 1979). The study's results are significant at 1 and 5% significance level. The lag length in ADF test is based on Akaike information criterion (AIC). The next step is to use the PP test. Major rationale for using the PP test is to ensure that the stationary level is stable. As it is known that, the PP test produces accurate results, especially when the data set is small (Nkoro & Uko, 2016).

Table 5.4: Unit Root Test Results of Pakistan

	PP test						
Variables		**At level**			**1st difference**		
	t. stats	**critical value**	**P value**	**t. stats**	**critical value**	**P value**	**Remarks**
Ln GDP	-2.06	-2.93	0.12	-3.74	-2.94	0.00**	I(1)
Ln GFCF	-1.10	-2.93	0.71	-5.34	-2.94	0.00**	I(1)
Ln TLF	-3.84	-2.94	0.00*	-3.443	-2.94	0.01**	I(0)
Ln BE	-0.19	-2.94	0.93	-6.21	-2.94	0.00**	I(I)

Note: Results are based on authors' calculations

The principal objective of the Phillips-Perron test statistics is to ensure the robust level of stationary. Because this study only has a small amount of data, the PP test is a good option (Dantama et al., 2012). The null hypothesis for the PP test is the same as for the ADF test, and its asymptotic distribution is the same. The existence of a unit root in the data is the null hypothesis, whereas the absence of a unit root is the alternative hypothesis (Emeka & Kelvin, 2016). At

level, the findings show that lnTLF is unit root free. The t stat value is more than the t-critical value and the P value is less than 0.05 when LnGDP, lnGFCF, and lnBE are integrated at first difference, So it is obvious to reject the null hypothesis and accept the alternative hypothesis when the underlying series becomes stationary (Bahmani-Oskooee & Nasir, 2004). The ADF and PP unit root tests reveal a mixed sequence of integration in the current study. In such conditions, the most appropriate approach for obtaining resilient parameter values is ARDL. The components of the ARDL approach are listed in the subsection below. First, a bound testing technique is used, followed by a long run or cointegration model. Last but not least, there's the short run form, which is vital for maintaining dynamic stability in the short run, as well as model diagnostics.

5.4 ARDL Bound Testing in case of Pakistan

As discussed earlier that first step of ARDL is to check long-run cointegration between the variables of model.

Table 5.5: Results of Bound Test for Cointegration

Test Statistics	Value	K	Significance	I0 Bound	I1 Bound	Conclusion
F Statistics	7.20	3	10%	2.72	3.77	Cointegration Exist
			5%	3.23	4.35	
			2.50%	3.69	4.89	
			1%	4.29	5.61	

Note: Results are based on authors' calculations

The results shows that the computed F statistics is 7.20 which is greater than the lower critical bound value and upper critical value which are 3.23 and 4.35 respectively at 5% significance level. Thus the null hypothesis of no cointegration is rejected, implying long run cointegration relationships among the variables (Mota et al., 2005). The Akaike information criterion (AIC) has chosen for the appropriate lag order of the variables in present study. The proper selection of variables lag length is helpful in calculating the ARDL (F-statistic) in determining whether or not cointegration exists (Hedi & Shahbaz, 2013). The results of the test

indicate that there exits long-run relationship among the variables in model. After confirmation of cointegration the next task is to find long run form of model. In the following tables, the short and long run findings of this model are described.

5.5 Results of the Long Run ARDL Model in case of Pakistan

The long-run estimates of ARDL model are reported in Table 5.6. The dependent variable is economic growth (GDP) whereas GFCF, TLF and BE are independent variables.

Table 5.6: Results of the Long Run ARDL Model in case of Pakistan

Variables	Coefficient	Std. Error	t-Statistics	Prob.
Ln GFCF	0.32	0.05	5.64	0.00
Ln TLF	0.48	0.16	3.03	0.00
Ln BE	0.35	0.13	2.64	0.01
C	0.23	0.45	0.50	0.61

Results are based on author's calculation

These findings highlight the facts that there is a strong impact of blue economy, capital formation and labour force on economic growth of Pakistan in the long run. As in long run the GFCF has significant and positive impact on GDP. It has been observed that the value of regression coefficient of GFCF that is 0.32 which shows that on average 1 % increase in GFCF leads to increases the economic growth (lnGDP) by 0.32 percent and this effect is strong and statistically significant. These findings are consistent with earlier research, such as (Sethi & Kaur, 2013; Qamruzzaman & Jianguo, 2018). Infrastructure development directly supports economic activity. Another possibility is that investment spending on numerous projects boosts overall productivity and economic growth (M. S. Khan & Reinhart, 1990). The value of coefficient of TLF is 0.48 %, by keeping other factors constant, a 1% surge in TLF drives GDP upward by 0.48% over the long run. Advanced machinery and technological adaptation increase the productivity of labour and thus enable them to produce better quality goods in more quantity and less time (M. S. Khan & Reinhart, 1990).

The core variables of this study are blue economy. The blue economy has a positive and significant influence on economic growth. Result shows that 1% increase in blue economy raises GDP by 0.354 % in long run all else remain same. blue economy is a phenomenon of long run so the coefficient of blue economy is substantial in long run. The findings are consistent with earlier research, such as (Bari, 2017; Ninawe, 2017). The next step in this research is to calculate ECM in order to assess the short run impact.

5.6 Results of the short Run Dynamic Model in case of Pakistan

Table 5.7 reports the short-run coefficients of model, or it is ECM form of the ARDL approach.

Table 5.7: Results of the short Run Dynamic Model in case of Pakistan

Variables	Coefficient	Std.Error	t-Statistic	Prob.
D(lnGFCG)	0.35	0.21	3.41	0.00
D(lnTLF)	0.28	0.67	0.42	0.67
D(lnBE)	0.36	0.21	1.72	0.00
CointEq(-1)	-0.38	0.29	-4.72	0.0
R^2	0.99	**Adjusted R^2**		0.99
Akaike info	-5.40	**DW statistics**		2.33

Cointeq = lnGDP-(0.32*lnGFCF+0.48*lnTLF+0.35*LnBE+0.233)

As previously stated, the error correction term specifies the rate at which the dynamic model's equilibrium is restored. (Ali et al., 2015). The ECM coefficient shows how quickly variables converge to equilibrium and it should have a statistically significant (Pahlavani et al., 2005). Here the significance and the negative sign of the ECM also confirm the existence of a long-run equilibrium relationship between economic growth and the other independent variables. The coefficient of ecmt-1 in the preceding table is (-0.38), indicating that an external shock will wear

off in the long run and the economy will return to a stable track. It illustrates that the variables have deviated for some period of time in the short run, but that in the long run, the variables will return to their equilibrium position (Ullah et al., 2016). The regression coefficient of GFCF is 0.35 which means that one percent rise in GFCF will leads to rise to 0.35 percent of growth with all things remain constant. In contrast, the results of the preceding table reveal that, while the TLF coefficient is positive, it is insignificant in the short term. Our findings are in line with traditional neoclassical thinking (R. J. Barro, 1991). Due to inefficiencies of labor, productivity level of Pakistan is very low as compared to developed countries.

Similarly, the blue economy coefficient has a positive relationship with GDP in the short run. On the basis of long run, the coefficient of blue economy is significant. The blue economy, as previously said, is a long run phenomena (Bari, 2017).The values of R^2 and adjusted R^2 shows that the model is good fit. Generally, a higher r-squared suggests a better fit for the model. The adjusted R square shows that around 99% of the variation in GDP is explained by the regressors in model.

5.7 Model Diagnostic Test of Pakistan

Diagnostic statistics is applied to scrutinize the consistency of the applied model (M. K. Khan et al., 2019). These tests are important because it shows that short run model passes through all diagnostic tests in the first stage (Shahbaz et al., 2008).

Table 5.8: Model Diagnostic Test of Pakistan

Diagnostic Tests	F-statistic	Prob	Obs*R-squared	Prob
Breusch-Godfrey LM Test	0.96	0.28	3.26	0.11
White Test of Hetero	0.53	0.73	12.44	0.68
Normality		0.48	_	_
Wald Test	3.97	0.01	_	_

Serial correlation and heteroskedasticity were checked using diagnostic tests. This indicates that the model is legitimate and that it may be used to make policy recommendations without needing to be re-specified (okafor et al., 2016). The serial autocorrelation in our model is tested using the Breusch-Godfrey LM test to see if there is any serial correlation. We can't reject the null hypothesis because the probability value is more than 0.05, but we can perform the white test for heteroskedasticity. As a result, our models pass every diagnostic test. Our model has a normally distributed error term with no heteroscedasticity. The value of R^2 indicates that the model is well specified. The Wald test is also applied to check either there is an issue of omitted variable biasness or not in models. The probability value of Wald test confirms that our model is not suffering from omitted variable biasness.

5.8 Unit Root Test Results of India

Now after the results of Pakistan have been examined, the present study seeks to understand the empirical findings in the case of India, which will be explained in depth below.

Table 5.9: Unit Root Test Results of India

	ADF test						
Variables		**At level**			**1st difference**		
	t. stats	**critical value**	**P value**	**t. stats**	**critical value**	**P value**	**Remarks**
Ln GDP	-2.27	-2.94	0.39	-5.56	-2.94	0.05**	I (1)
Ln GFCF	-1.84	-2.94	0.51	-7.00	-2.94	0.00**	I(1)
Ln TLF	-4.85	-3.53	0.00*	-5.70	-2.94	0.00**	I(0)
Ln BE	-1.605	-2.94	0.48	-4.98	-2.94	0.02**	I(1)

Source: Authors' calculation

Table 5.9 shows the ADF results in case of India. It is shown from the table that ln TLF is stationary at level means that the t-statistics value is greater than its t-critical value at level and P value is less than 0.05, as it is discussed earlier. Ln GDP, ln GFCF and ln BE is stationary at first difference. In this case, the test statistic value is compared with the critical value on 5 % significance level. If the test statistic is more than the critical value, the null hypothesis is rejected and when test statistic is lesser than the critical value, the null hypothesis cannot rejected (Emeka & Kelvin, 2016).

Table 5.10: Unit Root Test Results of India

	PP test						
Variables		**At level**			**1st difference**		
	t. stats	**critical value**	**P value**	**t. stats**	**critical value**	**P value**	**Remarks**
Ln GDP	-1.61	-2.94	0.33	-5.54	-2.94	0.00**	I(1)
Ln GFCF	-0.11	-2.94	0.54	-6.93	-2.94	0.00**	I(1)
Ln TLF	-4.92	-2.94	0.00*	-5.55	-2.94	0.00**	I(0)
Ln BE	-0.41	-2.94	0.33	-5.05	-2.94	0.00**	I(1)

Source: Authors' calculation

Table 5.10 shows the results of the Phillips-Perron test statistics in the context of India in order to determine the order of integrations. Model variables are mixed in the following order: I(0), I(1). ADF and PP tests can help with this by confirming the unit root level and ensuring that none of the variables are integrated at the second difference. The results of the study reveal that the lnTLF is unit free and stationary at the level i.e. (0). The other variables, such as lnGDP, LnGFCF, and lnBE, are all integrated at the first difference, I(1), with trend and intercept. The results demonstrate that all variables have a mixed order of integration. The cointegration test in this study is used to determine long-run associations based on such variable properties. In these

circumstances, the ARDL cointegration approach is suited for observing long run relationships between variables (Adeel-Farooq et al., 2017).

5.9 ARDL Bound Testing in case of India

In the ARDL method, first the bound test is held before examining the cointegration association among the dependent and independent variables (Javaid, 2017).

Table 5.11: Results of Bound Test for Cointegration

Test Statistics	Value	K	Significance	I0 Bound	I1 Bound	Conclusion
F Statistics	7.24	3	10%	2.72	3.77	Cointegration Exist
			5%	3.23	4.35	
			2.50%	3.69	4.89	
			1%	4.29	5.61	

Source: Authors' calculation

Above table shows the estimates for ARDL bound testing approach to cointegration. The calculated F-statistics in case of India is 7.24. According to the table F-statistic is higher than upper bond value both at 5 percent and 10 percent level of significance. AIC has been selected for suitable lag order of the variables (Asghar & Abid, 2007). The above results indicate that there is a long run association between the variables. That means, GDP in case of India has long-run relationship with the explanatory variables (GFCF, TLF and BE). We proceed to execute the long-run estimations of the model based on the bound test findings. After a bound-test confirmed the existence of cointegration, the long-run coefficients of ARDL are now provided in Table 5.12.

Table 5.12: Results of the Long Run ARDL Model in case of India

Variables	Coefficient	Std. Error	t-Statistics	Prob.
Ln GFCF	1.65	0.59	2.80	0.01
Ln TLF	0.56	0.10	2.42	0.02
Ln BE	0.44	0.12	3.42	0.00

C	-1.84	1.72	-1.06	0.29

Source: Authors' calculation

GDP is the model's dependent variable. The long run findings for India reveal that all variables have a favorable impact on the country's economic growth. In long run, on average 1% surge in GFCF is promoting economic growth by approximately 1.65% assuming all other factors remain unchanged and it is statistically significant. The findings of current research are consistent with the previous study by Qamruzzaman & Jianguo, (2018) and Alharthi & Hanif, (2020) in which they estimated a positive impact of GFCF on economic growth. Solow (1956) argued that capital accumulation increases productivity in an economy because it is a key factor in economic growth. Furthermore, there is a positive and statistically significant relation among TLF and GDP. The findings are consistent with Alharthi & Hanif, (2020) which found that both labor and capital play a substantial and favorable impact.

If the impact of the blue economy on India's GDP is looked, it can be seen that a 1% rise in the blue sector corresponds to a 0.44% increase in GDP when all other factors stay constant. It plays an important and positive effect. Previous investigations such as Sakhuja, (2015) and Atmanand et al., (2019) validate these findings. India is the largest country in South Asia, and it has achieved tremendous scientific and technical advancements in this field (Atmanand et al., 2019). By sharing the advantages of marine resources, the blue economy paradigm creates a sustainable development framework for poor nations' economies, allowing for reinvestment in human development and the reduction of crippling national debt crisis (UNCSD et al., 2016). It is also seen as a source of employment, innovation, and a competitive edge. Indeed, the worldwide marine sectors generate 3–4% of global GDP in terms of value added.

5.10 Results of the short Run Dynamic Model in case of India

The next step is to generate the error correction representation of selected model after calculating the long run coefficients. Economic growth (GDP) is the dependent variable, whereas GFCF, TLF, and BE are independent variables.

Table 5.13: Results of Short Run Dynamic Model in case of India

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(lnGFCG)	0.58	0.19	3.01	0.00
D(lnTLF)	0.74	0.46	1.57	0.12
D(lnBE)	0.28	0.09	3.07	0.00
CointEq(-1)	-0.65	0.09	-7.1	0.00
R-squared	0.98	**Adjusted R-squared**		0.95
Akaike info	-3.13	**DW statistics**		2.35

Cointeq = lnGDP-(1.65*lnGFCF+0.56*lnTLF+0.44*LnBE)

The error correction model (ECM) is used in this research. In Table 5.13, the outcome reveals that when the fundamental component, blue economy, improves, India's economic growth improves significantly as well. The findings show that a 1% increase in the blue economy will result in 0.28 % economic growth, and vice versa, assuming all other factors remains constant in the short term.

The GFCF coefficient is significant and has a positive effect on GDP in the short run; for example, a simple 0.58 % rise in economic growth is connected to a one percent gain in capital, all other factors remaining constant. In the case of India, TLF is positively impacted, although statistically insignificantly. The ECM (- 1) coefficient indicates that the adjustment procedure is satisfactory. The Error Correction Term (ECM-1) is derived from the long run and describes that in the short run how much disequilibrium will be moved away in the long run. It specifies the speed of adjustment back to long run equilibrium after a shock in short-run (Ullah et al., 2016). ECM coefficients are statistically significant and numerically -0.65 in the models. These findings indicate that by coming year, the GDP divergence from the long run growth rate is rectified by 0.65%. R^2 and adjusted R^2 values indicate a good fit for the model. In general, a greater r-squared suggests that the model is more well-fitting. In addition, the Durban-Watson (D-W) score suggests that this research model is free of autocorrelation. There is no autocorrelation if DW

equals to 2. A positive autocorrelation is when the value is less than 2, while a negative serial correlation is when the value is more than 2 (Nkoro & Uko, 2016).

5.11 Model Diagnostic Test in case of India

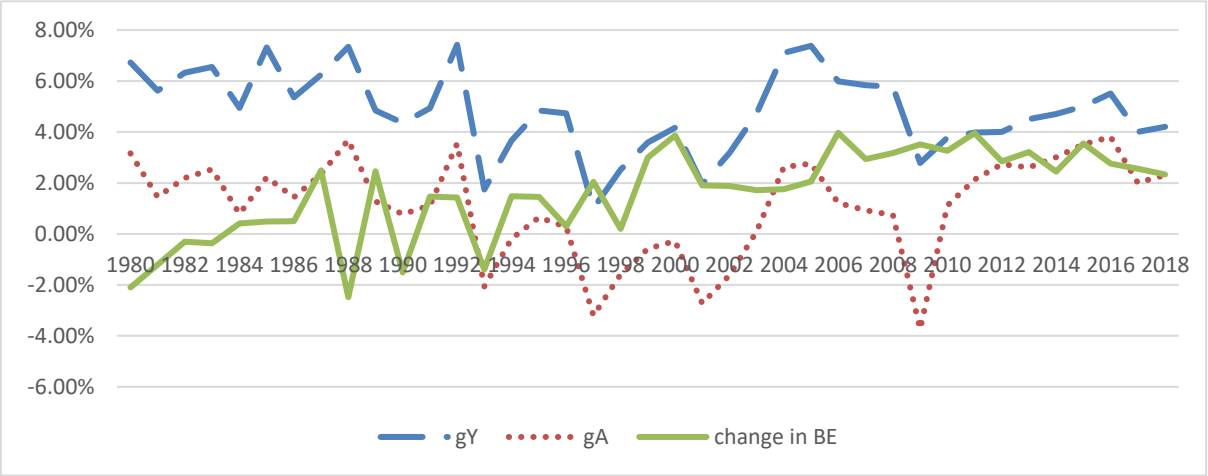
The study utilizes diagnostic tests to determine if the model is fit or robust. Table 5.14 shows that the model passes all of the diagnostic tests that have been performed. Finally, the importance of the variables and other diagnostic tests of the model, such as serial correlation, heteroscedasticity, and normality, are assessed in order to check for the estimated ARDL models. The Wald test is also applied to check either there is an issue of omitted variable biasness or not in models. The probability value of Wald test confirms that our model is not suffering from omitted variable biasness.

Table 5.14: Results of Model Diagnostic Test in case of India

Diagnostic Tests	F-statistic	Prob	Obs*R-squared	Prob
Breusch-Godfrey LM Test	0.96	0.40	4.53	0.10
White Test of Hetero	0.61	0.84	15.36	0.70
Normality	_	0.699	_	_
Wald Test	5.68	0.00	_	_

Source: Authors' calculation

Figure 5.1 Trend of GDP growth, TFP and Blue Economy in case of Pakistan



Source: Authors Calculation

Figure 5.1 depicts the pattern of output growth with total factor factory productivity growth as well as the output growth explained by changes in blue economy. There is a volatility in GDP and TFP growth rates. Whenever the TFP growth has increased, there has also been an uptick in the GDP growth rate, and vice versa. In Pakistan's case, there is an indication of a strong relationship between the TFP and GDP growth rates. This implies that TFP growth has led to GDP growth in Pakistan.

Table 5.15: Average Annual Growth Rate Pakistan

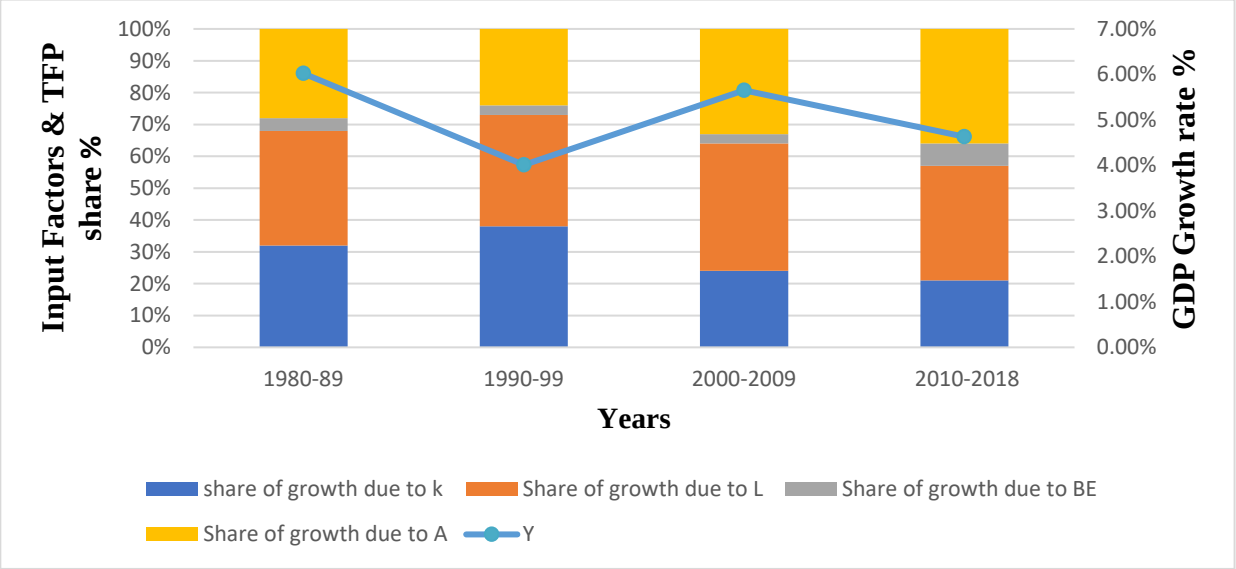
Years	**1980-89**	**1990-99**	**2000-2009**	**2010-2018**
Y	6.02%	4.01%	5.65%	4.63%
K	5.65%	6.41%	3.70%	2.9%
L	1.8%	2.6%	4.0%	2.5%
BE	1.15%	0.23%	0.31%	4.42 %
A	1.71%	0.33%	1.31%	1.75%
Share of growth due to K	32%	38%	24%	21%

Share of growth due to L	36%	35%	40%	36%
Share of growth due to BE	4%	3%	3%	7%
Share of growth due to A	28%	24%	33%	36%

Source: Authors Calculation

Based on the growth accounting framework, this section analyzes the source of growth in Pakistan for different periods between 1980-89, 1990-99, 2000-09, 2010-2018. In Table 5.15 first this study decomposed the sources of Pakistan's economic growth into growth of capital, labor, blue economy and TFP and then relative share of growth in output due to Y, L and blue economy. *The rows labelled "Share of Growth Due to K, L and BE" attributes what percentage of output growth is due to the factors of production and productivity growth. And the columns labeled "Share of Growth Due to TFP Growth" reports contribution of productivity growth to output growth.*

Fig 5.2 Shares of TFP & Factor Inputs in Pakistan's GDP Growth



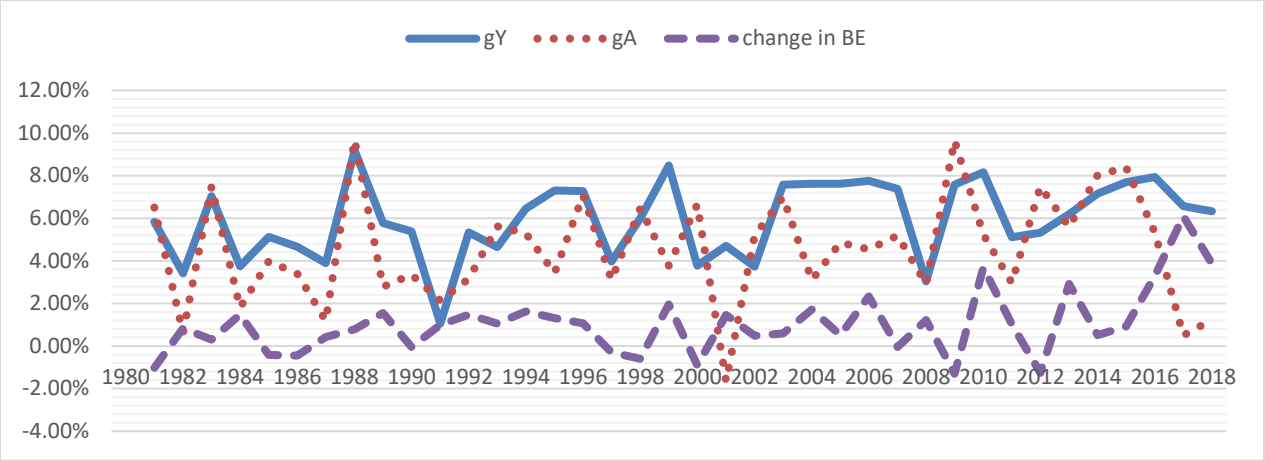
Source: Authors Calculation

Figure 5.2 is the visual representation of contributions of TFP and factor inputs to GDP growth rates decade wise. During the period 1980-1989, on average the GDP growth rate is 6.02%, the growth rate of K is 5.65%, blue economy increases by 1.15 %, and TFP growth is

1.71% annually. Thus, capital contributes nearly 32%, and blue economy only contributes 4% of growth, the rest 28% is contributed by TFP over the period of 1980-1989. The average growth rate of capital is 5.65% over the period of 1990-1999, and 3.70% over 2000-2009, and meanwhile the contribution of capital to growth from 1990-1999 is 38%, and 24% from 2000-2009. From 2010-2018 the capital becomes 2.9 percent and contribution of capital becomes 21 percent. During 1990 and 1999, the blue economy has grown at an average yearly rate of 0.23 %, then increased to 0.31% per annum between the period of 2000 and 2009.

Labor contribution is 36% in 1980- 1989, and in the period 1990-99,200-09, 2010-18 is 35%, 40%, 36% respectively. The share of growth due to blue economy from 1990-1999 and 2000- 2009 is 3 % and later increased to 7 percent in 2010-2018 as shown in table 5.15. Also, the TFP growth rate is 0.33 and 1.31 percent per annum during the period 1990-1999 and 2000-2009 respectively and later becomes 2.01 % annually in 2010-2018. During the years 1990 to 1999, TFP growth contributed 24% to overall economic growth. It surged to over 33% between 2000 and 2009, and then to almost 36 % between 2010 and 2018. One reason for a better TFP growth could be that in the 2000s quite a few reforms were undertaken to liberalized the financial sector of Pakistan. For example, tariffs were rationalized in 2005-06. Similarly, the financial sector was liberalized considerably during the 2000s, which perhaps bore fruits in the 2010s, which is evident from impressive TFP performance during the decade (Siddique, 2020). Although the blue economy is an underappreciated notion, there are serious challenges with data availability, as well as the need for good policymaking to make it effectively. If BE is used appropriately, it can yield optimum benefits. It has the potential to be a game-changer for Pakistan.

Figure 5.3 Trend of GDP growth, TFP and Blue Economy in case of India



Source: Authors Calculation

Figure 5.3 analyzed Indian macroeconomic series between 1980 to 2018 in order to classify period-wise growth trends. It demonstrates that in the 1980s, India's greatest TFP growth was over 9%, in the 1990s, it was around 7%, in the 2000s, it was around 10%, and in the 2010s, it was around 8%. Throughout the time of observation, the rise of GDP and TFP both followed the same pattern. It reflects the fact that as TFP growth increases, so does GDP growth also gain momentum and vice versa.

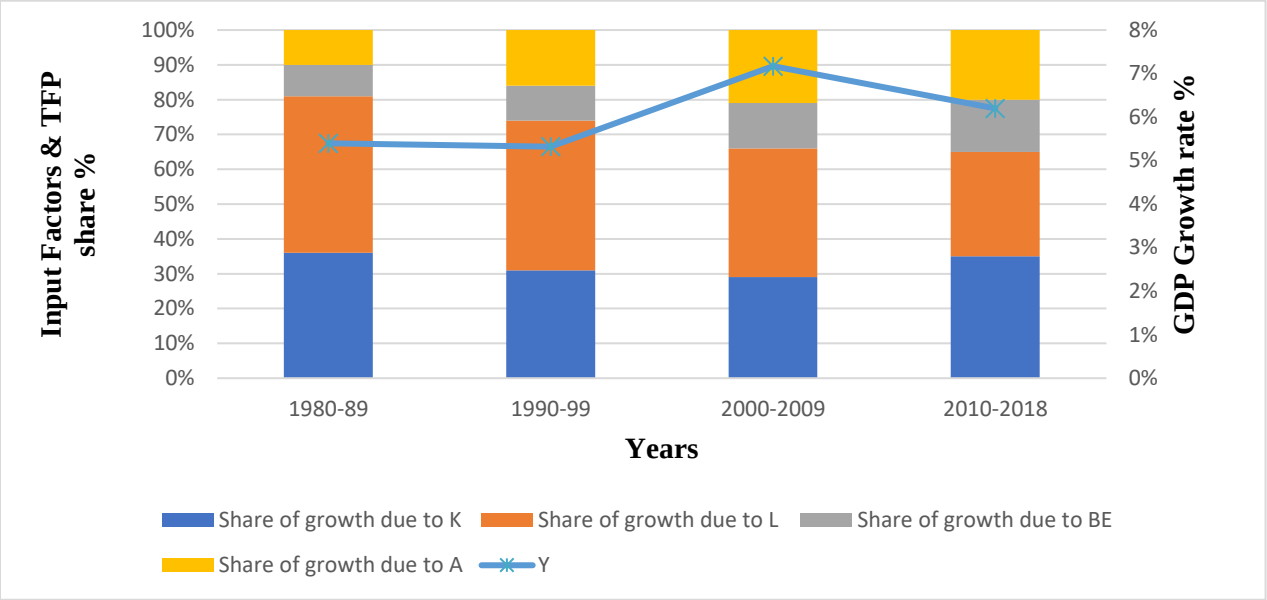
Table 5.16: Average Annual Growth Rate India

Years	**1980-89**	**1990-1999**	**2000-2009**	**2010-2018**
Y	5.40%	5.32%	7.17%	6.50 %
K	7.23%	6.31%	5.29%	6.73%
L	7.2%	8.1%	6.3%	5.2%
BE	1.8%	4.2%	5.9%	6.0%
A	1.75%	1.69%	2.50%	1.38%
Share of growth due to K	36%	31%	29%	35%

Share of growth due to L	35%	43%	37%	30%
Share of growth due to BE	6%	10%	13%	15%
Share of growth due to A	23%	16%	21%	20%

Source: Authors Calculation

Fig 5.4 Shares of TFP & Factor Inputs in India's GDP Growth



Source: Authors Calculation

In Table 5.16, the study examines India's sources of growth for the time periods 1980-1989, 1990-1999, 2000-2009, and 2010–2018, demonstrating the various output average growth rates with other factor of productions and TFP growth. As Table 5.16 illustrates the average growth rate of output was 5.40% between 1980-1989. During this period, average growth rate of capital was 8.7% annually, blue economy was 0.8% and total factor productivity growth was 1.75%. The share of growth due to capital, labor, BE, and total factor productivity is 36%, 35%, 6, and 23% respectively. However, in the next decade from 1990-1999 GDP growth (Y) grew at an annual average growth rate of 5.32%, the capital contributes 6.31 %, the blue economy contributes 1.2 % and 1.69% contributed by total factor productivity. Meanwhile during this period share of growth due to capital, blue economy and total factor productivity were 41%,

14%, and 31% respectively. The share of growth in blue economy slightly higher than previous decade. From the decade of 2000-2009 the findings indicates that on average the growth rate of output surged to 7.17%, improved significantly over the preceding decade. Average growth of capital accounted for only 5.29% and blue economy 1.9% respectively and the average total factor productivity growth rose to 2.40%. The study also showed that during the same period 25% of output growth could be contributed by growth of capital and 17 % and 33% contributed by blue economy and total factor productivity. The average GDP growth rate were 6.50%, while capital, blue economy and total factor productivity accounted for 4.73%, 2.0%, and 1.31% respectively from 2010-2018. Similarly, on average the capital contribution, blue economy and total factor productivity is 25%, 19% and 20% respectively.

India is a fast-growing economy that ranks fifth in the world in nominal GDP and third in purchasing power parity, making it the world's fastest emerging economy, overtaking China (Upadhyay & Mishra, 2020). Because of the country's young workforce, less dependency ratio, strong saving, good investment rates, as well as an ever-increasing integration into the global economy, long run GDP growth remained positive. India is the world's sixth biggest consumer market, accounting for 60% of GDP in domestic private consumption. Apart from government spending, investments, and net exports, India's GDP is influenced by a variety of factors. According to statistics from 2018, India is the world's 10th largest importer and 19th largest exporter. In the ease of doing business index, India is placed 63rd, while in the global competitiveness report, it is ranked 68th (Mubasher Hassan & Mirza, 2021).

The blue economy was emphasized as one of the ten essential pillars of growth in the Government of India's Vision of New India by 2030, which was published in February 2019. It was indicated as the vision's sixth dimension, emphasizing the necessity for a comprehensive policy that integrates many sectors in order to improve the lives of coastal populations while also accelerating development and employment (Trishala, 2016).

CHAPTER 6

CONCLUSION AND POLICY RECOMMENDATIONS

This chapter includes a conclusion as well as policy recommendations for improving Pakistan's economy. Section 6.1 discusses the conclusion of the research done based on the findings of this study, and section 6.2 offers some suggested recommendations to make the situation better.

6.1 Conclusion

The main aim of current study is to examine the impact of the blue economy and its economic consequences on Pakistan's and India's economic growth by using growth accounting framework. We face many economic challenges as a developing country, but the blue economy has a great prospect to support newly emerging sectors and also has the ability to support the growth in green economy, create employment, and contributing to the broader framework of the sustainable development agenda. Various sectors of the blue economy can provide new prospects for employment, local sustainable development, and regional and international collaboration. The significance of the blue economy relies in conserving the ocean ecology while also delivering new resources and employment opportunities (Upadhyay & Mishra, 2020).

There are numerous measuring issues and data limitations with the blue economy; hence it is not a clear indicator. For long run economic growth, the dimensions of fisheries, aquaculture, shipping, trade, tourism and the environment must be prioritized. Economic growth is a significant phenomenon in the twenty-first century. Economists have been attempting to identify the factors that contribute to economic growth (Graziano et al., 2019). In recent decades, the blue economy and its long run viability have emerged as one of the most important research issues, and it has become a buzzword among policymakers in this field. Despite the fact that a number of studies have sought to examine the blue economy from diverse angles, to best of our knowledge no research has empirically explored the factors that drive the size of the blue economy. By looking at both Soth Asian countries Pakistan and India, the current study attempted to examine the factors that influence blue economy activities and do the comparative

analysis. To begin, we create a BE index of both countries based on important factors. These dimensions are further subdivided into various proxy variables that show how well each dimension performs.

The initial objective of this research is to identify a dynamic relationship between blue economy on economic growth. Calculating the growth accounting of blue economy for both India and Pakistan are second objective of contemporaneous study. For this purpose, time series data has been collected over a period of 1980-2018 or both the countries. We used the ARDL bound testing approach to regress the model which is projected by (Pesaran et al., 2001). It is important to perform the unit root test just to check the stationarity of the variables. The variables should not integrate of the second order i.e. I (2) since the ARDL cannot be used with stationary variables at second difference I (2) (Bahmani-Oskooee & Nasir, 2004). Each variable in both nations is subjected to ADF and PP tests. To check stationarity of the variables, all the variables that used in the study (GDP, GFCF, TLF and BE) are integrated at level and first difference. The first stage in the ARDL bond testing technique is to verify for long-run cointegration between the model's variables. The results showed in the study of Pakistan that the computed F statistics of 7.20 which has greater than the lower critical bound value and upper critical value which were 3.23 and 4.35 respectively at 5% significance level. Thus, the null hypothesis of no cointegration is rejected, implying long run co integration relationships among the variables. The calculated F-statistics in case of India was 7.24. According to the table F-statistic has higher value than upper bond value both at 5 percent and 10 percent level of significance. AIC has been selected for suitable lag order of the variables (Asghar & Abid, 2007).

After verification of the long run cointegration between economic growth and its determinant when economic growth (GDP) served as dependent variable whereas GFCF, TLF and BE were the independent variables. Then, for both economies Pakistan and India, we computed both the long and short run form of the ARDL model. In case of Pakistan the findings highlighted the fact that there has a strong impact of blue economy, capital formation and labor force on economic growth of Pakistan in the long run. As in long run the GFCF has significant and positive impact on GDP. Infrastructure development directly supports economic growth.

Another possibility is that spending on different projects boosts overall productivity and economic growth (M. S. Khan & Reinhart, 1990). The coefficient of TLF also have significant and positive impact on economic growth. Technological advances and modern technological adaptation enhance labor productivity in every economy, enabling workers to produce higher-quality goods in larger quantities and in less time. To analyze the results of India's context all the variable (GFCF, TLF, BE) has positive influence and has statistically significant on GDP growth in the long run. The core variable of this study is blue economy. The blue economy has a positive and statistically significant effect on India and Pakistan's economic growth. Blue economy is a phenomenon of long run so the coefficient of blue economy is significant in long run (Bari, 2017)

Following these findings, the ECM form of ARDL has been employed. The ECM term indicates the rate of adjustment to restore equilibrium in the dynamic model (Ali et al., 2015). The ECM values specify how rapidly variables reach equilibrium, and it should be statistically significant (Pahlavani et al., 2005). Here in the study the significance and the negative sign of the ECM also demonstrated the presence of a long-run equilibrium relationship between economic growth and the other independent variables. The GFCF regression coefficient is positively significant, according to the error correction model in the short term. But the regression coefficient of TLF is positive but statistically insignificant in case of Pakistan. In India's case the coefficient of GFCF is significant and positively affect the GDP over the short run. The result showed that the core variable which is blue economy improved, and then economic growth of India also significantly improved and total labor force result's has positive impact but insignificant.

After the empirical findings, we used time series data from 1980 to 2018 to explore the drivers of economic growth in Pakistan and India. To examine the influence of capital, blue economy, total labor force and total factor productivity to economic growth in Pakistan and India, the researchers used the growth accounting framework of the traditional neoclassical production function.

Basically, an attempt has been made to analytically investigate the contribution of total factor productivity to output growth of Indian and Pakistan economy. As per the main finding on

TFP front, performance of India has been perceptibly superior to that of Pakistan. Nonetheless, all sectors in each of the two states have experienced a temporal reduction in TFP growth, indicating that economic reform initiatives to stimulate technological advancement in the countries have been ineffective. However, in the overall Indian and Pakistan economy, the core variable blue economy experienced productivity improvement over time. Whereas, on the other hand, it was the TFP growth that acted as the major source of economic growth of the aggregated Indian and Pakistan economy during the entire study span.

6.2 Policy recommendations

The present study arrests the attention of the policymakers towards the unprecedented potential of the BE. The study brings evidence that until and unless the policymakers do not overcome the phenomenon of sea blindness and provide institutionalized support to different sectors of the BE, its potential will remain untapped.

- The study's findings contribute to a wise and prudent utilization of the blue economy for economic development.
- 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.
- Because the blue economy is still in its early stages, access to capital, a lack of entrepreneurial culture, and regulatory issues are all major obstacles to innovation. At the regional, national, and international levels, a blue economy policy agenda must be established to address the aforementioned concerns. There should be capacity building through public-private partnerships.
- Blue economy requires investment in labor force, 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.

- 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 in marine capture fisheries are essential for the blue economy's future. Considering the achievements of many other countries (such as Mauritius and the Seychelles), it is imperative to set particular fish harvesting objectives in order to minimize overfishing and mistreatment of the blue resources. In addition, fishing should be restricted in terms of schedule, regions, and quantity. It has the potential to ensure the protection of key habitat and the regeneration of fish stocks in the fisheries industry. As a result, improving the fishing industry as a societal priority.
- Both major export-oriented enterprises and small-scale operations would benefit from improving and investing in the fisheries sector. As a result, the measures will disproportionately favor poorer households and women.
- In order to raise awareness and impart knowledge about the breadth and potential of blue resources, it is important to establish a network of researchers, industry stakeholders, government officials, and media outlets. For greater awareness and understanding of the topic, informational campaigns, mainstreaming, and dissemination of the knowledge developed by researchers will be useful. Non-availability of research, policy, planning, execution of interventions by professionals, transfer of technology, coordination with international development institutions funding etc are challenges.
- Pakistan must focus on developing new ports and make structural changes in existing ones to improve their capacity to handle greater volume/tonnage of cargo at minimal costs and save major portion of foreign exchange which previously used to be expended

in sea borne trade. All this can only be achieved by creating awareness both in public and private sectors and taking major policy decisions.

- The revenue from the sea routes transport system can be improved. The government has to play an important role to enhance ships fleet and increase the share of GDP.
- It is suggested that SMEs should be promoted and integrated into the blue economy to ensure that to become more employment generated.
- Strong legal and governance frameworks will only help to boost economic development. These frameworks must be secure, transparent, and consistent, before firms and industry to safely invest in new projects.
- Tourism is the most significant and economically advantageous industry of the blue economy. Hotels, underground aquariums, and beach resorts, all of which are popular internationally, might be included in long run plans. In coastal locations, Pakistan visibly lacks beaches and tourism attractions. So, to make our beaches more appealing, projects should incorporate. These actions will appeal both domestic and foreign tourists. As a result, Pakistan's tourism sector will benefit.
- The CPEC project, which will improve road and rail infrastructure, could improve the efficiency of Pakistan's ports (CPEC). Increasing the efficiency of seaports will, in the end, boost the blue economy.

6.3 Way Forward

Though Pakistan has begun to strive toward a blue economy, the ambition of long run growth and development will only be realized if the political elite exhibits strong commitment and seriousness to this sector. Pakistan must give importance to the blue economy in its national priorities just as India and Bangladesh has given it a prominent place in its economic policy, so too must Pakistan work along these lines. Poor infrastructure, systemic red tape, bureaucratic bottlenecks, regional instability, particularly a dismal law and order situation, and a lack of cooperation and knowledge amongst departments and ministries must all be addressed. All-encompassing policies should be implemented, and concerted efforts, large and small, should be made in support of the blue economy concept. It is high

time to pursue the blue growth agenda more succinctly as BE offers long-term shared prosperity, social equity, and environmental sustainability.

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