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Ports War: Determining Gwadar and Chabahar Ports Trade Attractiveness Using *Multi-Criteria Decision Analysis*

Yousaf Ali[1] | Muhammad Sabir[2*] | Pashmina Amjad[3] | Wajeeh Najam[4] | Murtaza Shafiq[5]

1. School of Management Sciences, Ghulam Ishaq Khan (GIK) Insitute of Engineering Sciences and Technology Topi, Swabi, Pakistan. Email: yousafkhan@giki.edu.pk
2. Corresponding Author, NUST Business School (NBS), National University of Sciences and Technology (NUST), Islamabad, Pakistan. Email: sabir.m@nbs.nust.edu.pk
3. Faculty of Materials & Chemical Engineering, Ghulam Ishaq Khan (GIK) Insitute of Engineering Sciences and Technology Topi, Swabi, Pakistan. Email: u2014289@giki.edu.pk
4. Faculty of Materials & Chemical Engineering, Ghulam Ishaq Khan (GIK) Insitute of Engineering Sciences and Technology Topi, Swabi, Pakistan. Email: u2014409@giki.edu.pk
5. Faculty of Computer Sciences and Engineering, Ghulam Ishaq Khan (GIK) Insitute of Engineering Sciences and Technology Topi, Swabi, Pakistan. Email: u2014238@giki.edu.pk

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ABSTRACT

This study compares the two emerging seaports: Gwadar port (Pakistan); and Chabahar port (Iran). The study evaluates the trade attractiveness among the neighboring countries, i.e., Afghanistan, China, and the Central Asian States, while keeping China-Pakistan Economic Corridor (CPEC) development in perspective. The two ports may provide one of the closest sea links for the resource-rich Central Asian countries and Afghanistan. At the same time, Gwadar provides China with an alternative and short trade route via Pakistan. The study employs the Order of Preference by Similarity to Ideal Solution (TOPSIS) technique of Multi-Criteria Decision Making methods to evaluate and select the best seaport. The findings establish that Gwadar is a better option. The study also provides recommendations for the authorities of the two ports and the prospective other countries in the neighborhood to ensure maximum return on their investment.

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Introduction

Seaports or Airports have been essential drivers of international trade globalization and hugely contribute to economic growth and development across the globe. Smith (1776) states that the Mediterranean Basin (especially the European side) is more developed due to its proximity to the sea. Furthermore, geographical considerations such as access to the sea and distance to the major markets have substantial impacts on transportation costs that strongly influence the growth of the export-related manufacturing sector, leading to the economic development of the region (Radelet & Sachs, 1998). Even today, if we look around the world map, we find that major developed cities are (or were) major port cities. For instance, London (UK), Rotterdam (the Netherlands), Singapore, Hong Kong, Shanghai (China), Shenzhen (China), New York (America), Tokyo (Japan), Mumbai (India), and Karachi (Pakistan) are all port cities.

In the post 9/11 era, the importance of ports has further increased, not only for trade but also for geopolitics and military usage. In a unipolar world, where the nucleus of economic power is gradually shifting from the West towards the East (China, India, East Asian countries), the importance of ports has increased multiple times for economic, trade, and geopolitics reasons. The Asian continent has a combined population of over four billion (the total world population is about 7.4 billion) and is home to the three most populous countries out of the topmost populated countries.[1] This region has become more critical because the two major global economic growth hubs (China and India) are also located in Asia. China's continuous economic growth leads to a considerable flow of goods via sea transportation to the Middle East, Europe, and the rest of the world. Also, China and India strongly rely on imported fuel to meet their growing economic needs. Interestingly, within Asia, China, India, and Pakistan (the three most populated countries in Asia) are neighboring countries; they often engage in various conflicts over border controls, water distribution, and political point-scoring, to mention a few.

During the last one and a half-decade, the significance of the Arabian Sea increased because it provides access to the Persian Gulf and the Red Sea via the Gulf of Aden. Therefore, opening a big consumer market in the Middle East (e.g., Saudi Arabia, United Arab Emirates, Oman, and Qatar) and African countries (like Egypt, Sudan, and Eretria). Additionally, the Gulf of Aden route can further link to the Mediterranean Sea via the Suez Canal, thus linking Arabian Sea routes to Europe. On the other hand, the resource-rich Central Asian Countries (Uzbekistan, Turkmenistan, Kyrgyzstan, and Tajikistan) are landlocked. Their only viable access to water is via the Arabian Sea through Iran, Afghanistan-Pakistan. Figure 1 shows a regional map showing the strategic positions of these countries.

China's global initiative of *One Belt, One Road* is developing Gwadar Port of Pakistan as part of the China-Pakistan Economic Corridor (CPEC).[2] The work on Gwadar Port under CPEC has been ongoing since 2015. Iran and India have been working on the Chabahar Port development since 2003 for trade and transportation with Afghanistan and Central Asian states.

These two ports are about 170 kilometers apart, but these ports will be rival ports to attract trade from the landlocked resource-rich Central Asian countries. Besides, landlocked Afghanistan also needs access to seaports given that its economy is down due to decades-old wars; and the country is strongly relying on imports for its need.

To have all this background in perspective, the primary objective of this particular study is to identify the best port for landlocked Central Asian countries and Afghanistan. And also an alternative port for China for trade and transportation while using the *Order of Preference by Similarity to Ideal Solution* (TOPSIS) technique of Multi-Criteria Decision Making (MCDM) methods by incorporating different attributes. The study contributes to the literature by comparing two ports to become operational by 2025. Contrary to the existing literature on the subject, most earlier studies on port choice are based on fully functional ports (e.g., Parola et al., 2016; Chou, 2010; Ding et al., 2019).

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1. UNO (2017)
2. CPEC is a joint project of China and Pakistan to develop, a network of roads, railways, fiber optics, building of energy infrastructure in Pakistan, and development of Gwadar port, construction of an International Airport at Gwadar, along with special economic zones in Gwadar and along with the economic Corridor. The total investment is expected to be over US$ 50 billion by 2025. CPEC will be connecting the Eastern China (Kashgar), to Gwadar through transportation network. It is believed to be a shortest route for China for its exports compare to China export route via Chinese Western ports. CPEC is part of the China *One Belt One Road Initiative*. Full review of the China's *One Belt One Road Initiative* can be accessed at Chinese Government official website for same purpose. < http://english.gov.cn/beltAndRoad/ >

We employed the TOPSIS technique that improves the methodology for port selection literature and applies modern MCDM techniques in the subject area. The study will be helpful to Central Asian countries: Afghanistan, China, the governments of Pakistan, and Iran for their port development and related policies. At the global level, it will contribute to creating scholarly knowledge that can be used for strategic and geopolitical decision-making to support countries like China and India interested in developing Gwadar and Chabahar ports, respectively.

The rest of the paper is organized as follows: Section 2 consists of two sub-sections that present profiles of both seaports; it also discusses various factors and attributes that will be incorporated in the analysis section of this paper. Section 3 presents a literature survey and discusses gaps in the existing literature. Section 4 explains the experimental data, attribute weight assignments, the rationale for weight assignment, and the TOPSIS technique. Section 5 discusses the results of the TOPSIS, followed by a discussion. Finally, Section 6 sums up the paper by stating that both ports present a tremendous opportunity for regional countries; to alleviate poverty and work for regional prosperity through investment in these ports.

2. Introduction to the two competing Seaports

This section is divided into two sub-sections. These sub-sections describe the profiles of Gwadar and Chabahar ports, respectively.

2.1 Gwadar Port

Gwadar port, located in Gwadar city (southwest part of Pakistan in Balochistan), is a deep-sea warm water port. It is approximately 120 km and 170km away from the border of Iran and Chabahar port, respectively. Furthermore, it is about 380km away from Oman. It is near a major sea trade route, i.e., the Strait of Hormuz, a pathway for the transportation of about 35 percent of world petroleum traded by sea routes and overall 20 percent of the oil transportation globally.[1] Gwadar is a possible land connection between the landlocked Central Asian Republics and Afghanistan.

The development of Gwadar port incurred a cost of about US$248 million from 2002 to 2006 (Zaheer 2006 and Walsh 2013). This work includes the construction of 3 multipurpose Berths (total length of 602 meters) with a capacity of 25,000 Dead Weight Tonnage (DWT) and bulk carriers of 30,000 DWT. Additionally, a 100-meter service Berth was also built. The turning basin has a 450-meter diameter. An approach channel with a length of 4.5 kilometers and dredged to a depth of 12.5 meters was also part of these developments. Finally, other associated and handling equipment required for the port, e.g., tugs, pilot boats, and survey vessels, has also been arranged and operationalized (Zaheer, 2006).

Phase II of the Gwadar port project is still ongoing. This phase is based on development projects under CPEC with an expected cost of around one billion US dollars (CPEC, 2019). This study uses information from Phase II for the analysis, given that these are the things that will be implemented in this project. As per Phase II, the following development projects will occur at Gwadar port by or before 2025 (CPEC, 2019).

- Establishing one Bulk Cargo Terminal with a capacity of 100,000 DWT ships
- Developing 3.2 km of shoreline with four container berths, upgradeable to 150 berths by 2045
- Development of an Economic Zone on 2,293 acres adjacent to the port (China Daily, 2015).
- Establishing one Grain Terminal and two Oil Terminals, each with a capacity of 200,000 DWT ships
- Developing desalination plant, 1 Roll-on, and Roll-off Terminal
- Dredging approach Channel to the depth of 14.5 m, further increased to 20 meters by 2050 to enable large ships and cargo handling ports.
- To construct *Makran Coastal Highway* to connect the port by four-lane expressways
- Developing a coal-fired 360-megawatt power plant
- Construction of a new international airport in the locality of the port
- Building a floating liquefied natural gas Terminal having a capacity of 500,000,000 cubic feet of gas per day

1. EIA (2012)

2.2 Chabahar Port

Chabahar seaport is located in Chabahar on the *Makran* coast in the *Baluchistan* province of Iran, by the Gulf of Oman. This seaport has also been referred to as the Golden Gate as it enables landlocked Afghanistan and other Central Asian countries to access the sea (Roy, 2012). India, Afghanistan, and Iran are jointly developing the Chabahar port with set objectives: to reduce Afghanistan's dependence on Pakistan for trade and neutralize the strategic balance caused by the development of the Gwadar port under CPEC.

The development of the Chabahar port is divided into different phases, as shown in Table 1 below. Currently, Phase 1 is completed. The analysis of this study is based on progress made till Phase 2, and work in Phase 2 is currently underway.

Table 1. Current Work and Future Plans for Chabahar Port

Phase 1			
2017			
Three multipurpose berths of 540 m Two container berths of 620 m 1650m of breakwater extension Dredging to -16m depth at the cost of 17 million 195 hectares of land reclamation by sedimentation			
Phase 2	**Phase 3**	**Phase 4**	**Phase 5**
2018	2020	2020	2024
360m container berth construction	Oil berth construction	Multipurpose berth construction	360 m container berth construction

Source: PMDGSB (2013)

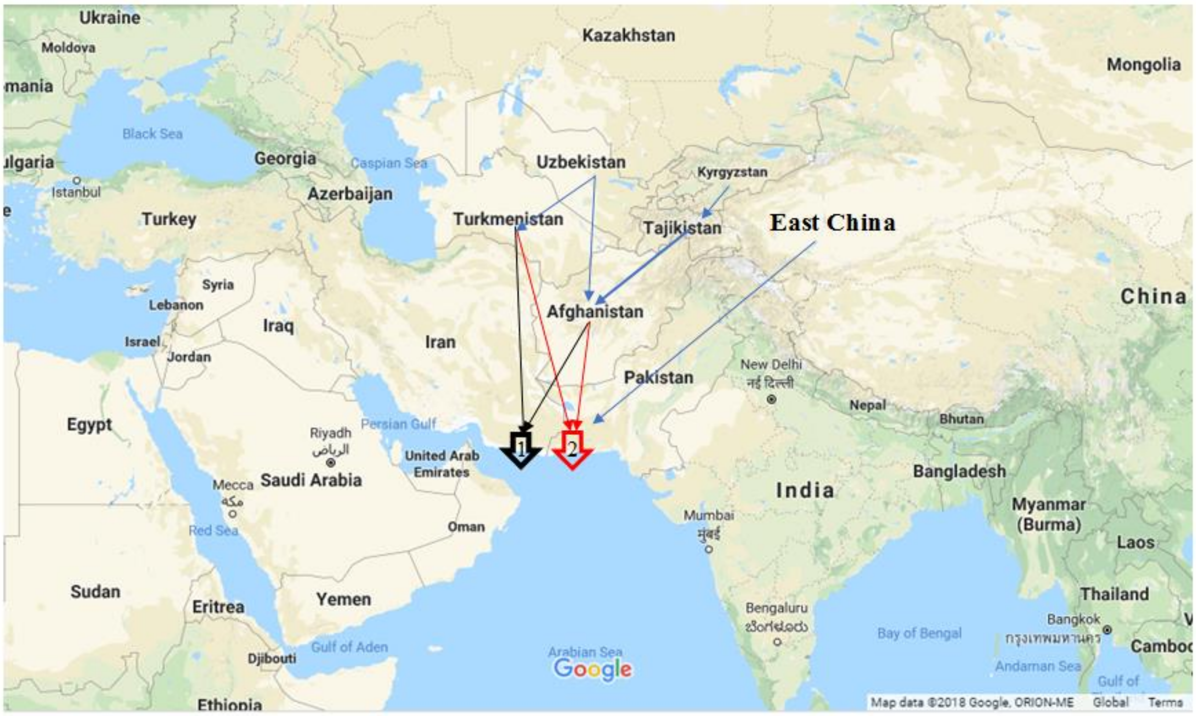

Figure 1. Regional Map with the location of Chahabahar (1) and Gawadar (2) ports

3. Literature Review

There is extensive literature available on port selection, such as Slack (1985), Song & Yeo (2004), Yap et al. (2006), Chou (2010), and (Ding et al., 2019). The existing scholarly work on port selection choice can be grouped in various ways based on the factors associated with seaport authorities: factors beyond the control of port authorities, decision-makers (shippers, freight forwarders), geographical locations, type of flows, and type of port. A good overview of the related literature is presented in Moya & Valero (2017). They reviewed port choice literature and identified Port Authorities' role in determining the current port environment and performance. Similarly, Parola et al. (2016) consider port competitiveness a multidimensional phenomenon based on their analysis from reviewing leading peer-reviewed international journal articles on port selection from 1983 to 2014. However, in the current literature review section, we limit ourselves to the studies clustered mainly around two major themes. i.e., literature that considers factors influencing port selection; and studies having different port selection methodologies. In the rest of this section, we will discuss these two categories of scholarly literature in detail.

There is extensive scholarly literature available on factors influencing the choice of seaports. Some of these studies and the considered factors influencing the choice of ports are given in Table 1. While analyzing these studies, it is evident that many factors can influence port choice. We clustered similar kinds of influencing factors in Table 1. It is also visible that most studies focus on multiple factors.

Additionally, port location and port operation are also important factors influencing port choice by shippers, freight forwarders, or strategic business decision-makers (Slack, 1985; Brooks, 2000, Yuen et al., 2012). Other factors worth mentioning here include the infrastructure of the port, connectivity of a port with inter-model links, and prices (port charges, inland freight rates, or loading and unloading charges). There are very few studies that discuss safety and security factors in port selection.

Shipping companies and businesspeople consider port security, size of the port, inland freight rates, port charges, quality of customs handling, free time, congestion, port equipment, number of sailings, the proximity of the port, and the possibility of inter-modal links as major influencing factors for port selection (Slack, 1985 and Ding et al., 2019). Furthermore, cost and services at the port are more important for shipping companies and businesspeople (e.g., for North Atlantic container trade) than the facilities and port features. However, the analysis of Slack (1985) is based on a survey (and presenting the responses only) rather than analyzing the data using Multicriteria Decision Analysis (MCDM) or econometric/statistical tools. The survey-based studies may have their bias in data collection and sometimes are limited to descriptive statistics only. Similarly, from the outsider's perspective, Song & Yeo (2004) studied the competitiveness (cargo volume, facilities, location, service level) of container ports in China and Hong Kong to provide managerial and strategic implications for port choice. Song & Yeo (2004) used the Analytic Hierarchy Process (AHP) technique on a survey of ship owners, shipping company executives, shippers, terminal operators, academics, and researchers in the region. Accordingly, the two most essential elements for port competitiveness are port location and facilities at the port, respectively. A similar study using AHP is that of Chou (2010).[1] Their study developed an AHP model and used it to calculate the weight of various influencing factors (namely, depth of containership berth, port charges, port loading, and discharging efficiency). Accordingly, the hinterland economy and port-related charges were the major vital elements. Sayareh & Alizmini (2014) also used AHP and TOPSIS to select an optimized container seaport in the Persian Gulf. Accordingly, port operations, safety, infrastructure, and costs were significant factors influencing port selection in the Persian Gulf. More recently, Fahim et al. (2021) used the MCDM-based Best-Worst Method for performance evaluation and choice on the physical internet. It is essential to mention that most MCDM-based studies used the AHP technique (except for Fahim et al. 2021), a widely applicable MCDM method. The AHP technique has some limitations. For instance, according to Holder (1990), AHP is not a well-validated method. Also, using a linear scale for comparison is illogical, and AHP should be modified to avoid the problem of ranking reversal.

Some studies on port choices are based on theoretical models. For instance, Zan (1999) proposed a static model based on game theory for port management. Zan (1999) uses his model for interaction among the three parties, i.e., the shipping companies, the shippers, and the port authorities. Similarly, further studies such as Chang et al. (2008) and Chou (2007) also proposed similar techniques. Although all these studies are helpful, these studies offer less practical usage given the dynamic situations of the real world.

Yap et al. (2006) studied the attractiveness of mainland Chinese ports along with long-dominated ports of Hong Kong, Busan, and Kaohsiung. They reported that Chinese ports' new services bypassed the services of Japanese and Taiwanese ports. However, their study is limited to information supplied

1. (Chou) 2007 presented a new theoretical Fuzzy Multiple-Criteria Decision Making Method for solving transshipment container port selection problem under fuzzy environment based on transportation costs.

by container shipping services in East Asia from major markets and trade routes between 1995-2001; while complemented with information from other sources. These studies do not apply any statistical methods. Another similar research (a survey based on freight forwarders in East Asia) reported efficiency being the most critical factor for port selection, followed by shipping frequency, adequate infrastructure, and location (Tongzon, 2009).

Table 2. Factors Influencing Port Choice

	Location[1]	**Infrastructure[2]**	**Operation[3]**	**Connectivity[4]**	**Costs[5]**	**Safety & Security**	**Other[6]**
Slack (1985)	x	x	x			x	
Jansson & Shneers (1987)	x		x				
James & Gail (1988)			x	x			
Thomson (1998)		x	x	x	x		
Sternberg (2000)	x	x	x				x
Ernst (2001)		x	x	x			
Brooks (2000)	x		x				
Song & Yeo (2004)	x	x	x				
Chang, Lee, & Jose (2008)	x						
Wiegmans et al. (2008)			x	x	x		
Yeo, Roe, & Dinwoodie (2008)			x	x	x		x
Tongzon (2009)	x	x	x		x		x
Chou (2010)		x	x		x		
Veldman, Garcia-Alonso, & Vallejo-Pinto (2011)			x		x		
Yuen, Zhang, & Cheung (2012)	x		x		x		x
Sayareh & Alizmini (2014)		x	x		x	x	
Rezaei et al. (2019)					x		
Ding et al. (2019)		x	x		x		x
Fahim et al. (2021)			x		x	x	
Dong & Franklin (2021)					x		

It will be interesting to mention that port selection literature has historically employed many methodologies. Some of these methods have been discussed in this section, mainly from MCDMs. Some other studies that used MCDM are Jafri (2013), Gi-Tae, Adolf, Paul, & Zaili (2014) Yang & Chen (2016), and Ding et al. (2019). Some other methodologies like game theory (Zan 1999 and Anderson et al., 2008), factor analysis (Chang, Lee, & Jose, 2008), discrete choice models (Tiwari, Itoh, & Doi 2003 and Nir, Lin, & Liang 2003), survey-based analysis (Slack, 1985) are also used. While using MCDM-based AHP, game theory, factor analysis, discrete choice models, or survey-based methods has advantages and disadvantages, no universal method may be applied in every context. However, using a superior methodological approach (e.g., the use of TOPSIS instead of AHP) contributes to the scholarly work with an improved method usage for port choice decisions. Also, except for AHP, all other stated methods require extensive data and cannot manage qualitative responses. Similarly, as stated earlier, AHP also limits linear scale usage and ranking reversal issues.

There are several gaps in the existing literature on port selection choice. Firstly, most of the current studies mentioned in Table 2 investigated the port selection between already established ports (e.g., (Slack, 1985) and (Wiegmans et al., 2008)). Additionally, choice decision analysis is based on either a survey from shippers or freight forwarders (Slack, 1985) or comparing existing ports' attractiveness (e.g., (Ding, Kuo, Shyu, & Chou, 2019) by using MCDM techniques (AHP and DEMTAL) for port

1. Distance, accessibility, proximity of port.
2. Port size, number of berths, sailings, port equipment, continuous investment, facilities at port.
3. Time, flexible process, quality of customs handling, related business, working hours, congestions, degree of integration, labours.
4. Link to major consumer markets, frequency, inter-modal links, shuttle-service/ sea-feeder.
5. Port charges, inland fright rates, loading/unloading rates.
6. Knowledge of market of marine container operators, custom and government regulations, hinterland conditions.

attractiveness in Thailand). However, hardly a study exists that discusses the port choice between two ports that are yet to be operational and of equally strategic and trade importance for the region in general and the landlocked countries in particular. Secondly, literature on port selection for landlocked countries is non-existent. Thirdly, safety and security factors in port selection have been of little concern, especially for the ports located in developed countries. Still, in recent times - and also for the ports located in the South Asian / Middle-East region - the situation on the ground has become competitive and relatively hostile. These regions include developing countries that are facing several conflicts.[1] Therefore, consideration of safety and security becomes essential; however, available literature on the usage of safety and security in port selection is limited. Finally, the general survey-based studies (or using basic tools of MCDM such as AHP) are appropriate for drawing general conclusions that may be valid only in very restrictive circumstances.

This study fills most of the above-identified literature gaps. The study contributes to the existing literature on port choice by considering the attractiveness of two developing but strategically important ports while also considering safety & security factors and employing MCDM-based TOPSIS technique (Technique for Order Preference by Similarity to Ideal Solution).

4. Research Methodology and its Application

4.1 Decision-Making with TOPSIS

This study aims to obtain the optimum alternative with the highest satisfaction for all the relevant attributes. The outcome will be the most suitable seaport for trade with Central Asia, Afghanistan, and China (as an alternative route). Thus, we convert this situation into an MCDM Problem in which we have a choice to make among the two competing ports and several attributes (quantitative and qualitative). We are employing the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) technique for decision-making. The reasons for employing TOPSIS are as follows: First, it is a superior decision-making technique compared to the AHP technique of MCDM that is frequently used in literature. Secondly, TOPSIS is rarely used in port selection decisions; thus, the application of TOPSIS in our work brings methodological novelty. Thirdly, the TOPSIS method is simple to apply and does have the flexibility for adjustment for considering an unlimited number of alternatives and criteria in the Decision-Making Process and is better for Quantitative Data. However, TOPSIS has a rank reversal problem (unlike Fuzzy TOPSIS). Still, in this study, the chances are minimal because we have only two alternatives without having any probability of adding another.

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) solves MCDM problems by evaluating each alternative against each criterion. It brings the best alternative closest to the *Positive Ideal Solution* (PIS) and farthest from the *Negative Ideal Solution* (NIS). PIS has the best attribute value (maximum benefit attributes and minimum cost attributes), while NIS has the worst attribute value (minimum benefit attributes and maximum cost attributes).

TOPSIS assumes that we have *m* alternatives and *n* attributes, and we have the score of each choice concerning each criterion. Let x_{ij} score of option *i* concerning criterion *j*; then we have a matrix X = $(x_{ij})_{m\times n}$ matrix. Furthermore, let *J* be the set of benefit attributes or criteria (more is better) and *J'* be the set of negative attributes or criteria (less is better). The TOPSIS technique comprises of following steps:

Step 1: Construct a normalized decision matrix.

This step transforms various attribute dimensions into non-dimensional attributes, allowing comparisons across criteria.

Normalize scores are given as follows:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} X_{ij}^{2}}} \; For\ i = 1,\ldots,m;\ j = 1,\ldots,n \tag{1}$$

1. For instance, Pakistan has been hardly hit by militancy since 2007. Similarly, Iran has a long history of conflict with USA, Saudi Arabia and Israel.

Step 2: Construct the weighted normalized decision matrix.
Assume we have a set of weights for each criterion w_j $For\ j = 1, \dots, n$. Multiply each column of the normalized decision matrix by its associated weight.

An element of the new matrix is:

$$v_{ij} = w_j r_{ij} \quad For\ i = 1, \dots, m;\ j = 1, \dots, n \tag{2}$$

Step 3: Determine the Positive Ideal Solution (PIS) and Negative Ideal Solution (NIS) for the Problem.

Positive Ideal Solution:

$A^* = \{v_1^*, \dots, v_n^*\}$, Where

$v^* = \{\ \max(v_{ij})\ if\ \ j\ \varepsilon J\ ;\ \min(v_{ij})\ if\ \ j\ \varepsilon J'\ \}$

Negative Ideal Solution: $A' = \{v_1', \dots, v_n'\}$, Where

$v' = \{\ \min(v_{ij})\ if\ \ j\ \varepsilon J\ ;\ \max(v_{ij})\ if\ \ j\ \varepsilon J'\ \}$

Step 4: Calculate the separation measures for each alternative.
It is the relative distance of each alternative from the Positive Ideal Solution and Negative Ideal Solution. The separation from the positive ideal alternative is:

$$S_i^* = \sqrt{\sum_{j=1}^{n} \left(v_j^* - v_{ij}\right)^2} \quad For\ i = 1, \dots, m \tag{3}$$

Similarly, the separation from the negative ideal alternative is:

$$S_i' = \sqrt{\sum_{j=1}^{n} \left(v_j' - v_{ij}\right)^2} \quad For\ i = 1, \dots, m \tag{4}$$

Step 5: Calculate the relative closeness to the ideal solution C_i^*
v

$$C_i^* = \frac{S_i^*}{S_i^* + S_i'} \quad 0 < C_i^* < 1, i = 1, \dots, m \tag{5}$$

Select the option with C_i^* Closest to 1.

Step 6: *Rank the alternatives in preference order*.
In this step, the decision-maker selects the highest-ranked alternatives

4.2 Data collection

Data collection involves several steps. We need to identify various criteria to compare the two ports, Gwadar and Chabahar. The scholarly literature does provide a long list of criteria used in multiple studies in different contexts with different methodologies for other locations and port users. Accordingly, we developed a list of 33 criteria from the existing literature that can be most effectively used in port selection decisions in this study. Some novelty in selection criteria includes using *safety and security*, *political factors*, and *foreign policies* (Pakistan, Iran, China, Afghanistan, and the Central Asian states). Given the strategic locations of both ports, companies' and countries' choices for a particular port may be strongly influenced by international politics and a long list of other factors. On the other hand, we are restricted from incorporating some beneficial elements (such as the volume of exports/imports) because these ports are still not operational.

Several factors out of the total 33 selected factors were of less use, given that our subject ports are still not operational. Therefore, we reduced our list of factors to 18, categorized into quantitative and qualitative criteria. These 18 factors are given in Table 3.

To apply MCDM criteria, we need information about these factors and weights assignment for each criterion. We obtained this information through two major sources. First, we obtained secondary data about both ports, concerned government websites, and other publicly available sources. This data is given in Table 4.

Secondly, weight assignment to criteria is a prerequisite for the application of TOPSIS. It was a challenging task because these ports were not operational yet. However, we used a literature survey and published peer-reviewed articles for weight assignments of the selected factors. The following subsection discusses the weight assignment process in detail.

Table 3. Factors influencing port choices

Quantitative Criterion	**Qualitative Criterion**
Maximum ship capacity	Government Foreign Policies & International politics
Cargo terminals	Inter-modal link (rail and highways)
Storage yard	Security and Safety
Number of berths	Industries
Approach channel	Location (International Route)
Navigational channel	Location (National Route)
Airport	National Politics
Economic zone	-
Government investment policies	-
Oil terminal	-

4.3 Weight assignment rationale and procedure

In application of MCDM-based TOPSIS requires weight assignments for all criteria. In general, such weight assignment is performed through field surveys. However, in the current case, we were interested in knowing port attractiveness from a different "country's perspective" rather than shippers or port administrations. Furthermore, these two ports are still not operational, so getting more accurate information from any possible field survey becomes more challenging and costly. Therefore instead of using a pure field survey, we used existing literature to overcome this problem and weights assignments for different factors where data were unavailable from the respective port or government publically shared information. We used published peer-reviewed papers mainly based on surveys conducted by experts and top officials in the shipping companies, thus a valuable source of reliable data that we could not collect otherwise. The remaining section describes how weights were assigned to every criterion used in this study.

A weight of 1 to 2 ratio was assigned to *Port Safety* to Infrastructure, "1 to 1" ratio for *Government Investment Policies to Depth of Berth*, "1 to 1" for *Number of Berths*, "1 to 9" for *Hinterland Economy to Depth of Berth*, and "1 to 8" for *Size* and *efficiency of container yard to Depth of Berth* (Chou 2010). Furthermore, locating an international route (obtained from relevant literature) is the most critical factor for seaports.

The development of Gwadar and Chabahar seaports is no exception due to their strategic locations (close to international oil transportation routes covering over two-thirds of oil trade) and easily accessible to Central Asian countries, Afghanistan (another landlocked country), and China (an alternative and shortest link for the Middle East). Therefore, the location attribute was assigned a weight of 10, which is the maximum. Similarly, government investment policy in port development is equally important. A port with lesser or no government investment (in the form of interlinkages with the hinterland and the absence of infrastructure) will not be effective. Therefore, it is rational also to assign a maximum weight of 10 to the location of the national route.[1]

The government's foreign policies and international politics are also important factors that may strongly influence port choices for landlocked regional countries. A port country with a good representation in the international community (that depends on government foreign policy and also on international politics) with more industries and an investment-friendly environment, then such port country may be more attractive to landlocked countries. At the same time, more operational industries in ports mean more trade and increased investment leads to better infrastructure. In this study, the ports of Pakistan (Gwadar) and

1. Location International Route was assigned equal value for Gwadar and Chabahar because both ports lie only about a 100 km from each other at a prime location.

Iran (Chabahar) are compared. The Central Asian States, Afghanistan, and China will be influenced by their relationship with the port country (in the current case, Pakistan and Iran, respectively).

The *foreign policy* factor was assigned the attribute weight of *9*. Pakistan seems to have an advantage here due to the CPEC agreement with China. In contrast, Iran is looking for the same benefits while taking India on board, thus making the higher attribute weight justified (GoP, 2016).

Inter-modal links of the port via railways and highways of the country are another critical attribute determining port competitiveness. It ensures the timely transshipment of goods from the port to the respective destinations. In the case of Gwadar, a highway and rail link to the port is being established from Gwadar to China and Afghanistan; and the economic zones will be developed on this road as part of inter-modal links. It will ensure an ideal situation for the trade transshipment for a country choosing a port. Based on these reasons, a weight of “8” is assigned to inter-modal linkages.

We also assigned a “7” weight to the *Location of the National Route* because the port location is affected by the locations of industrial zones and economic areas at the national level. Easy accessibility of seaports from industrial areas ensures low-cost delivery of industrial products to the ports and thus encourages trade. It is beneficial, primarily if the Economic Zone is situated close to the port. It causes efficient transshipment. This factor becomes more important to be considered; because both seaports (Gwadar and Chabahar) are being developed in the most overlooked provinces of their respective countries.

Security and safety are essential factors that have strong relevance to both ports. Security and safety were compared for both countries (Pakistan and Iran) from their respective safety ranks on the global safety index considering (SI, 2017).[1] Based on the importance of the safety index, we assigned attribute weights as “7,” which is somehow on the higher side. Still, we believe that the owners of the goods want their property to be transported safely to its destination, and it is equally important that the shippers and their staff are safe at the respective port. If a country has an unstable political or security situation (e.g., unrest in some parts of Balochistan province, Pakistan), the shipper prefers a relatively safer port.

Industries at the port locality can be another critical element of choice among the two competing ports. For instance, if there is an oil refinery at a port locality, the central Asian state may find such a port more attractive, as they can send the raw petroleum products directly from exploration sites to the port. After processing at the refinery, they can instantly transport oil to the desired location compared to inter-country movement from the exploration site to the refinery and then from the refinery to the ports. It will save the transportation cost and time for the trading country. The industries in a port country and nearby the port may strongly influence the trade via seaport in that particular country. We assigned industry weights as “6” based on industrial sector share in countries' GDP.

We have already observed from the literature that port infrastructure is an essential attribute in port selection. It consists of the facilities provided for the load and discharge of ships, such as many cranes, terminals, tugboats, and measurement instruments. Also, having standard and emergency services are used to judge overall port conditions. Such facilities should be provided at their best at any port. Good infrastructure results in efficient transshipment, so ships don’t have to wait long for loading and discharge. Therefore, we assigned port infrastructure a relatively higher weight (i.e., “7”).

The governments are not well established in developing countries due to weak institutional structures. The weak institutions increase the importance of national politics for all sorts of activities, including trade and commerce. Pakistan and Iran are big countries with strong ethnic and religiously motivated parties and politics that influence country policies to a greater extent. Especially in Pakistan, such events are every day in which religious parties come out on the street and bring everything to a standstill, e.g., business, social and educational activities in the country.[2] Given that the respective governments have strongly supported the development of both ports, irrespective of party affiliations and politics, such elements' role has been minimal, but it cannot be ignored entirely. We use the democracy Index and the ranking of both countries as a basis and accordingly assign a medium attribute weightage of 5 to the *National Politics*.[3] This information is given in Table 5.

1. Pakistan and Iran are ranked as 149th and 140th safest countries in a list of 159 countries of the world.
2. A recent such example is over 20 days’ blockage (during November-December 2020) of the Capital city by some 2000 to 5000 supporters demanding the removal of a Federal Minister from the cabinet.
3. In democratic regime index of EIU, Pakistan is placed in hybrid regime whereas Iran is placed in authoritative regime (EIU, 2016).

In this unipolar world, where economic power gradually shifts from the West to the East, the government's foreign policies and international politics become more important. Pakistan, having stable relations (on average) with the USA since 1947, is gradually shifting to be closer to China and Russia. Similarly, under economic sanctions for decades, Iran slowly got a concession from the United Nations; simultaneously, the country is building a regional alliance with India (arch-rival of Pakistan). As a war-hit region for generations, Afghanistan has kept changing sides to its economic and political needs. All this makes foreign policies - devised by the Pakistani and Iran governments - and international politics essential factors to be considered before attracting trade towards the seaports from the target customer countries.

Table 4. Criteria for Port Selection

	Gwadar	Chabahar
Quantitative criterion[1]		
Maximum Ship capacity	200,000 DWT	100,000 DWT
Cargo Terminals	100,000 DWT	100,000 DWT
Storage Yard	76,947 m^2	51,700 m^2
No. of Berths	13	12
Approach Channel	14.5 m	16 m
Navigational Channel	5 Km	2.7 Km
Airport	Within city	40 km from the city
Economic Zone	2,292 hectares	3,562 hectares
Government investment policies	1.02 Billion USD	565 Million USD
Oil terminal	2*200,000 DWT	1*80,000 DWT
Qualitative Criterion		
Government Foreign Policies and International politics	Expansion of regional trade between India, Iran, and Afghanistan	Expansion of trade with China by providing the shortest land routes from western China to the Arabian Sea through the port
Inter-modal link (rail and highway)	Plans to build the road and railway networks by 2018	The intermodal link of Gwadar can handle up to 5 percent of China's cargo
Security and Safety	Safety rank of 34.8 (SI, 2017)	Safety rank of 26.3 (SI, 2017)
Industries	40 percent of GDP by industries	21 percent of GDP from industries
Location International Route	Makran coast next to the Gulf of Oman	Arabian sea
Location National Route	Province of Sistani and Baluchistan	Province of Baluchistan
National Politics	Democracy index of 145 out of 167 and Global peace ranking of 126((EIU, 2016), (IEP, 2017))	Democracy index of 111 out of 167 and Global peace ranking of 152 ((EIU, 2016), (IEP, 2017))

Table 5. Decision Matrix

Criterion	Gwadar	Chabahar	Average[2]	Attribute Weights[3]
Maximum ship capacity	7	5	8.60	6
Cargo Terminals	6	6	8.49	5
Storage Yard and Facilities	7	5	8.60	6
Oil Terminals	8	4	8.94	5
No. of Berths	6	6	8.49	7
Approach Channel	5	6	7.81	6
Navigational Channel	5	3	5.83	4
Airport	7	7	9.90	6
Economic Zone	7	8	10.63	7
Port Infrastructure	6	6	8.49	7
Government investment policies	9	7	11.40	10
Government Foreign Policies & International politics	6	5	7.81	9
Inter-modal link (rail and highway)	7	5	8.60	8
Security and Safety	4	6	7.21	7
Industries	5	7	8.60	6
Location International Route	8	8	11.31	10
Location National Route	6	5	7.81	7
National Politics	4	7	8.06	5

1. Data on Gwadar port was obtained from (http://www.gwadarport.gov.pk/) and data on *Chabahar* port was obtained from Chabahar Port Development Authority (2017)
2. Averages are calculated by first taking sum of the squaring corresponding criterion values for both ports, and then taking its square root.
3. These values are assigned based on literature review as described in detail in Section 4.3.

5. Findings and Discussion

We constructed a TOPSIS model to study the behavior of shipping choices between Chabahar and Gwadar for Afghanistan, the Central Asian States, and China. As mentioned above, attribute weights of both quantitative and qualitative factors were assigned according to the existing literature review and based on the choice of ports. Since the ports are in two different countries, some qualitative factors with a global impact were given more weight than others. E.g., international politics, location, international route, security and safety, and government foreign policies were weighted more than other factors.

In the application of TOPSIS, the Decision Matrix was complete and normalized as per Equation (1). Thus we converted various attribute dimensions to non-dimensional attributes. Next, we constructed the Weighted Decision matrix by multiplying the Decision Matrix with the Attribute Weights. Afterwards, we created *Positive* and *Negative* Ideal Solutions, respectively, and found the relative distance from positive ideal alternatives (Si^*); and relative distance from negative ideal alternatives (Si'). Then we calculated the relative closeness to the Ideal Solution (Ci^*), and we ranked the alternatives.

Table 6 summarizes the results from TOPSIS. It is evident that the alternative with the highest value of Ci*, between 0 and 1, is considered the Ideal Alternative (IA). According to Table 6, the Alternative Gwadar is closer to PIS and farther from the NIS than the Alternative Chabahar. So, Gwadar Port is the better choice. However, the comparable values of relative closeness to the Ideal solution show that these two ports will be closely competitive even though Gwadar port seems the most suitable choice based on currently available information.

6. Discussion

The results obtained indicate an advantageous situation for Gwadar port. The first notable result is that Gwadar is clearly in an advantage position, yet the difference is not *very* big. It implies that Chabahar port authorities can still work on several factors to catch up. Gwadar has some visible advantages, such as being a deep seaport accommodating big ships, with added additional capacity at the port. There is nothing that Chabahar Seaport can do about it. However, few other things can be done equally by both countries (and port authorities) that include but are not limited to infrastructure development at the ports; industrial development near the ports; intermodal connectivity of the ports through railways; highways networks with the rest of the respective countries; and neighboring landlocked countries—further, improving own law and order situation, especially, in the ports regions, which will be helpful, not only for attracting trade to the respective ports but also for the safety, security, and well-being of the general public in both countries.

Gwadar port is also advantageous due to the ongoing establishment of economic zones and industrial development at the port location as part of CPEC. In CPEC, both China and Pakistan are jointly spending over US$50 billion in upcoming years for Pakistan's infrastructure: with a particular focus on Gwadar Port and its linkages with China and the rest of Pakistan's transportation networks. Iran may benefit from CPEC, too, if it work on its foreign policy and join the CPEC to become a partner rather than a rival. However given that Iran has a strong inclination towards India and Afghanistan, the possibility of joining CPEC is likely to be low; this issue is now becoming more political and less of an economic nature. We still believe that the collaboration of these three countries can be helpful for these countries in particular and the overall region in general.

Table 6. *Ci** Relative Closeness to the Ideal Solution

	Gwadar	Chabahar
Si^*	3.19	4.409283
Si'	4.409283	3.193823
$Si' + Si^*$	7.60	7.603106
Ci^*	0.579932	0.420068

Pakistan already has an excellent relationship with China at a country level, and recent development via CPEC is an added advantage. Pakistan needs to improve ties with Afghanistan and the Central Asian countries to attract them to use Gwadar port for trade. Incentives such as lowering transit charges, facilitation at borders, and concession in taxes for investment in industrial zones of the seaport can highly encourage the Central Asian States to focus on Gwadar. Concomitantly, Iran can follow suit, too, bearing in mind the added advantage to its economy and the region. However, Iran may face the potential risk of breaking down its nuclear deal with the United Nations globally, resulting in economic sanctions. Such sanctions, as a result, may serve as a blow to the Chabahar port trading, thus ignoring all other factors. On the other hand, Pakistan does not have issues in the foreseeable future. But, Pakistan’s relationship with India may influence the dynamics significantly on the ground, given that both India and Pakistan often get engaged in blame games and proxy wars over the international border control lines. Pakistan links its unrest in the Baluchistan province to Indian-sponsored terrorism to sabotage the CPEC gains. Sporadic terrorist activities, as a result, may not only make it complicated for Pakistan to ensure the safety and security on and around the seaport but also leverage the Chabahar port over Gwadar for trade and investment opportunities in the future.

7. Conclusion

This research study is an addition to the existing literature on seaport selection. The study employed TOPSIS of MCDM tools to model selection choices between Gwadar and Chabahar ports. The study's novelty is the usage of TOPSIS: consideration of two ports that are yet to be operationalized. Furthermore, the study considered safety, security, and international & national politics; these factors were ignored mainly from earlier studies. This study established that Gwadar is the most suitable option for central Asian countries, Afghanistan and China, compared to Chabahar. However, the study found that Chabahar lacks the advantages offered by Gwadar; It is suggested that with specific corrective measures in place, Iran can make Chabahar equally attractive. For instance, Iran can join hands with Pakistan and China to link its port with Gawadar and partner in this development. If all the regional countries start working for the common cause of economic prosperity of the region, it will be a win-win situation for all.

In summary, Gwadar and Chabahar are a welcome move in the region, although the development of both ports is being viewed as two competing seaports with politically motivated strategic objectives. Both ports, however, use the same slogans of ‘regional trade uplifting and poverty alleviation to attract the marginally under-developed landlocked countries of the region for trade and investment. The development of both ports is being supported (financially and politically) by two big economic giants, i.e., China and India; both governments have competing and conflicting objectives in the region, which makes it a complicated business for Pakistan, Iran, and beneficiary countries. CPEC and the port of Chabahar development is a fantastic opportunity for the economic prosperity of this region. Given that all the involved countries use it for the economic prosperity of their masses rather than being a tool to get strategic or military superiority over one another, both projects can transform the socio-economic status of the masses of this region.

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