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An AHP-SWOT Analysis of Gwadar Port's Strategic Growth Potential Under the BRI and CPEC Frameworks



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Abstract: *Gwadar Port, a key node of the China–Pakistan Economic Corridor and the Belt and Road Initiative, plays a critical role in regional economic cooperation and the global logistics network. This study develops an evaluation system with 16 indicators based on the SWOT framework, analyzing the port's development environment across four dimensions: strengths, weaknesses, opportunities, and threats. The Analytic Hierarchy Process (AHP) is applied to determine indicator weights, with all consistency ratios ($CR < 0.10$) confirming result reliability. The entropy method is also used for comparison to improve objectivity and robustness.*

Results show that Gwadar Port's development environment is dominated by weaknesses and threats, with combined weights of 0.3716 and 0.3715, respectively, far exceeding strengths (0.1630) and opportunities (0.0942). The top constraints are security risks in Balochistan (0.1905), regional geopolitical tensions (0.1856), and port competition pressure (0.1071). SWOT coordinate analysis ($X = -0.2086$, $Y = -0.2773$) places the port in the WT strategic zone.

Accordingly, the study proposes a multi-layered strategy centered on WT defensive measures, supported by WO and ST strategies, with SO strategies as long-term goals. These findings provide practical guidance for Gwadar Port's stable development and offer strategic insights for other Belt and Road ports.

Keywords: Gwadar Port; CPEC; SWOT-AHP analysis; China–Pakistan relations; Strategic infrastructure; Geopolitics; Port development; Institutional reform; Stakeholder perceptions; BRI

1. Introduction – Strategic Vision of BRI, CPEC, and the Role of Gwadar Port

Amid deepening economic globalization and expanding regional cooperation, infrastructure connectivity, international logistics networks, and cross-regional economic integration have become key drivers of global development. The Belt and Road Initiative (BRI) has created a new platform for cooperation in trade, investment, energy, transportation, and cultural

exchange, while offering significant opportunities for the development of regional hub ports. As a flagship project of the BRI, the China–Pakistan Economic Corridor (CPEC) reflects the strategic partnership between China and Pakistan and serves as a critical node in regional connectivity.

Gwadar Port, a core component of CPEC and a strategic gateway to the Indian Ocean, is vital to Pakistan's economic growth and regional

development, as well as to China's western opening-up and energy security. Its development involves not only port infrastructure but also complex factors such as geopolitics, security, institutional conditions, and regional coordination. Therefore, identifying key influencing factors and formulating targeted strategies is essential.

This study examines Gwadar Port within the BRI and CPEC context, applying SWOT analysis, the Analytic Hierarchy Process (AHP), and the entropy method to systematically evaluate its strengths, weaknesses, opportunities, and threats. By integrating qualitative and quantitative approaches, the research enhances analytical rigor and provides practical guidance for Gwadar Port's sustainable development and China-Pakistan economic cooperation.

Although extensive research has been conducted on the Belt and Road Initiative (BRI), little attention has been given to applying a structured SWOT analysis to evaluate Gwadar Port's strategic role within the China-Pakistan Economic Corridor (CPEC). To fill this gap, this study addresses two key research questions.

1. How can Gwadar Port take advantage of both external and internal potential within the framework of the BRI-CPEC?
2. Which strategy avenues successfully lessen the serious external risks and internal shortcomings of Gwadar Port?

The responses to these queries will shed light on the current difficulties in CPEC, the significance of Gwadar Port in transshipment

and regional trade, and the port's transition from an almost abandoned state to a deep-sea port. This study advances our understanding of how significant international initiatives impact regional development by highlighting the challenges of coordinating national strategic aims with local socioeconomic demands.

1.1 China's Development Strategy and the Belt and Road Initiative (BRI)

China's development strategy focuses on economic modernization, regional integration, and global market expansion as key pillars of its long-term national vision. In recent decades, China has actively pursued policies aimed at enhancing industrial upgrading, improving infrastructure connectivity, and strengthening its position in the global economic system. The Belt and Road Initiative (BRI), launched in 2013, is central to this vision, promoting connectivity across Asia, Europe, and Africa through large-scale investments in trade, energy, transportation, and infrastructure development. The initiative emphasizes policy coordination, trade facilitation, financial integration, and people-to-people exchanges among participating countries. Organized around six major economic corridors, the BRI has significantly expanded China's trade network and economic influence, with a substantial share of its international trade increasingly linked to partner countries. As a comprehensive and long-term strategy, the BRI not only supports China's domestic economic transformation but also contributes to regional development and global economic cooperation.

1.2 The Strategic Importance of the China-Pakistan Economic Corridor (CPEC)

CPEC is a flagship corridor of the BRI, representing one of the most advanced and strategically significant components of the initiative. It links China and Pakistan through an integrated network of land and maritime routes, facilitating trade, investment, and economic collaboration between the two countries. The corridor primarily focuses on infrastructure development, energy projects, and industrial expansion, connecting Kashgar in China's Xinjiang region to Gwadar Port in Pakistan's Balochistan province. By improving transportation networks, enhancing logistics efficiency, and addressing Pakistan's long-standing energy shortages, CPEC plays a crucial role in promoting regional integration and economic stability. It also strengthens bilateral cooperation between China and Pakistan, deepening their strategic partnership. Furthermore, CPEC provides China with a shorter, more efficient, and secure trade route to the Indian Ocean, significantly reducing its dependence on the Strait of Malacca. This not only improves trade efficiency but also enhances China's energy security and geopolitical positioning in the region.

1.3 Gwadar Port: The Gateway to Regional Connectivity and Economic Transformation

Gwadar Port is a core component of CPEC and a strategically important deep-sea port located on the Arabian Sea. Its unique geographical position near key international shipping routes

enables efficient access to major markets in the Middle East, Africa, and Europe, thereby enhancing regional and global trade connectivity. The port also plays a vital role in improving China's energy transportation security by providing an alternative route for oil and gas imports. Developed with significant Chinese investment and technical support, Gwadar Port has been equipped with modern infrastructure, including logistics corridors, free trade zones, and planned industrial parks. These developments aim to transform Gwadar into a major regional trade and logistics hub. Beyond its physical infrastructure, Gwadar holds substantial potential for driving economic growth, attracting foreign investment, and creating employment opportunities in the surrounding region. Moreover, it contributes to broader regional integration and plays an increasingly important role in shaping the geopolitical and economic landscape of South Asia.

Figure 1 illustrates the planned and existing infrastructure under CPEC, including energy installations, highways, pipelines, and fiber-optic routes across multiple provinces. Gwadar's role at the junction of these routes underscores its critical geopolitical and economic significance as the southern anchor of CPEC, connecting inland Pakistan and western China with global maritime trade.

Figure 1 Map of CPEC Transport and Energy Infrastructure in Pakistan

Source: <https://multimedia.scmp.com/news/china/article/One-Belt-One-Road/pakistan.html>



1.4 Literature Review

Existing literature highlights the strategic importance of the China–Pakistan Economic Corridor (CPEC) and Gwadar Port in promoting regional connectivity, infrastructure development, and economic growth (Abid, 2015; Khan, 2024). Studies show that CPEC strengthens China–Pakistan cooperation and improves trade efficiency, while also facing challenges such as security risks, governance issues, and geopolitical tensions (Durrani, 2020; Hassan, 2024).

Research on Gwadar Port emphasizes its geostrategic and geoeconomic value as a key logistics hub and energy corridor (Anwar, 2025; Rahman, 2024). However, scholars also identify constraints including security concerns, local socio-economic impacts, and institutional inefficiencies (Ali, 2023; Khan, 2024).

Methodologically, SWOT analysis is widely applied to evaluate internal and external factors (Teoli, 2019), while the Analytic Hierarchy Process (AHP) improves decision-

making by assigning weights (Saaty, 2008). The entropy method further enhances objectivity by reducing subjective bias in evaluation (Shannon, 1948; Yi Yun, 2006).

Overall, although existing studies provide valuable insights, they often rely on single or loosely integrated methods and lack systematic quantitative analysis, particularly for Gwadar Port. This gap supports the need for a combined SWOT–AHP–entropy framework for more comprehensive and reliable evaluation.

1.5 Research Gap

Although the infrastructural, security, and economic aspects of Gwadar Port have been extensively studied, few studies have adopted a comprehensive approach to evaluating stakeholder views, particularly by combining qualitative policy analysis with structured questionnaire methodologies. Most recent studies lack integration and instead concentrate on either macro-level strategy or micro-level social repercussions. Furthermore, most of the current research still uses data from before 2022. To create contextual development strategies, this study combines field-level data (from 150 surveys with 114 valid responses) with SWOT analysis, thereby bridging the empirical and methodological gap.

1.6 Research Methodology

1.6.1 Research Design

This study adopts a mixed-methods approach to evaluate Gwadar Port's strategic development under CPEC. It integrates SWOT analysis, the Analytic Hierarchy

Process (AHP), and the entropy method, supported by stakeholder survey data. While AHP provides subjective weighting based on expert judgment, the entropy method introduces objective weighting based on data variability, improving overall analytical rigor and reliability.

1.6.2 Data Collection

A structured questionnaire was distributed to stakeholders, including government officials, port authorities, business representatives, and logistics operators. A total of 114 valid responses were collected. The survey included pairwise comparisons (for AHP) and Likert-scale ratings, which also support entropy-based calculations by reflecting data dispersion.

1.6.3 SWOT-AHP Analytical Framework

The study identifies 16 key factors across four SWOT dimensions. AHP is used to construct a hierarchical model, perform pairwise comparisons, and calculate weights with consistency testing ($CR < 0.10$). The entropy method is then applied to objectively determine indicator weights based on variation in survey data. By combining AHP (subjective) and entropy (objective) weights, the framework enhances accuracy and reduces bias in evaluating strategic priorities.

1.6.4 Data Analysis

AHP is used to rank SWOT factors through eigenvector calculations, while entropy weights are computed to validate and adjust these rankings. Descriptive statistics from Likert-scale data are used to support both methods. The integrated results guide the

prioritization of SO, ST, WO, and WT strategies, ensuring consistency between subjective judgments and objective data patterns.

1.6.5 Validity and Limitations

Validity is enhanced through triangulation of AHP, entropy results, and survey data. The entropy method reduces subjectivity, while AHP ensures structured decision-making. However, limitations include sample size and potential bias in stakeholder responses. Despite this, the combined methodology provides a robust and reliable framework for strategic analysis.

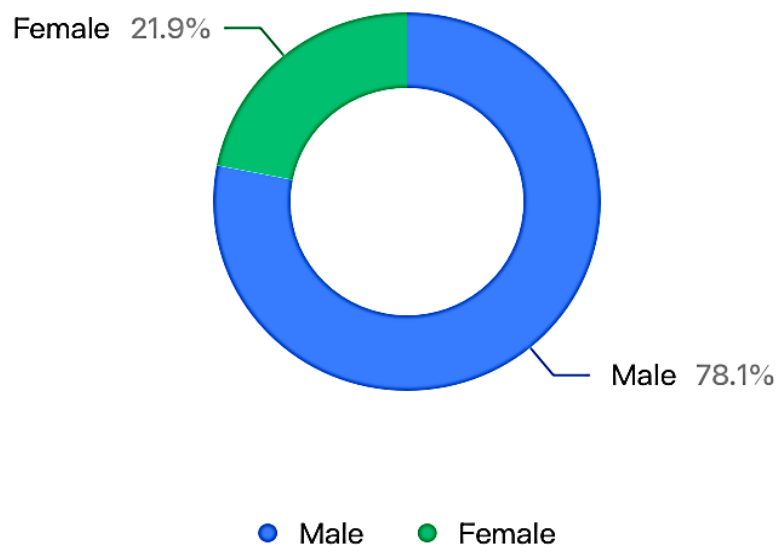
2. SWOT Analysis of Gwadar Port

The Port Competitiveness Model, the Resource-Based View (RBV), and Institutional Theory are the three theoretical stances that this study uses to define the strategic assessment of Gwadar Port. According to RBV, the port's advantageous position along vital international sea lanes and its natural deepwater harbor status are essential strategic advantages that support its

long-term competitiveness. By emphasizing elements like infrastructure quality, connectivity, and service efficiency—essential strengths and weaknesses determined by stakeholder responses—the Port Competitiveness Model adds even more support to the analysis. Meanwhile, Institutional Theory provides insight into governance-related challenges, particularly bureaucratic inefficiencies and regulatory delays, which emerge as prominent internal weaknesses affecting the port's operational effectiveness. These frameworks collectively help interpret the empirical findings from the SWOT survey and offer a structured understanding of Gwadar Port's strategic positioning under the China-Pakistan Economic Corridor (CPEC).

The questionnaire's demographic analysis showed that, in line with the gender distribution of those involved in or knowledgeable about Gwadar Port development, men made up most respondents (78.1%), with women making up 21.9%

Figure 2 Gender Distribution of Survey Respondents (n = 114)



2.1 Internal Strengths of Gwadar Port

Under the frameworks of the China–Pakistan Economic Corridor (CPEC) and the Belt and Road Initiative (BRI), Gwadar Port possesses several key internal strengths that enhance its strategic and economic value.

2.1.1 Strategic Geographic Location (S1)

Gwadar Port is in southwestern Balochistan near the Strait of Hormuz, making it a key hub connecting South Asia, Central Asia, and the Middle East. Its proximity to major shipping routes provides cost and transit advantages for global trade and energy transport. It also serves as a gateway linking China’s Xinjiang region to international markets. This unique location enhances its geopolitical importance and strengthens its role in regional connectivity and energy security.

2.1.2 Deep Natural Harbor (S2)

The port has a natural depth of approximately 18 meters, enabling it to accommodate large

vessels without extensive dredging. This reduces operational costs and enhances its competitiveness compared to other regional ports.

2.1.3 China-Pakistan Governmental Support (S3)

Strong bilateral cooperation between China and Pakistan ensures sustained investment, policy alignment, and political commitment. This support enhances infrastructure development and increases investor confidence in Gwadar’s long-term potential.

2.1.4 Integration with CPEC Infrastructure (S4)

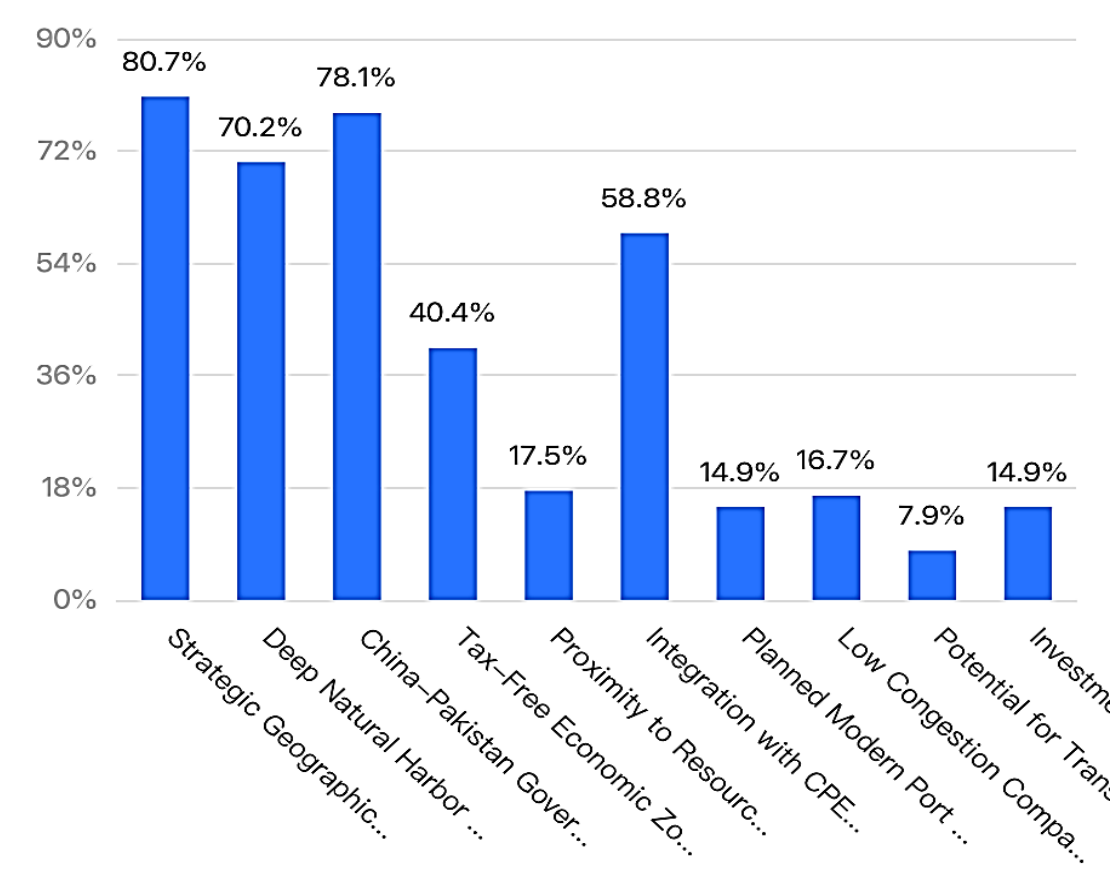
Gwadar is closely linked to CPEC infrastructure, including roads, railways, and energy corridors connecting Pakistan to China’s Xinjiang region. This integration improves logistics efficiency and strengthens its role in regional trade networks.

According to the questionnaire survey

results, the overall recognition of the internal advantages of Gwadar Port is relatively high, but there are some differences in its internal structure. Among them, its strategic geographical location (80.7%) and the support of the Chinese and Pakistani

governments (78.1%) are the most core advantages, followed by its natural deep-water port conditions (70.2%), while its integration into the China-Pakistan Economic Corridor infrastructure system (58.8%) is relatively weak.

Figure 3 Perceived Internal Strengths of Gwadar Port



2.2 Internal Weaknesses of Gwadar Port

Notwithstanding these advantages, Gwadar Port has several internal weaknesses that could prevent it from reaching its maximum operational capability.

2.2.1 Underdeveloped Local Infrastructure (W1)

Despite the port's development, the operational efficiency of the surrounding

area is limited by a lack of adequate roadways, utilities, and urban services. Gwadar's logistics assistance and cargo processing are further hampered by the lack of industrial zones and storage facilities. (Ali & Rizwan, 2024)

2.2.2 Shortage of Skilled Local Workforce (W2)

There is a lack of qualified labor required to

run contemporary port infrastructure since the local population has limited access to technical education and training. This dependence on outside human resources hinders the development of local capability and raises operating costs.[Hussain SS 2024]

2.2.3 Security Concerns in Balochistan (W3)

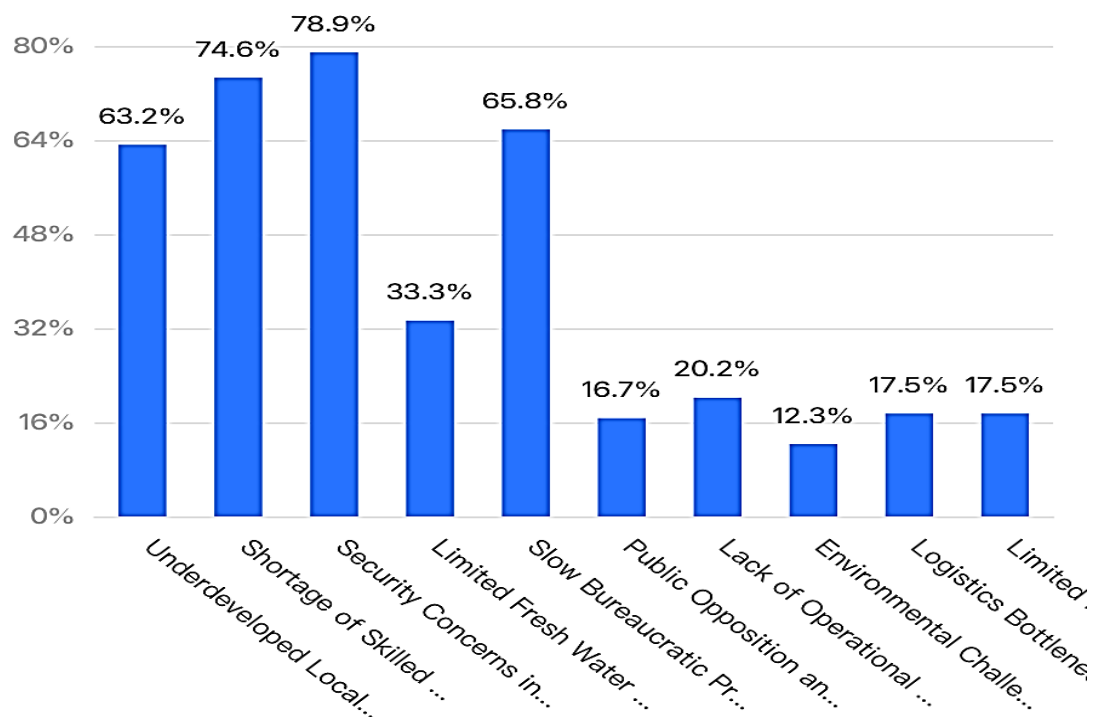
Insurgent actions by organizations like the Balochistan Liberation Army (BLA) are one of the ongoing security issues facing the Balochistan province. Investors are concerned because these attacks have specifically targeted Chinese employees and infrastructure projects. The volatility makes it more difficult for Gwadar Port to run smoothly, discourages foreign investment, and raises operational risks.[Jaleel 2017]

2.2.4 Slow Bureaucratic Procedures (W4)

Red tape, ineffective interagency cooperation, and onerous administrative procedures impede effective decision-making and project execution. Delays in licensing and customs clearance deter private investment and lower the port's competitiveness internationally.

The survey results show that the overall internal disadvantages of Gwadar Port are relatively strong and show a clear concentration trend. Among them, the security risk of Balochistan Province (78.9%) is the most prominent constraint, followed by the shortage of local skilled labor (74.6%), while inefficient bureaucratic procedures (65.8%) and lagging infrastructure (63.2%) also constitute important obstaclest.

Figure 4 Perceived Internal Weaknesses of Gwadar Port



2.3 External Opportunities of Gwadar Port

Opportunities for growth and strategic influence are presented by Gwadar Port's unique position to capitalize on several regional and international developments.

2.3.1 Integration into China's Belt and Road Initiative (O1)

Gwadar benefits from international attention, investment, and infrastructural integration as a BRI flagship project. It acts as a southern entry point for commerce with China, opening up global markets and fostering regional economic collaboration.[Wikipedia 2025]

2.3.2 Regional Connectivity with Central Asia and the Middle East (O2)

Gwadar provides western China and landlocked Central Asian nations with a direct sea outlet. Gwadar may become a hub for trade connecting South Asia and the larger Eurasian region because of this potential linkage.

2.3.3 Emerging Maritime Trade Corridors

(O3)

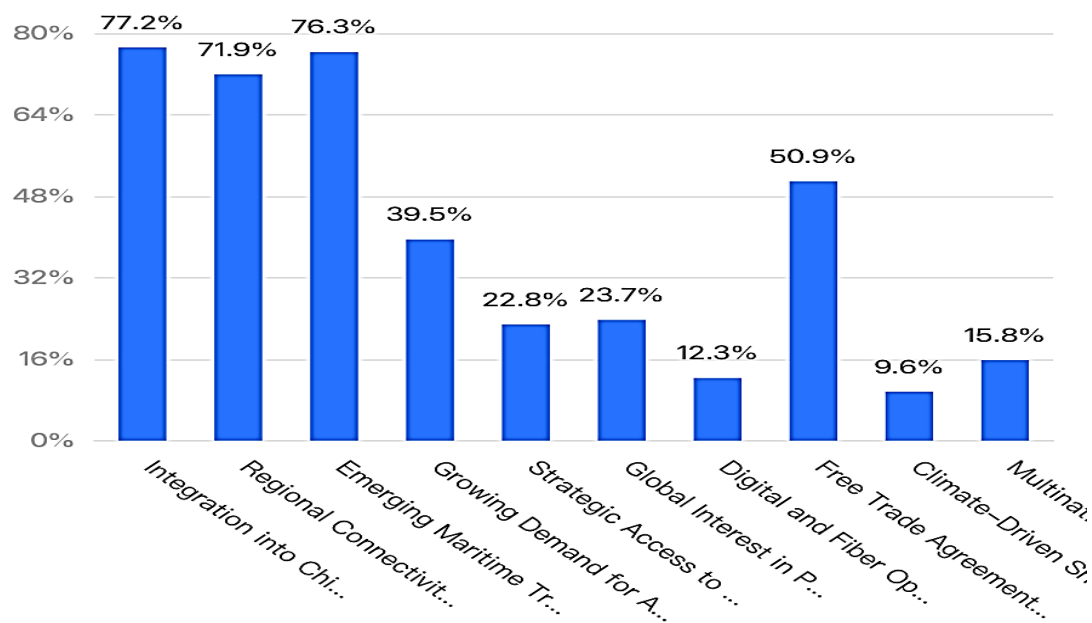
Gwadar can establish itself as a different transshipment and logistics hub thanks to new maritime routes and changing global trade dynamics. The strategic importance of Gwadar can be enhanced by heightened interest in Indo-Pacific trade.

2.3.4 Free Trade Agreements with Partner Nations (O4)

Businesses are encouraged to operate through Gwadar by Pakistan's free trade agreements with nations like China and ASEAN members. By lowering tariffs and fostering trade, these agreements may boost port activity.

Survey data shows that Gwadar Port's external opportunities are generally at a medium-to-high level. Among them, the integration of the Belt and Road Initiative (77.2%) and the emerging maritime trade corridor (76.3%) have the greatest development potential, followed by regional connectivity (71.9%), while free trade agreements (50.9%) are relatively weak

Figure 5 Perceived External Opportunities of Gwadar Port



2.4 External Threats to Gwadar Port

External factors present several strategic risks that could jeopardize the port's course for growth.

2.4.1 Geopolitical Tensions in the Region (T1)

The operations of Gwadar may be unstable and uncertain due to ongoing disputes, especially those between China, India, and other regional countries. Trade routes and investor interest may be disrupted by political resistance and possible blockades.

2.4.2 Competition from Established Ports (T2)

Well-known regional ports, including Karachi Port, Chabahar in Iran, and Jebel Ali in Dubai, are fierce rivals of Gwadar. Market penetration is challenging because these rivals already possess an established clientele, well-developed infrastructure, and effective logistics. [Gul 2020]

2.4.3 Debt Sustainability and Economic Risk in Pakistan (T3)

Concerns over Pakistan's debt sustainability are raised by the country's heavy reliance on foreign loans for port development. Fiscal restraints, currency devaluation, and economic volatility may impact long-term investor operations and economic trust.

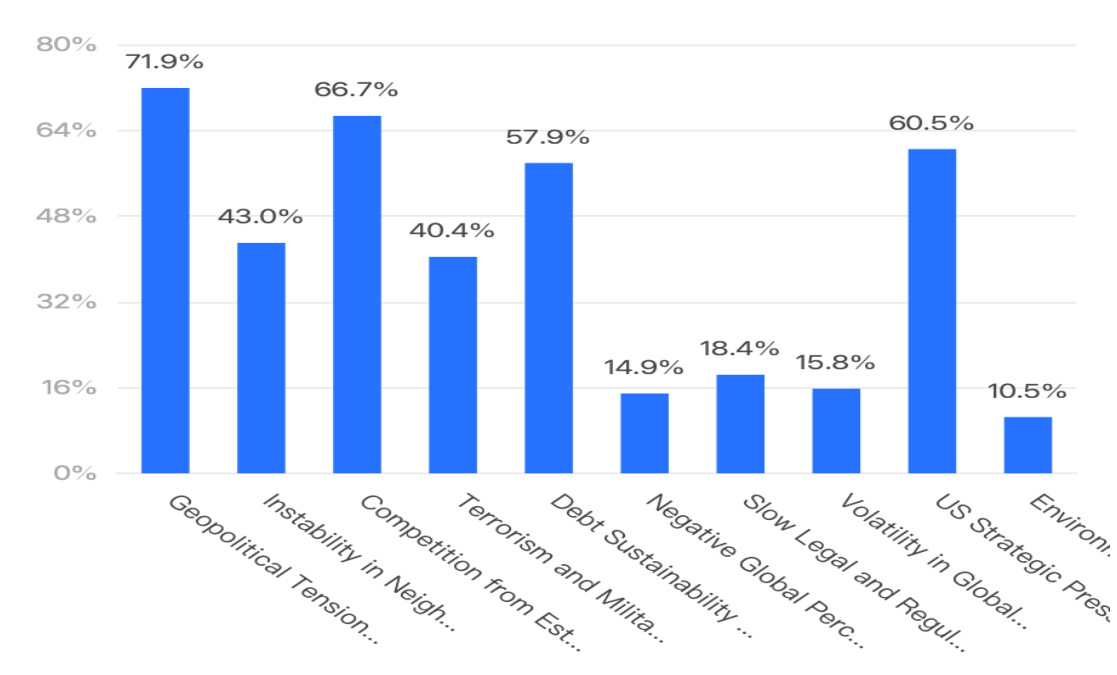
2.4.4 US Strategic Pressure on China-Pakistan Cooperation (T4)

China's Belt and Road initiative frequently clashes with US geopolitical goals. Projects like Gwadar may be indirectly impacted by trade and technology limitations, diplomatic pressure, or sanctions, which would limit their operational independence and global integration.

From an external perspective, Gwadar Port faces significant risks and pressures. Among these, geopolitical tensions (71.9%) are the most significant threat, followed by competition from established ports (66.7%),

strategic pressure from the United States (60.5%), and debt risks (57.9%).

Figure 6 Perceived External Threats of Gwadar Port



3. SWOT-AHP analysis of Gwadar Port

3.1 Methods and Procedures

The SWOT framework, developed by Heinz Weihrich in the 1980s, evaluates internal strengths and weaknesses alongside external opportunities and threats to support strategic decision-making. The Analytic Hierarchy Process (AHP), proposed by T. L. Saaty in the 1970s, decomposes complex problems into hierarchical structures and assigns weights through pairwise comparisons. To further enhance objectivity, the entropy method is introduced as a data-driven approach that determines indicator weights based on variability, reducing subjective bias. The integration of SWOT, AHP, and the entropy method enables a comprehensive combination of qualitative and quantitative analysis, improving the accuracy and reliability of factor prioritization.

The research process includes four steps: first, SWOT analysis identifies key factors influencing Gwadar Port’s development; second, a hierarchical evaluation model is constructed; third, AHP is applied to perform pairwise comparisons, calculate weights, and conduct consistency tests; and finally, the entropy method is used to validate and adjust the weighting results. The combined outcomes are then analyzed to determine strategic positioning and support the formulation of appropriate development strategies.

3.2 SWOT-AHP Analysis

3.2.1 Design of the Hierarchical Evaluation Model

Based on SWOT analysis, a three-level hierarchical evaluation model is constructed to assess Gwadar Port’s development. The goal layer is to determine the optimal

strategic development path. The criterion layer consists of four dimensions: strengths (S), weaknesses (W), opportunities (O), and threats (T). The indicator layer includes 16 specific factors, such as strategic location, deep-water harbor, government support, infrastructure integration, security risks, labor shortages, geopolitical tensions, and port competition.

Table 1 Hierarchical Evaluation Model for Gwadar Port Development

Development Strategy of Gwadar Port	Strengths (S)	Strategic Geographic Location (S1)
		Deep Natural Harbor (S2)
		China-Pakistan Governmental Support (S3)
		Integration with CPEC Infrastructure (S4)
	Weaknesses (W)	Underdeveloped Local Infrastructure (W1)
		Shortage of Skilled Local Workforce (W2)
		Security Concerns in Balochistan (W3)
		Slow Bureaucratic Procedures (W4)
	Opportunities (O)	Integration into China’s Belt and Road Initiative (BRI) (O1)
		Regional Connectivity with Central Asia and the Middle East (O2)
		Emerging Maritime Trade Corridors (O3)
		Free Trade Agreements with Partner Nations (O4)
	Threats (T)	Geopolitical Tensions in the Region (T1)
		Competition from Established Ports (T2)
		Debt Sustainability and Economic Risk in Pakistan (T3)
		US Strategic Pressure on China-Pakistan Cooperation (T4)

Using the AHP framework, pairwise comparison matrices are developed for each layer based on expert judgment. The Saaty 1–9 scale is applied to measure the relative importance of factors, where values range from equal importance (1) to extreme importance (9), with intermediate values (2, 4, 6, 8) and reciprocal relationships ensuring consistency.

Table 2 1–9 Level Standard Judgment Matrix

1	Equally important
3	Slightly more important
5	Moderately more important
7	Very important
9	Extremely important
2,4,6,8	Intermediate values)
Reciprocal	If the importance of element i compared to element j is a_{ij} , then the importance of element j compared to element i is: $a_{ji}=1/a_{ij}$

Table 3 Criterion Layer Matrix (S, W, O, T)

$$\begin{pmatrix} 1 & 1/3 & 3 & 1/3 \\ 3 & 1 & 3 & 1 \\ 1/3 & 1/3 & 1 & 1/3 \\ 3 & 1 & 3 & 1 \end{pmatrix}$$

Table 4 Strengths (S) Matrix

(Factors: S₁ = Strategic Geographic Location; S₂ = Deep Natural Harbor; S₃ = Governmental Support; S₄ = CPEC Integration)

$$A_S = \begin{pmatrix} 1 & 3 & 1 & 5 \\ 1/3 & 1 & 1/3 & 3 \\ 1 & 3 & 1 & 5 \\ 1/5 & 1/3 & 1/5 & 1 \end{pmatrix}$$

Table 5 Weaknesses (W) Matrix

(Factors: W₁ = Underdeveloped Infrastructure; W₂ = Skilled Workforce Shortage; W₃ = Security Concerns; W₄ = Slow Bureaucracy)

$$A_W = \begin{pmatrix} 1 & 1/3 & 1/5 & 1/3 \\ 3 & 1 & 1/3 & 3 \\ 5 & 3 & 1 & 3 \\ 3 & 1/3 & 1/3 & 1 \end{pmatrix}$$

Table 6 Opportunities (O) Matrix

(Factors: O₁ = BRI Integration; O₂ = Regional Connectivity; O₃ = Maritime Corridors; O₄ = Free Trade Agreements)

$$A_O = \begin{pmatrix} 1 & 1 & 1 & 5 \\ 1 & 1 & 1/3 & 3 \\ 1 & 3 & 1 & 5 \\ 1/5 & 1/3 & 1/5 & 1 \end{pmatrix}$$

Table 7 Threats (T) Matrix

(Factors: T₁ = Geopolitical Tensions; T₂ = Port Competition; T₃ = Debt Risks; T₄ = US Pressure)

$$A_T = \begin{pmatrix} 1 & 3 & 5 & 3 \\ 1/3 & 1 & 5 & 3 \\ 1/5 & 1/5 & 1 & 1/3 \\ 1/3 & 1/3 & 3 & 1 \end{pmatrix}$$

3.3 Consistency Test and Weight Calculation

According to the AHP analysis approach, each judgment matrix is subjected to hierarchical analysis, and hierarchical ranking analysis is used to determine the weights of each model level.

The geometric mean of each row is calculated as:

$$\bar{w}_i = \left(\prod_{j=1}^n a_{ij} \right)^{\frac{1}{n}}, \quad i, j = 1, 2, \dots, n$$

To normalize the weight vector:

$$w_i = \frac{\bar{w}_i}{\sum_{i=1}^n \bar{w}_i}, \quad i = 1, 2, \dots, n$$

The maximum eigenvalue:

$$\lambda_{\max} \approx \frac{1}{n} \sum_{i=1}^n \left(\frac{\sum_{j=1}^n a_{ij} w_j}{w_i} \right)$$

To ensure the reliability of results, consistency verification is applied to each

pairwise comparison matrix.

Consistency Index (CI) is defined as:

$$CI = \frac{\lambda_{\max} - n}{n - 1}$$

Consistency Ratio (CR) is calculated as:

$$CR = \frac{CI}{RI}$$

where RI is the random index that varies with the matrix's size (n). The matrix is deemed to be reasonably consistent if $CR < 0.1$. The matrix needs to be updated if $CR \geq 0.1$. The consistency ratio (CR) for each matrix is less than 0.1 after computation. The results of the analysis can be relied upon after passing the consistency test.

To validate the reliability of the matrices, we calculated priority weights using the geometric mean method and conducted consistency tests. For a matrix of order n:

Table 8 Priority Weights and Consistency Results

level	factor	Weight	$\lambda_{\max}$	CI	CR
Criterion layer	S (Advantages)	0.1630	4.1535	0.0512	0.0569
Criterion layer	W (Disadvantage)	0.3715			
Criterion layer	O (Opportunity)	0.0941			
Criterion layer	T (Threat)	0.3715			
Advantage layer	S1 Strategic Geographical Location	0.3908	4.0438	0.0146	0.0162
Advantage layer	S2 Natural Deep-Water Harbor	0.1509			
Advantage layer	S3 China-Pakistan government support	0.3908			

Advantage layer	S4 CPEC Infrastructure Convergence	0.0676			
Inferior layer	W1 Infrastructure Lagging	0.0764	4.1973	0.0658	0.0731
Inferior layer	W2 Labor Shortage	0.2605			
Inferior layer	W3 Safety Hazards	0.5127			
Inferior layer	W4 Bureaucratic inefficiency	0.1504			
Opportunity layer	O1 Belt and Road Integration	0.3112	4.1140	0.0380	0.0422
Opportunity layer	O2 Regional Interconnectivity	0.2082			
Opportunity layer	O3 Emerging Trade Corridor	0.4097			
Opportunity layer	O4 Free Trade Agreement	0.0709			
Threat layer	T1 Geopolitical tensions	0.4995	4.1973	0.0658	0.0731
Threat layer	T2 Port Competition	0.2884			
Threat layer	T3 Debt Risk	0.0657			
Threat layer	T4 US Strategic Pressure	0.1465			

If (CR) is less than 0.1, the matrix is consistent. This test was passed by every matrix (Table 8), indicating that the weights were valid.

3.4 Entropy Method Calculation and Robustness Test

The Analytic Hierarchy Process (AHP) relies on subjective expert judgment, which may introduce bias due to personal preferences and information asymmetry. To improve reliability, this study incorporates the entropy

method as an objective weighting approach, creating a combined subjective–objective evaluation framework that enhances the scientific rigor of the results.

A total of 114 valid questionnaires were used as the data source. The 16 SWOT indicators were quantified using a binary method,

where significant factors were assigned a value of 1 and others 0, forming a decision matrix. Although the data originates from expert judgment, the entropy method determines weights based on data dispersion, objectively reflecting the importance of each indicator.

Finally, entropy weights are compared with AHP results for cross-validation. This integration reduces bias and strengthens the robustness and credibility of the overall analysis.

Table 9 Comparison of Weight Between the Entropy Method and the AHP

Dimension	Indicator Code	Indicator Name	AHP Global Weights	Entropy weighting
Advantages	S1	Strategic geographical location	0.0637	0.1395
	S2	Natural deep-water harbor conditions	0.0246	0.0578
	S3	The Chinese and Pakistani governments support	0.0637	0.1153
	S4	Integrating into the CPEC infrastructure system	0.0110	0.0107
Disadvantages	W1	Local infrastructure lagging behind	0.0284	0.0243
	W2	Skilled labor shortage	0.0968	0.0871
	W3	Security risks in Balochistan	0.1905	0.1225
	W4	Inefficient bureaucratic administrative procedures	0.0559	0.0350
Chance	O1	Integrating into the Belt and Road Initiative	0.0293	0.1076
	O2	Regional Interconnectivity	0.0196	0.0683
	O3	Emerging Maritime Trade Corridors	0.0386	0.1002
	O4	Free Trade Agreement	0.0067	0.0001
threaten	T1	Regional geopolitical tensions	0.1856	0.0683
	T2	Competition from established ports	0.1071	0.0392
	T3	Debt sustainability and economic risks	0.0244	0.0086
	T4	Strategic pressure exerted by the United States on China-Pakistan cooperation	0.0544	0.0153

3.5 The strategic positioning of Gwadar Port

3.5.1 Strategic Quadrilateral and Centroid Analysis

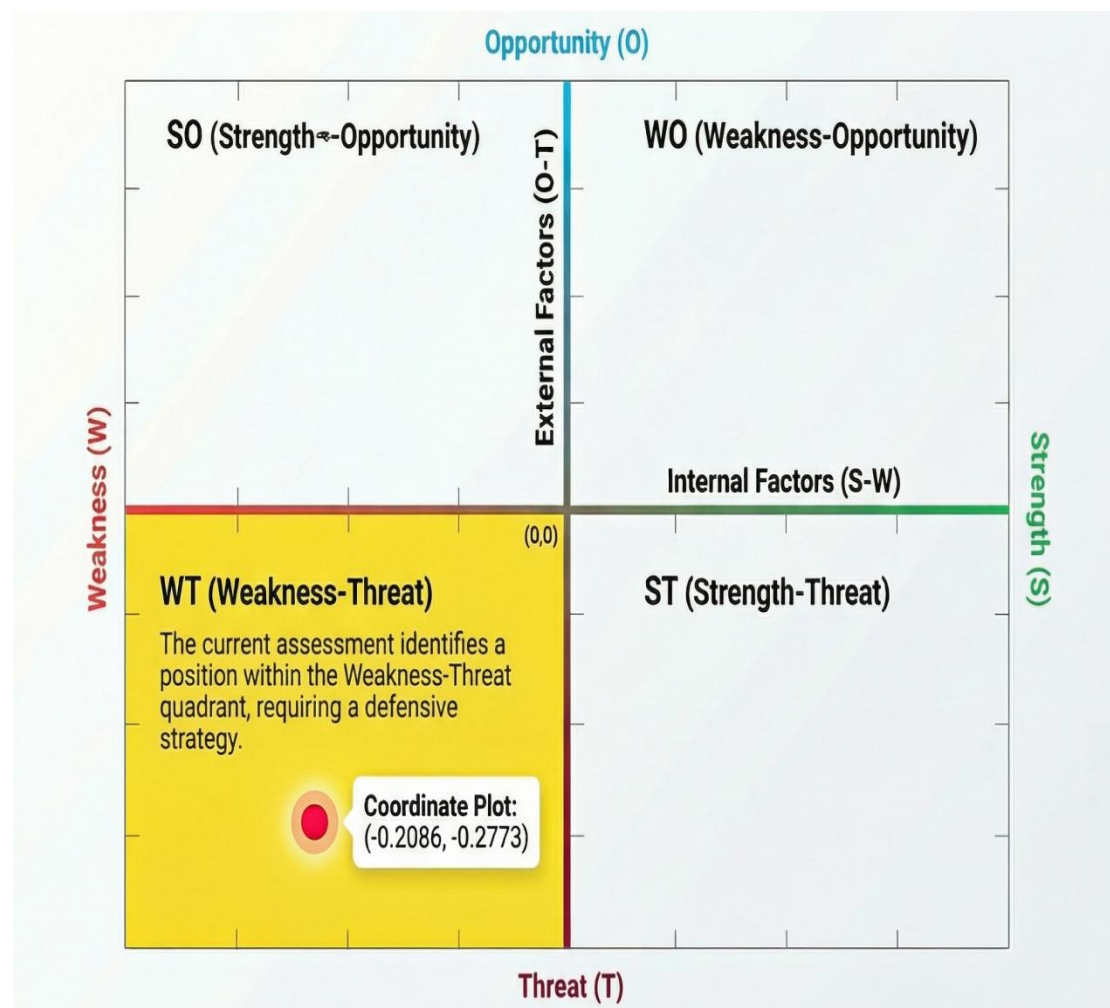
Based on the AHP results, the criterion-level weights are: $S = 0.1630$, $W = 0.3715$, $O = 0.0941$, $T = 0.3715$. The results show that the weight distribution of Gwadar Port among the four factors is significantly uneven. Weaknesses and threats dominate the strategic environment, placing Gwadar Port clearly in the WT quadrant.

Further comparison of internal and external factors reveals:

$$X = S - W = 0.1630 - 0.3715 = -0.2086$$

$$Y = O - T = 0.0941 - 0.3715 = -0.2773$$

Figure 7 SWOT Strategic Quadrilateral Positioning Map



3.5.2 Criterion-Level Priority Order

$$W + T \gg S + O$$

Based on the calculation results of this study, since:

3.5.3 Sub-Indicator Level Rankings

The sub-indicator rankings based on weights

show that, among weaknesses, security risks in Balochistan (W3) are the most critical, followed by skilled labor shortages (W2), bureaucratic inefficiencies (W4), and infrastructure limitations (W1), highlighting security as the primary internal constraint.

For threats, regional geopolitical tensions (T1) remain dominant, followed by port competition (T2), U.S. strategic pressure (T4), and debt risks (T3), indicating that external instability continues to shape development risks.

In terms of strengths, strategic location (S1) and governmental support (S3) are equally significant, while harbor conditions (S2) and

CPEC integration (S4) play supporting roles.

Regarding opportunities, emerging maritime trade corridors (O3) rank highest, followed by BRI integration (O1), regional connectivity (O2), and free trade agreements (O4). Overall, the findings suggest prioritizing security and geopolitical risk mitigation while leveraging geographic advantages and evolving maritime opportunities.

Table 10 Global Weight Ranking of Sub-Indicators

Ranking	Indicator Code	Indicator Name	AHP Global Weights	Entropy weighting
1	W3	Security risks in Balochistan	0.1905	0.1225
2	T1	Regional geopolitical tensions	0.1856	0.0683
3	T2	Competition from established ports	0.1071	0.0392
4	W2	Skilled labor shortage	0.0968	0.0871
5	S1	Strategic geographical location	0.0637	0.1395
6	S3	The Chinese and Pakistani governments support	0.0637	0.1153
7	W4	Inefficient bureaucratic administrative procedures	0.0559	0.0350
8	T4	Strategic pressure exerted by the United States on China-Pakistan cooperation	0.0544	0.0153

9	O3	Emerging Maritime Trade Corridors	0.0386	0.1002
10	O1	Integrating into the Belt and Road Initiative	0.0293	0.1076
11	W1	Local infrastructure lagging behind	0.0284	0.0243
12	S2	Natural deep-water harbor conditions	0.0246	0.0578
13	T3	Debt sustainability and economic risks	0.0244	0.0086
14	O2	Regional Interconnectivity	0.0196	0.0683
15	S4	Integrating into the CPEC infrastructure system	0.0110	0.0107
16	O4	Free Trade Agreement	0.0067	0.0001

The Spearman correlation coefficient between AHP and entropy weights is 0.6156 (61.56%), confirming the robustness of the results.

3.5.4 Global Weight Ranking of Sub-Indicators

According to the updated ranking of AHP global weights for each sub-indicator under the decision objective (see Table 10), W3, T1, T2, and W2 rank as the top four factors and are of critical significance in the overall development of Gwadar Port. Among these, it is essential to prioritize addressing W3 (security risks in Balochistan) and T1 (regional geopolitical tensions), as they represent the most pressing threats to stability and long-term development. At the same time, T2 (competition from established

ports) must be strategically managed to enhance Gwadar's competitiveness, while W2 (skilled labor shortage) should be alleviated to ensure sustainable operational capacity. By focusing on both risk mitigation and capacity building, Gwadar Port can better position itself for stable and competitive growth.

3.6 Construction of the Development Strategy System for Gwadar Port

Based on the results of the SWOT–AHP analysis, a strategic framework for the development of Gwadar Port is constructed by integrating internal factors (strengths and weaknesses) with external conditions (opportunities and threats). Accordingly, four strategic types—WT, WO, ST, and SO—are identified to guide the port's

development under different priority orientations.

Table 11 Strategic Development Paths for Gwadar Port

Strategic Type	Core logic (strengths/weaknesses × opportunities/threats)	Implementation Focus
WT Defensive Strategy (Core)	Mitigating weaknesses and controlling threats (W+T dominant)	Prioritize strengthening the port area's security governance system to alleviate security risks in Balochistan Province; address geopolitical risks and external strategic pressures; improve administrative efficiency and institutional implementation capabilities to reduce operational uncertainty.
WO Adjustment Strategy	Seize opportunities and compensate for weaknesses (O→W)	Leveraging the opportunities presented by the Belt and Road Initiative and regional connectivity, we will improve the infrastructure system; strengthen the training and recruitment of technical personnel; optimize the business environment; and enhance the comprehensive service capabilities of ports.
ST Hedging Strategy	Leveraging strengths and mitigating threats (S→T)	Leveraging its geographical advantages and the support of the Chinese and Pakistani governments, the region will enhance its function as a regional logistics hub; build a differentiated competitive system to counter competition from established ports in the surrounding area; and strengthen policy coordination capabilities to mitigate external shocks.

SO Development Strategy (Long-Term)	Leverage strengths and capitalize on opportunities (S+O)	Promote the coordinated development of ports, industries, and cities; cultivate high-value-added industrial chains; expand international shipping and trade networks; and gradually enhance global competitiveness.
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4. Conclusion

Using an AHP-SWOT framework, this study has methodically examined the strategic elements affecting the construction and long-term development of Gwadar Port, with particular emphasis on aligning its growth trajectory with the broader objectives of the Belt and Road Initiative (BRI) and the China-Pakistan Economic Corridor (CPEC). By systematically calculating and comparing the relative importance of key strengths, weaknesses, opportunities, and threats, the analysis provides a structured and data-driven foundation for prioritizing strategic actions. This integrated approach not only enhances analytical rigor but also facilitates a clearer understanding of how internal and external factors interact to shape Gwadar Port's development prospects within a complex regional and global context.

According to the findings, Gwadar Port is uniquely positioned to capitalize on emerging opportunities such as deeper BRI integration and enhanced regional connectivity with Central Asia, the Middle East, and other global markets. Its strategic geographic location near major maritime routes, combined with its deep natural harbor, strong bilateral governmental support, and integration with CPEC infrastructure, provides a significant comparative advantage. However, to fully realize this potential, the port must address persistent structural weaknesses, including bureaucratic inefficiencies, underdeveloped local infrastructure, and a

shortage of skilled labor. At the same time, proactive and forward-looking strategies are required to mitigate external threats such as financial risks, competition from established regional ports, geopolitical instability, and increasing external strategic pressures that may influence long-term sustainability.

A comprehensive strategic roadmap is outlined through the four identified pathways: SO (leveraging strengths to seize opportunities), ST (utilizing strengths to counter threats), WO (employing opportunities to overcome weaknesses), and WT (minimizing weaknesses to avoid threats). Among these, WO-oriented strategies are given particular priority, as they directly target critical development bottlenecks. For instance, enhancing infrastructure through international partnerships and streamlining administrative processes via the establishment of a dedicated Special Economic Zone (SEZ) authority can significantly improve operational efficiency. In addition, complementary SO strategies—such as strengthening coordination between BRI and CPEC initiatives—can amplify existing advantages, while ST strategies, including the development of specialized port services, can help differentiate Gwadar in a competitive regional landscape. WT strategies further contribute by focusing on risk reduction, particularly through improved security mechanisms and the diversification of international investment participation.

In conclusion, the sustainable success of Gwadar

Port depends on achieving a careful balance between addressing immediate operational challenges—such as administrative inefficiencies—and pursuing long-term strategic objectives, including enhanced regional connectivity and economic integration. By effectively implementing these strategies, Gwadar Port has the potential to transform its geographic and infrastructural advantages into sustained economic growth. Moreover, it can strengthen its role as a critical node within regional and global trade networks while mitigating competitive and geopolitical risks. Such a transformation would not only benefit Pakistan's economic development but also contribute to broader regional cooperation under the BRI framework.

To ensure Gwadar's long-term viability and inclusive development, future research can build upon this analytical framework by exploring additional dimensions. These may include examining the socioeconomic impacts of port development on local communities, assessing the implications of climate change on port operations and infrastructure resilience, and analyzing the role of digitalization and smart technologies in enhancing logistics efficiency and port management. Such extensions would provide a more holistic understanding of Gwadar's development and contribute to more informed policy-making.

Limitations: This study follows a systematic SWOT–AHP–entropy framework to ensure analytical rigor; however, several limitations remain. The research primarily relies on secondary sources, including literature, publicly available data, and questionnaire-based inputs, due to constraints related to time, funding, and cross-border accessibility. This limits the incorporation of primary data and large-scale field investigations, which may affect the timeliness and depth of insights into Gwadar Port's operational realities, policy implementation processes, and investor behavior. Furthermore, the SWOT–AHP methodology inherently involves a degree of subjectivity, as indicator selection and expert-based judgment matrices depend on researcher interpretation and expert perspectives, which

may introduce potential bias despite consistency checks. The indicator system, while practical and manageable, includes only 16 variables and does not comprehensively capture factors such as environmental sustainability, digital transformation, cultural dynamics, and community participation. Additionally, the study adopts a macro-level analytical perspective and does not sufficiently explore detailed implementation mechanisms or phased development strategies.

Prospects: Future research should address these limitations by strengthening both data collection and methodological approaches. Greater emphasis should be placed on cross-border collaboration and the acquisition of primary data through fieldwork, stakeholder engagement, and longitudinal studies, thereby enabling the development of more robust and dynamic datasets. From a methodological perspective, integrating additional quantitative techniques—such as fuzzy comprehensive evaluation, grey relational analysis, and system dynamics—can enhance analytical objectivity and support multi-scenario simulations. Expanding the research scope is equally important, including comparative analyses within the broader Belt and Road port network and in-depth micro-level case studies at the enterprise and project levels. Furthermore, incorporating environmental, technological, and social dimensions into the analytical framework will significantly improve the comprehensiveness, applicability, and policy relevance of future studies on Gwadar Port's development.

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