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From Port Performance to Regional Impact: A Multi-Level Causal Chain Model for Maritime Silk Road Ports

by

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Abstract

This thesis addresses why many Maritime Silk Road port investments fail to transit into broad regional benefits, despite visible infrastructure upgrades. It posits a persistent transition gap along the path from port capacity improvements to economy-wide outcomes and asks under what conditions the gap closes.

The study proposes a Multi-Level Causal Chain Model (MLCCM) linking Level 1 (port performance), Level 2 (supply chain integration), and Level 3 (regional economic impact), moderated by four Critical Success Factors (CSFs: governance, geopolitics, hinterland, project design). A nested mixed methods comparative design is applied to Piraeus (Greece), Hambantota (Sri Lanka), and Gwadar (Pakistan). Each level is operationalized with comparable indicators and clear judging rules and time windows, and all findings are cross checked with independent sources to strengthen attribution.

Findings show heterogeneous conversion along the chain: Piraeus transits sustained Level 1 gains into Level 2 integration via rail expansion and procedural modernization, with durable Level 3 signals in logistics services and regional value added; Hambantota records rapid Ro-Ro growth and improved access but delivers only partial, sector specific regional effects; Gwadar adds capacity yet exhibits incomplete Level 2 conversion due to corridor delays and border-agency frictions, limiting Level 3 impacts.

The thesis provides a testable framework for diagnosing where port led investments stall, a standard criteria and multi-source checks that standardize inference across cases, and policy conditions, predictable governance procedures, enforceable project design incentives, credible hinterland connectivity, and manageable geopolitical exposure, under which Maritime Silk Road port projects are more likely to yield broad and persistent regional benefits.

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List of Abbreviations

Abbreviation	Full Form
ADB	Asian Development Bank
ASYCUDA	Automated System for Customs Data
CBSL	Central Bank of Sri Lanka
COSCO	China Ocean Shipping Company
CPIC	China–Pakistan International Corridor
CSW	Customs Single Window
CSW-CERTEX	Customs Single Window – Certificate Exchange
DCS	Department of Census and Statistics (Sri Lanka)
DG	Directorate-General
DW	Deutsche Welle
ELSTAT	Hellenic Statistical Authority
ESCAP	Economic and Social Commission for Asia and the Pacific
FT	Financial Times
GVA	Gross Value Added
GDP	Gross Domestic Product
HIP	Hambantota International Port
HIPG	Hambantota International Port Group
ICT	Information and Communications Technology
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
ML-1	Main Line 1 Railway Project (Pakistan)
MOVE	Directorate-General for Mobility and Transport (European Commission)
MSR	Maritime Silk Road
NSW	National Single Window
NUTS	Nomenclature of Territorial Units for Statistics (EU)
OECD	Organization for Economic Co-operation and Development

ORL	Ocean Rail Logistics
PEARL	Piraeus Europe Asia Rail Logistics
PPA	Piraeus Port Authority
Ro-Ro	Roll-on/Roll-off
SCMP	South China Morning Post
SL	Sri Lanka
SLPA	Sri Lanka Ports Authority
SMEDA	Small and Medium Enterprises Development Authority (Pakistan)
TAXUD	Directorate-General for Taxation and Customs Union (European Commission)
TEN	Trans-European Networks
TEU	Twenty-foot Equivalent Unit
UIRR	International Union for Road–Rail Combined Transport
UNCTAD	United Nations Conference on Trade and Development
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
WTO	World Trade Organization

Chapter 1 Introduction

1.1 Research Background

The Belt and Road Initiative (BRI), initiated by Chinese President Xi Jinping, in 2013 has been described by many experts as one of the most magnificent 21st century global development strategies. The initiative is substantial enough with the involvement of more than 150 countries, with the participating countries contributing together to approximately 65% of the world population and 40% of world GDP (Turker, 2023). Total investments are also forecast to be between $1 trillion and $4 trillion (Mallick, 2024; Turker, 2023). The initiative consists of the land-based Silk Road Economic Belt (SREB) and the 21st Century Maritime Silk Road (MSR), with the long term aim of rearranging the world economic order through the establishment of a new era of port, supply chain connectivity. Official rhetoric presents the BRI as a gateway for global cooperation. Regional economic impact and shared prosperity are presented by the BRI as its desired aim. The profound economic impacts of the initiative are highlighted by the remark that, through the first decade of the program 2013-2022, the aggregate value of trade between China and the program participating countries had already reached US$19.1 trillion (Chen et al., 2025).

The MSR is an essential component of the grand design, with special emphasis being given to the development and port supply chain connectivity of the seaports and sea based shipping routes that connect Asia with Africa, Europe, and the rest of the world. The MSR has made several promises to enhance port performance and promote integration with broader supply chains. These promises are coupled with the rationalization of global supply chain integration through enormous port capacity expansion projects. The World Bank also predicts that if the logistics infrastructure of the BRI is realizable in full, 1.1% - 2.2% of the costs of global trade would be reduced. This has given rise to the dramatic increase of Chinese overseas port portfolio, By 2021, Chinese firms had already acquired ownership stakes in 93 ports globally, spanning the Atlantic, Indian, and Pacific Oceans, as well as the Mediterranean Sea (Serafimov, Stets, & Shkolyk, 2021). This growth in port assets is part of a broader trend of engagement. As of early 2022, China had signed BRI cooperation agreements with 149 countries and 32 international organizations (Gao et al., 2025).

Although the ambitious vision has achieved some notable port-level performance improvements, it has also led to widespread debate. The most distinguished example is the Port of Piraeus in Greece, where investment by the Chinese State-Owned Enterprise (SOE) COSCO transformed it into one of the fastest growing container ports in the world, soaring from 93rd to 36th in global traffic rankings in under a decade (Haralambides & Merk, 2020; Calinoff & Gordon, 2020). Piraeus is widely seen as a model case for MSR implementation success in a developed economy context. The exceptional performance trajectory of selected projects has had a measurable impact on major global trade routes, contributing to increased cargo traffic through critical chokepoints like the Suez Canal (Rakha & El-Aasar, 2024).

However, despite celebrated success stories like Piraeus, MSR implementation across developing countries has resulted in highly uneven outcomes, particularly in the ability to transit port upgrades into real supply chain integration and economic benefits. For every success story like Piraeus, numerous projects are affected by significant challenges and controversies. Hambantota Port in Sri Lanka, part of a staggering $12.1 billion Chinese port-led infrastructure investment portfolio in the country (Mallick, 2024), has become a symbol of the debt trap debate (Calinoff & Gordon, 2020) and is reportedly facing severe underutilization (Haralambides & Merk, 2020). Similarly, Gwadar Port in Pakistan, a flagship case of the $82 billion China-Pakistan Economic Corridor (CPEC) (Mallick, 2024), faces persistent challenges related to regional geopolitics and security, with its operational activity remaining failing to deliver intended port–supply chain integration and throughput targets (Haralambides & Merk, 2020). Beyond these high-profile cases, a wider body of research highlights recurring failures in what this study defines as Critical Success Factors (CSFs),a set of contextual variables that determine whether infrastructure investment can lead to broader development outcomes, including weak environmental governance (Turker, 2023), and lack of transparency (Upadhyay, 2023).

This contrast highlights a persistent gap in the ability to convert improved port performance into supply chain integration and, eventually, regional economic impact. The concept of connectivity often fails to lead to real economic benefits. This persistent disconnect is referred to as the “transition gap”, a failure to convert Level 1 (port performance) into Level 2 (supply chain integration), and ultimately Level 3 (regional economic impact). The main challenge of this thesis is to identify the key factors that explain why this gap is bridged in some MSR cases but remains in others.

1.2 Problem Statement

The central research problem of this thesis is the significant and persistent transition gap between the delivery of hardware, such as physical infrastructure investment at ports under MSR port led programs, and the realization of downstream outcomes in developing countries. These outcomes include both supply chain integration and broader regional economic impact. The MSR is based on an idealized sequence in which port infrastructure improves port performance, which then enables supply chain integration and ultimately supports economic development (Haralambides & Merk, 2020). However, empirical evidence shows that this chain often breaks at various stages. The presence of modernized port infrastructure does not automatically lead to logistics integration or measurable economic returns. The transition gap can manifest in different forms across the three levels. In the case of Hambantota, infrastructure has been delivered, but effective supply chain connectivity and demand generation have not followed. Similarly, Gwadar has clear geopolitical relevance, but remains disconnected from logistics networks and has limited influence on the surrounding economy (Calinoff & Gordon, 2020).

These shortcomings are rarely explained by technical limitations alone. They are more often shaped by how projects are selected, financed, and embedded into broader institutional and economic contexts. Existing literature points to several recurring explanations. From a geopolitical standpoint, some port developments are driven primarily by strategic motives, with limited concern for market conditions or trade demand (Mallick, 2024). From a governance perspective, low institutional capacity, limited coordination, and opaque procedures are often cited as key obstacles to effective implementation (Upadhyay, 2023). From an operational standpoint, many ports fail to integrate into broader supply chains due to limited Hinterland Connectivity, disjointed customs procedures, and inadequate logistics coordination (Huang, Loughney, & Wang, 2023). These problems recur across MSR cases and form the basis for this thesis's selection of four Critical Success Factors (CSFs): governance, geopolitics, hinterland conditions, and project-specific characteristics.

While each CSF express certain aspects of outcome variation, none alone can fully account for success or failure. For example, a port might lack strong Hinterland Connectivity but still perform adequately if supported by sound governance and effective Project Design. Conversely, strong physical infrastructure may remain underutilized when geopolitical priorities overshadow commercial viability. These patterns highlight the importance of a structured framework to examine how different factors interact and shape project outcomes. In response, this thesis introduces the Multi-Level Causal Chain Model (MLCCM), which traces outcomes across three stages, port performance, supply chain integration, and regional economic impact, while assessing the influence of the four CSFs at each step. Rather than treating these factors in isolation, the model approaches them as interdependent influences that determine whether MSR port investments contribute to sustained development.

1.3 Research Questions

This study is guided by one central research question and five sub-questions, each targeting a key step or influence in the port - supply chain - economy sequence.

Main Research Question

"How and to what extent do the four Critical Success Factors - geopolitics and strategic alignment, governance and institutional capacity, hinterland conditions, and project design - account for the divergent outcomes of Maritime Silk Road port projects, and under what specific conditions do these projects succeed in generating sustained regional economic benefits?"

Sub-Research Questions

1. How do MSR port investments affect port performance across the three cases, measured by throughput growth, cargo diversification, investment scale and timing, and maritime connectivity
2. To what extent and through which channels does improved port performance transit into supply chain integration, as observed in multimodal reach and service regularity, logistics service availability, and customs/clearance efficiency?
3. Under what timing, persistence, and channel evidence does supply chain integration transit into regional economic impact, and where does the transition stall?
4. How do the four Critical Success Factors - Governance & Institutional Capacity, Hinterland Conditions, Project Design, and Geopolitics & Strategic Alignment - operate as moderating variables at both stages, and what configurations are associated with success or failure in each case?
5. Based on the findings, what strategic policy actions can host governments, port authorities, and concessionaires take to achieve the successful CSF configuration and sustain regional economy outcomes?

This study will adopt a Multi-Level Causal Chain Model (MLCCM), which traces the relationship from port performance to supply chain integration and ultimately to regional economic outcomes. This chain will be analyzed through four types of Critical Success Factors:

governance quality, geopolitical alignment, hinterland and trade connectivity, and project design.

1.4 Research Objectives and Significance

The main objective of this thesis is to explain the divergent outcomes of MSR port projects by developing and testing the MLCCM, a framework that links three core variables (port performance, supply chain integration, regional economic impact) and incorporates four Critical Success Factors (CSFs) as moderating variables.

The significance of this research is multi-dimensional. It offers both practical and strategic insights for different groups involved in or affected by the MSR.

For policymakers in developing countries hosting MSR projects, this study serves as a practical guide. It enables them to evaluate proposed investments with greater scrutiny, secure more balanced and long-term agreements, and introduce complementary domestic measures, such as improving customs procedures or upgrading hinterland infrastructure. These steps can help maximize the developmental benefits of port projects while mitigating common risks like weak institutions, unsustainable debt, and geopolitical pressures (Upadhyay, 2023).

For Chinese stakeholders, including government institutions and state-owned enterprises (SOEs), the research offers critical insights into why some projects have underperformed or attracted international criticism. These findings can inform future Project Design and implementation, encouraging a shift toward more transparent and commercially sound forms of cooperation. In doing so, they may also help respond to concerns around so-called "debt-trap diplomacy" (Calinoff & Gordon, 2020).

For international stakeholders, such as multilateral lenders and donor countries, the findings contribute to more robust risk assessments and better policy coordination. They also offer practical input for shaping alternative global infrastructure agendas, including initiatives like the G7's Build Back Better World (B3W) (Upadhyay, 2023). Uncovering the structural limitations of current MSR practices can guide the creation of financing models that are more transparent, inclusive, and development-focused.

This research addresses an existing gap in the literature by proposing and empirically applying the MLCCM. The model delineates a three-stage outcome pathway, port performance, supply chain integration, and regional economic impact, as introduced in Chapter 2. It also examines how this chain is shaped by four critical success factors: governance, geopolitics, hinterland conditions, and project design. This model represents the core theoretical contribution of the thesis and offers a new lens to understand the critical drivers of MSR port development.

1.5 Scope and Case Selection

This thesis employs a nested, mixed-methods comparative case study design to provide both broad quantitative context and deep qualitative insight. This approach is best suited to answer the why and how questions as the core of the research, allowing for a detailed exploration of the causal mechanisms at play within different contexts.

The scope of the study is defined by several boundaries. Geographically, it focuses on the MSR and its related port projects. Although the Silk Road Economic Belt (SREB) is also part of the BRI, overland corridors are not analyzed in detail. The core focus remains on maritime connectivity and its link to downstream supply chain integration and regional economic impact in developing countries. The Port of Piraeus (Greece) is included as a developed economy benchmark. Thematically, this study centers on the transition gap, the disconnection between port infrastructure investment and economic development outcomes, as shaped by Critical Success Factors (CSFs) such as governance, geopolitics, and operational conditions. While security and geopolitical motives are acknowledged where relevant, this thesis does not provide a full scale military analysis of the MSR.

To apply this framework, the study uses purposive case selection. Based on prior research, three MSR port projects are chosen for in depth analysis. These ports represent different performance outcomes and challenges, making them well suited to address the research questions. Chapter 3 will provide a detailed methodological justification for this selection.

Piraeus Port (Greece) is selected as a benchmark case of success. Since Chinese SOE COSCO took over operations, the port rose from 93rd to 36th in global traffic rankings within a decade (Haralambides & Merk, 2020), and it now serves as a key European trade gateway (Wang, 2020). It is widely viewed as a model of cooperation, showing what the MSR can achieve under favorable institutional conditions. However, its context within an EU member state limits direct comparison with developing country settings.

Gwadar Port (Pakistan) is chosen as a case representing significant geopolitical and security challenges. As the flagship project of the massive China-Pakistan Economic Corridor (CPEC), its development is driven by the strategic imperative to provide China an alternative route to the Indian Ocean, thereby helping to resolve the Malacca Dilemma (Calinoff & Gordon, 2020). Despite its immense strategic value, its commercial activity remains far below capacity (Haralambides & Merk, 2020). The phenomenon presents a paradox of strategic utility, yet concomitantly exhibits a commercial underperformance.

Hambantota Port (Sri Lanka) illustrates debt related risks and weak economic linkages. The port is frequently cited in debates around debt trap diplomacy due to Sri Lanka's 99-year lease to a Chinese SOE after struggling with debt repayments (Calinoff & Gordon, 2020). Despite major investment, the port remains commercially underutilized (Haralambides & Merk, 2020), revealing a failure to stimulate local supply chain integration or economic development.

These three cases will be systematically compared using the MLCCM introduced in Chapter 2. This framework is further operationalized in Chapter 3. Their divergent results will be analyzed in Chapters 4 and 5 to isolate which Critical Success Factors (CSFs) most strongly influence success or failure.

1.6 Thesis Outline

This thesis is organized into six chapters, each building step by step toward answering the core research questions.

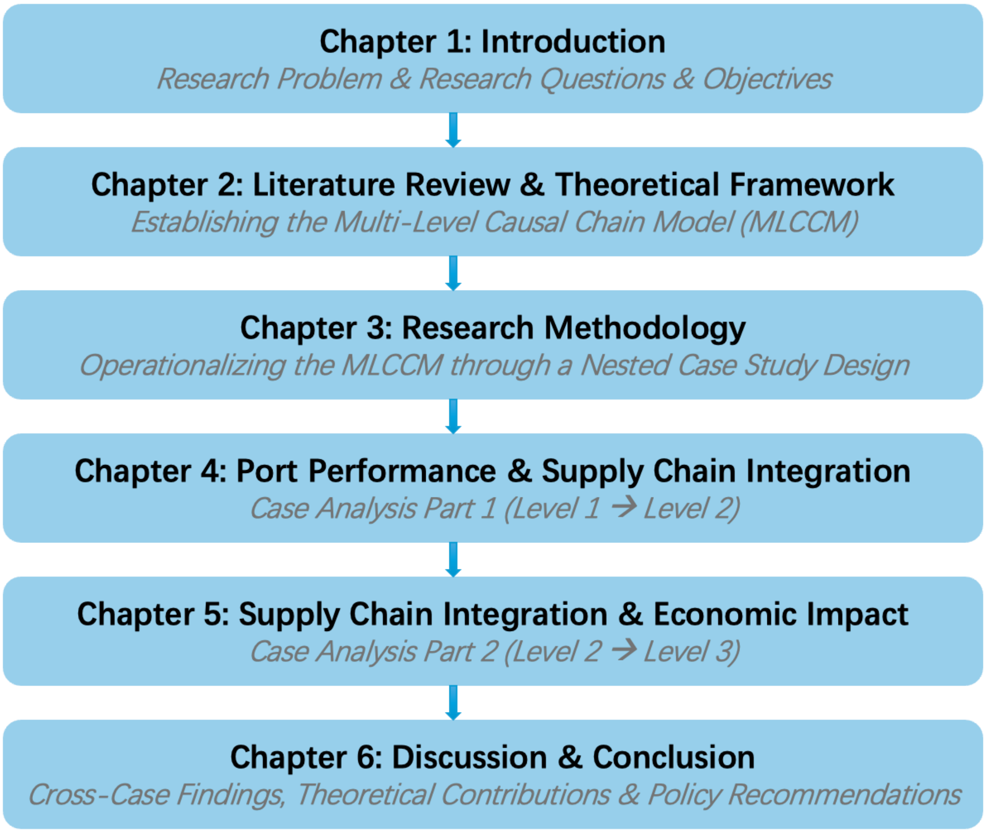

Figure 1 The Overall Structure of the Thesis

Chapter 1 introduces the research topic and defines the central issue of the transition gap between infrastructure investment and regional outcomes. It also outlines the research questions, objectives, and significance of the study.

Chapter 2 critically reviews existing literature on the BRI, with a focus on MSR related governance, geopolitics, and sustainability debates. It then introduces the central theoretical framework of this thesis: the MLCCM, which links port performance, supply chain integration, and regional economic impact, as moderated by key Critical Success Factors (CSFs).

Chapter 3 presents the research methodology, justifying the use of a nested mixed methods comparative case study approach. It outlines the specific data collection and analysis techniques, including the use of triangulation to enhance validity through the combination of qualitative and quantitative sources. The chapter also explains the rationale for selecting Piraeus, Gwadar, and Hambantota as the three focal cases for in depth analysis.

The empirical analysis is presented across two chapters, reflecting a two layer analytical approach.

Chapter 4 delivers the first layer of empirical analysis, addressing Sub Questions 1 and 2. It compares how MSR investments have influenced port performance across the three cases and evaluates how far these improvements transit into supply chain integration, introducing the moderating role of the CSFs in the L1→L2 transition.

Chapter 5 addresses Sub-Questions 3 and 4. It examines the L2→L3 step, regional economic impact, and analyzes how CSFs shape outcomes. The chapter mirrors the structure of Chapter 4 (indicators → channels → transition tests → CSF interpretation → conclusion).

Chapter 6 synthesizes the findings to answer the Main Research Question. It presents a refined CSF model for MSR port success, discusses theoretical and methodological contributions, and responding to Sub-Question 5, offers policy recommendations for host governments, Chinese stakeholders, and international partners, followed by limitations and avenues for future research.

Chapter 2: Literature Review & Theoretical Framework

This chapter critically examines the existing literature to establish the theoretical foundation of the study. It first introduces the strategic and economic rationale underlying the Belt and Road Initiative (BRI), followed by a discussion of the conceptual framework linking port performance, supply chain integration, and regional economic outcomes. This sequence represents the intended progression from port infrastructure development to wider economic benefits. The chapter then turns to examine common contextual barriers that disrupt this pathway, integrating perspectives from various academic fields to explain why many projects fall short of expectations. These discussions lay the groundwork for the MLCCM, which provides the analytical foundation for the subsequent empirical analysis.

2.1 The BRI's Strategic and Economic Logic

2.1.1 Grand Vision and Official Narrative

Initiated in 2013, China's Belt and Road Initiative (BRI) has been presented as a wide ranging plan to enhance cross border connectivity and economic ties across Asia, Africa, and Europe (Haralambides & Merk, 2020). According to official narratives, the initiative is grounded in the principles of "extensive consultation, joint construction, and shared benefits," with goals spanning infrastructure, trade, and financial systems (Gao et al., 2025).

This thesis concentrates on the maritime strand of the BRI, known as the 21st Century Maritime Silk Road (MSR). The MSR links China's seaboard to key port developments in Southeast Asia, South Asia, Africa, and Europe. These ports are intended to serve not only as nodes in global shipping networks but also as platforms for deeper regional integration and engines of local economic growth (Rakha & El-Aasar, 2024).

Figure 2 outlines the global infrastructure network of the BRI. It illustrates the six overland corridors of the Silk Road Economic Belt (SREB) alongside the maritime trade routes of the MSR.

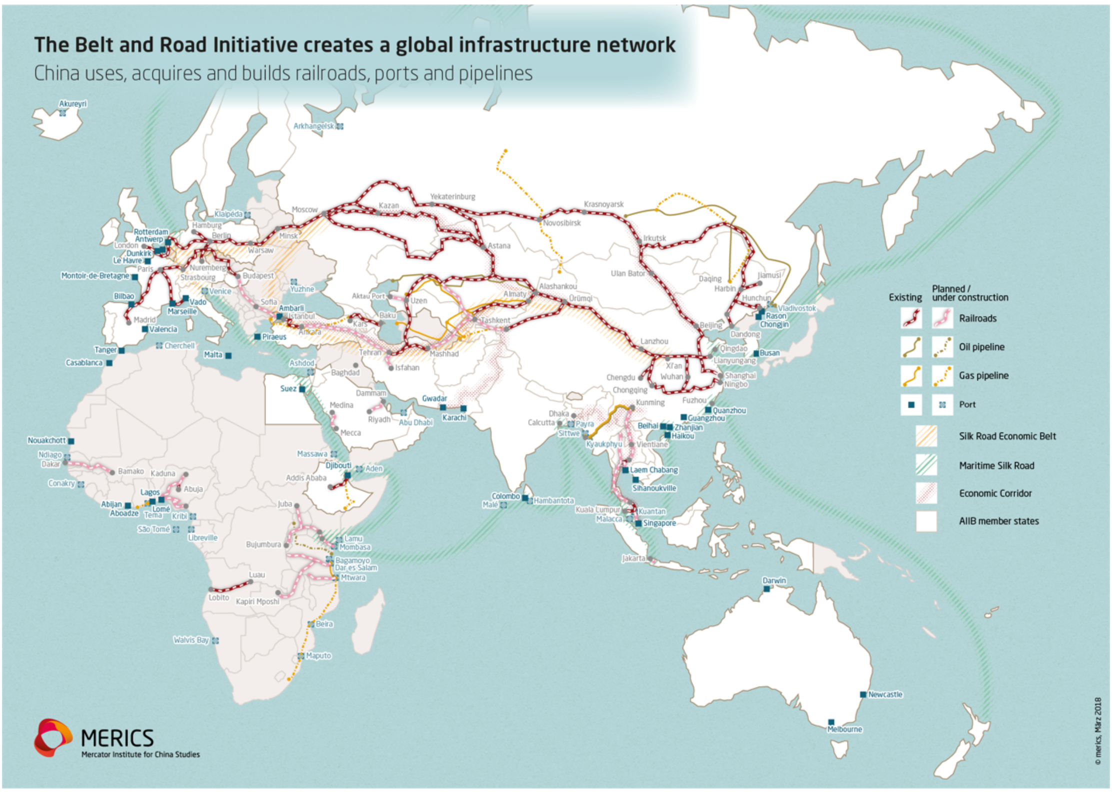

Figure 2 The Belt and Road Initiative's Global Infrastructure Network

Source: Mercator Institute for China Studies. (2018, June 7). Mapping the Belt and Road Initiative: This is where we stand.

The ports analyzed in this study, Piraeus, Hambantota, and Gwadar, are situated along the green maritime route shown in the map. Their locations reflect the MSR's role as a backbone of intercontinental connectivity.

The BRI has grown significantly since its inception. As of 2024, more than 150 countries have signed cooperation agreements, with total trade exceeding USD 19 trillion and investment commitments projected to reach USD 4 trillion (Mallick, 2024; Turker, 2023; Chen et al., 2025). The scope of the initiative has also evolved over time. While initial stages emphasized multilateral platforms and physical infrastructure, recent developments, driven by post-COVID challenges and rising geopolitical tensions, have shifted the focus toward "high quality development." This includes new dimensions such as the Digital Silk Road, Health Silk Road, and Green Silk Road (Upadhyay, 2023).

In the context of this broad agenda, this thesis narrows its focus to a specific question: how MSR port projects function as mechanisms of development, and why outcomes differ across countries despite similar levels of infrastructure investment.

2.1.2 Domestic Economic Drivers

The BRI also responds to a range of domestic economic pressures within China. A central motivation lies in addressing structural overcapacity in industries such as steel, cement, and construction, which have faced declining domestic demand in recent years. By channeling outbound infrastructure investment, the initiative generates external demand for Chinese construction materials, engineering services, and related sectors, helping to ease the imbalance created by a slowing growth trajectory (Turker, 2023).

Another driver involves the deployment of China's large foreign exchange reserves. As conventional monetary tools have become less effective in managing these reserves, overseas investment under the BRI offers an alternative outlet to put them to productive use while supporting geopolitical and economic objectives (Xu, 2025).

The BRI also reinforces China's long-standing "go global" strategy, which encourages domestic enterprises to expand abroad. This includes gaining operational experience in new markets, forming cross border partnerships, and securing access to critical resources and infrastructure. For many Chinese firms, particularly in labor intensive industries, rising domestic wages have created incentives to relocate parts of their operations to lower cost partner countries along the BRI (Li, 2025). The initiative contributes to China's industrial upgrading and global value chain repositioning in BRI.

Taken together, these drivers illustrate how the BRI serves not only external geopolitical and connectivity aims, but also functions as a tool for supporting China's domestic economic transition. Some researchers characterize it as a form of state driven globalization, where overseas infrastructure projects are used to relieve internal economic pressures while expanding China's global economic footprint (Upadhyay, 2023).

2.1.3 Geostrategic Objectives

Beyond its domestic economic objectives, the Belt and Road Initiative (BRI) is also widely regarded as a strategic instrument for advancing China's geopolitical interests (Mallick, 2024). Analysts argue that it enables China to extend its global influence, reshape regional power balances, and secure access to key trade and energy corridors (Turker, 2023; Mallick, 2024). These aims are especially visible in the MSR, where many port projects are located at strategic chokepoints, strengthening China's presence in sensitive or contested areas (Calinoff & Gordon, 2020).

A key element in this strategic calculus is China's energy supply vulnerability, often referred to as the "Malacca Dilemma." This term highlights China's heavy dependence on the Strait of Malacca, a narrow and congested waterway, for a large share of its imported energy resources. Due to its exposure to geopolitical risk, China has sought to diversify its transport routes through initiatives such as the China Pakistan Economic Corridor (CPEC) and port investments along alternative, more secure maritime passages (Calinoff & Gordon, 2020; Upadhyay, 2023).

Rank	Stratigic Value	Passage
1	0.8024	Strait of Hormuz
2	0.7571	Strait of Malacca
3	0.5399	Suez Canal
4	0.5281	Bab el-Mandeb Strait
5	0.5221	Panama Canal
6	0.4867	Alashankou
7	0.4798	Taiwan Strait
8	0.4356	Strait of Gibraltar
9	0.3953	Straits of Bosphorus/Dardanelles
10	0.3849	English Channel
11	0.3569	Kiel Canal
12	0.354	Korea Strait
13	0.343	Manzhouli
14	0.3087	Erlianhaote
15	0.2755	Mozambique Channel
16	0.2442	Makassar Strait
17	0.2399	Lombok Strait
18	0.222	Bering Strait
19	0.2214	Sunda Strait
20	0.2062	Soya-kaikyo
21	0.2012	Tsugaru-kaikyo

Table 1 Overall Utility Assessment of China's Top 10 Strategic Transport Passages

Source: Adapted from Huang, Loughney, & Wang (2023, p. 603).

Table 1 presents a utility ranking of strategic transport passages relevant to China's trade and energy security. The high score assigned to the Strait of Malacca confirms its centrality to China's geostrategic planning (Huang, Loughney, & Wang, 2023). The construction of bypass corridors and port infrastructure, particularly at Gwadar, a flagship MSR project under CPEC, exemplifies how strategic imperatives often outweigh immediate commercial logic (Calinoff & Gordon, 2020). Gwadar's value lies not in its current trade volume but in its potential to provide China with direct access to the Indian Ocean, circumventing the Malacca chokepoint. It is important to note that China's geostrategic interest in key maritime routes existed before the formal launch of the Belt and Road Initiative (Calinoff & Gordon, 2020). A clear pattern has since emerged across MSR investments: the gradual development of a distributed network of maritime assets along major sea lines of communication (SLOCs). This includes both port infrastructure and inland transport links, extending from the South China Sea to the Arabian Sea. These efforts aim to increase China's strategic depth and provide alternative routes for maritime transport (Mallick, 2024).

Taken together, the BRI can be seen as a hybrid initiative shaped by overlapping development aims, internal economic needs, and long term geostrategic ambitions. Given these overlapping aims, economic performance alone may not be the primary benchmark of success for all MSR port projects. Some investments, though well financed and politically supported, have struggled to produce tangible economic benefits. In such cases, factors such as local governance capacity, geopolitical tensions, and limited regional market development can constrain intended outcomes.

To better understand why outcomes differ across MSR port projects, the following section presents a conceptual model that maps the expected link between maritime connectivity and broader developmental effects. This model forms the analytical basis for the case study evaluations that follow.

2.2 The Port-Connectivity-Economy Nexus: The Idealized Model

The MSR is often conceptualized through a sequential model in which investments in port infrastructure are expected to enhance maritime connectivity, reduce trade related costs, and eventually promote broader economic growth (De Soyres et al., 2019). The idealized progress, referred to as the Port–Connectivity–Economy nexus, is illustrated in Figure 3 and serves as the prevailing blueprint for how MSR projects are assumed to support development.

However, insights from transport and development economics caution against viewing this sequence as automatic or uniform. Each link in the chain functions under specific conditions, and improvements in one domain do not necessarily transit into gains in the next. The overall outcome hinges on how well these stages align and interact in practice.

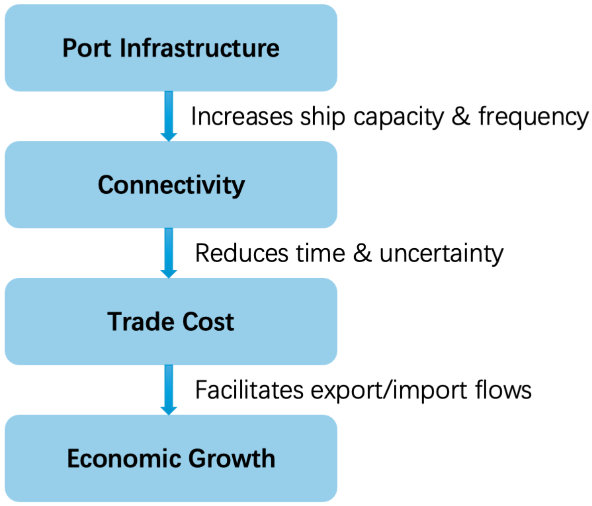

Figure 3 An Idealized Model of the Port-Connectivity-Growth Nexus

The figure illustrates a theoretical chain linking port infrastructure to regional economic growth. Starting with port investment, the model assumes a sequential improvement in maritime connectivity, followed by reductions in trade costs and eventually positive economic outcomes in the host country.

2.2.1 The Foundational Link: Port Infrastructure

Although modern port infrastructure plays a critical role in enabling maritime trade, its presence alone does not ensure stronger connectivity (Haralambides & Merk, 2020). Empirical research has consistently found that better quality ports are associated with lower trade costs, with some studies estimating reductions between 30% and 50% (Haralambides & Merk, 2020). Wilmsmeier and Hoffmann (2008) demonstrated that even a one standard deviation improvement in port quality can lead to a measurable drop in freight rates.

Reflecting this logic, many MSR initiatives have prioritized large scale physical upgrades, such as constructing deep water berths, expanding terminal capacity, and installing modern cargo-handling technologies (Serafimov et al., 2021). These investments are designed to better connect developing regions to global shipping routes and enhance their participation in international trade.

2.2.2 The Critical Link: Connectivity

Port infrastructure generates economic value not by its presence alone, but by how effectively it is integrated into wider trade and logistics networks (Hu & Hu, 2024). In this context, connectivity is a central link in the Port–Connectivity–Economy chain. It refers to the degree to which a port is operationally embedded within domestic and international transport systems, this includes shipping routes, inland transportation, and coordinated logistics processes (Huang, Loughney, & Wang, 2023). Even technologically advanced terminals, if poorly linked to key trade corridors or hinterland markets, often see low utilization and limited economic returns (Haralambides & Merk, 2020).

The BRI recognizes this reality by promoting not just port construction, but also the development of cross border corridors, seeking to improve connectivity through a combination of maritime, rail, road, and customs integration (Rakha & El-Aasar, 2024).

A widely used indicator to assess maritime access is the Liner Shipping Connectivity Index (LSCI), published by UNCTAD. The LSCI reflects a country's position within global container shipping networks and is often used as a proxy for trade accessibility (Haralambides & Merk, 2020).

However, improved infrastructure at the port level does not automatically transit into better connectivity. In many BRI partner countries, structural issues, such as weak inland transport links, inefficient border procedures, and poor coordination across supply chain actors, limit the broader impact of port investments. As a result, some ports remain underused, functioning more as standalone facilities than as integrated trade nodes.

2.2.3 The Ultimate Goal: Trade & Growth

The final link in the Port-Connectivity-Economy sequence concerns the broader economic effects of improved logistics infrastructure. These effects emerge when better transport systems lower trade costs and shorten delivery times, creating conditions that support expanded trade and attract external investment. Estimates by the World Bank suggest that if BRI transport corridors were fully implemented, trade among participating countries could increase by nearly 10%, with global real income rising by close to 3% (Baniya, Rocha, & Ruta, 2020; De Soyres et al., 2019).

In cases where improvements take hold, one visible outcome is an increase in foreign direct investment (FDI), as investors respond to more efficient trade environments and stronger market access. Investors are drawn to more efficient logistics environments, which support the growth of production and distribution hubs. These steps generate jobs and promote industrial upgrading in turn(Ardianto et al., 2023; Peng et al., 2021). China's port investments in Piraeus, Genoa, and Trieste illustrate this strategy. These projects aimed to create fast sea - land corridors linking Southern and Central Europe, positioning them as alternatives to Northern ports like Rotterdam and Hamburg (Gallelli & Ghiretti, 2023).

The Maritime Silk Road is introduced on a stepwise sequence. Building infrastructure, integrating supply chains, and fostering regional development. However, this sequence often breaks down in practice. Port improvements do not always lead to wider supply chain integration which is especially true in regions with weak institutions, fragmented regulations, or poorly coordinated transport systems.

Even where ports are physically connected, their economic impact may still fall short. In many MSR host countries, deep-rooted challenges, such as limited industrial capacity, investor uncertainty, or geographic isolation always prevent the full benefits from materializing.

This study refers to this kind of breakdowns as the "transition gap." It describes the disconnect between what the nexus model predicts and what actually occurs. These gaps do not undermine the usefulness of the original framework. Instead, they highlight the need to better understand the external factors that shape real-world outcomes.

To explore this further, the next section introduces the MLCCM. The model builds on the nexus framework by adding four Critical Success Factors (CSFs). CSFs explain the conditions under which the model succeeds, and why it sometimes fails.

2.3 Critical Success Factors (CSFs) and the Transition Gap

The Port-Connectivity-Economy framework offers a basic lens through which infrastructure-led development is often understood. Nevertheless, the linear progression does not fully reflect the mixed results observed across MSR port initiatives. In reality, the step by step sequence often stalls because of persistent structural issues, including limited institutional capacity, conflicting stakeholder incentives, and poorly integrated logistics, which prevent infrastructure from transiting into long-term economic benefits. This recurring disconnect is referred to in this study as the transition gap. It describes cases in which improvements at the port level, or Level 1, fail to trigger meaningful gains in supply chain integration at Level 2 or regional economic performance at Level 3. The gap is especially apparent where newly constructed ports operate below capacity or remain weakly connected to inland transport systems (Haralambides & Merk, 2020).

To explain why such gaps persist under seemingly similar engineering and financing conditions, this thesis focuses on four Critical Success Factors. Throughout the analysis, these factors are treated as moderating influences that condition whether, and how effectively, progress at one level supports outcomes at the next. The formal model that organizes Levels 1 to 3 is introduced in Section 2.4, the emphasis remains on the factors themselves.

Geopolitics can pull projects toward strategic objectives rather than commercial demand, which creates misalignment with local needs and weakens market traction (Mallick, 2024). Governance problems, such as regulatory gaps, limited administrative capacity, and inconsistent policy implementation, undermine execution quality and impede policy learning (Mo & Sun, 2025). Hinterland conditions and operational processes shape whether connectivity gains exist. Inefficient procedures, restricted inland access, and fragmented intermodal links can constrain pay offs even when new facilities are in place (Hu & Hu, 2024). Project design influences the durability and diffusion of benefits. Financing structures and environmental safeguards affect long-run sustainability, and high debt exposure or ecological risks can blunt impacts (Turker, 2023).

These CSFs introduced in Section 2.3 help explain divergent transition paths among projects built under similar physical and financial conditions. The remainder of this section examines each factor in turn, while Section 2.4 formalizes the analytical model and specifies how these factors enter as moderators within it.

2.3.1 Critical Success Factor 1: Geopolitics Overriding Commercial Logic

Geopolitical considerations are central to many MSR investments. However, they frequently diverge from the commercial logic necessary to ensure the long term viability of port infrastructure. A prominent example is Gwadar Port in Pakistan. As a central element of the China-Pakistan Economic Corridor (CPEC), the port offers strategic access to the Arabian Sea and aims to reduce China's reliance on the Strait of Malacca. Despite its geopolitical value, the port remains disconnected from core economic activity.

The gap between strategic ambition and local economic conditions disrupts the expected transition from infrastructure development (Level 1) to supply chain integration (Level 2). Even when port facilities are technically advanced, they struggle to attract traffic or generate value in the absence of structural demand. This dynamic reflects a disconnection between Level 1 and Level 2 within the MLCCM framework, where geopolitical aims override commercial viability.

This pattern points to the need to treat geopolitical motivations as a separate Critical Success Factor (CSF). While such considerations often justify initial investment, they may also distort Project Design by neglecting commercial viability. When infrastructure is built without alignment to trade patterns or production systems, the sequential logic of the Port-Connectivity-Economy model tends to break down.

2.3.2 Critical Success Factor 2: The Governance Gap

A second major CSF to the Port-Connectivity-Economy nexus arises from weak governance. This challenge emerges both within MSR project management and in the broader institutional environments of host countries (Upadhyay, 2023). Key symptoms include limited administrative capacity, poor legal enforcement, and a lack of transparency.

Governance-related risks undermine the effectiveness of port investments. A persistent issue concerns the opacity of loan agreements and procurement processes, which often facilitate rent-seeking, reduce accountability, and result in inefficient resource allocation (Gallelli & Ghiretti, 2023). In many cases, project documents lack binding obligations or enforceable safeguards.

Institutional fragility is further exacerbated by fragmented legal systems. Hybrid frameworks, mixing civil, common, and Islamic legal traditions, create regulatory inconsistencies and unpredictable enforcement (Mo & Sun, 2025). Legal uncertainty increases investor risk and delays implementation. In critical areas such as environmental and labor regulation, vague enforcement adds compliance uncertainty and reputational risk.

The lack of effective dispute resolution mechanisms further compounds these challenges. In many jurisdictions, judicial processes are slow and outcomes uncertain. The absence of binding international arbitration instruments such as the New York Convention makes legal enforcement more difficult.

Collectively, these failures disrupt the transition from port infrastructure (Level 1) to integration (Level 2) and, ultimately, to economic development (Level 3). In the MLCCM, this constitutes a breakdown across the MLCCM, justifying the identification of Governance and Institutional Capacity as a second Critical Success Factor (CSF).

2.3.3 Critical Success Factor 3: Hinterland Conditions

The third Critical Success Factor shaping the Port-Connectivity-Economy nexus is the condition of a port's hinterland. Two elements matter most: hinterland demand and logistics accessibility. Where the surrounding economy is thin, modern terminals struggle to attract stable flows; where access is weak, even efficient quays remain commercially underutilized, what prior studies describe as "isolated infrastructure" (Haralambides & Merk, 2020).

On the demand side, ports need a sufficient base of production and consumption in their catchment areas. Without sustained industrial output and market size, cargo generation is fragile and volatile, regardless of terminal upgrades (Haralambides & Merk, 2020).

On the accessibility side, performance depends on dependable road, rail, or inland waterway links that move cargo beyond the gate. Missing rail connections, capacity limits on key corridors, or recurring congestion shift the bottleneck inland, raising costs and eroding time reliability (Huang, Loughney, & Wang, 2023; Hu & Hu, 2024).

Implications for the MLCCM. At Level 1, weak hinterland conditions cap throughput and limit berth productivity gains. At Level 2, they hinder integration with broader supply chains because corridors and nodes do not function as a system. At Level 3, the absence of demand depth and corridor quality reduces spillovers into employment, value added, and investment (Haralambides & Merk, 2020; Hu & Hu, 2024).

2.3.4 Critical Success Factor 4: Project Design Factors

The fourth Critical Success Factor concerns the design and operation of individual projects. Physical layout, berth configuration, and terminal specialization shape workflows and determine whether facilities can process diverse cargo types efficiently (Haralambides & Merk, 2020).

Procedures and clearance are equally decisive. Integration with single-window environments and the use of digital documentation shorten dwell times; fragmented or paper-based processes add delay and cost, offsetting gains achieved at the quay (Mo & Sun, 2025).

A supportive logistics ecosystem, warehousing, cold storage, value-added services, and competent third-party logistics, enables the port to operate as a distribution node rather than a simple transfer point (Xie et al., 2025).

Financial structure is also project designed. Capital cost levels, debt service profiles, and the choice of public private arrangements influence the ability to maintain operations and reinvest under changing market conditions (Calinoff & Gordon, 2020).

Implications for the MLCCM. At Level 1, good design and clear procedures lift terminal productivity. At Level 2, digital clearance and complementary services support reliable corridor flows and multimodal integration. At Level 3, resilient financing and scalable operations make it more likely that port upgrades transit into durable regional economic effects (Haralambides & Merk, 2020; Xie et al., 2025).

The next section links these four CSFs to the three levels of the MLCCM through explicit arrow relations, clarifying where each factor exerts direct influence and how effects propagate along the L1→L2→L3 chain.

2.4 Theoretical Framework: A Multi-Level Causal Chain Model

The Port-Connectivity-Growth nexus is a commonly used model for understanding how port infrastructure can drive regional development. It describes a sequential process: physical investments in ports improve connectivity, which in turn supports broader economic gains. Yet, evidence from MSR projects shows that this logic often breaks down in practice. Many initiatives fail to deliver the anticipated benefits, as structural issues, such as weak institutions, misaligned incentives, and poorly coordinated logistics, interrupt the chain of progress.

To better capture these dynamics, this study introduces the Multi-Level Causal Chain Model (MLCCM). The model retains the core structure of the nexus, moving from port infrastructure (Level 1) to supply chain integration (Level 2) and finally to economic development (Level 3), but adds an essential layer of analysis. It embeds four Critical Success Factors (CSFs) as moderating variables, each of which helps explain why some projects advance smoothly while others stall or underperform.

By integrating these CSFs into the framework, the MLCCM offers a more grounded explanation for the divergence between expected and actual outcomes. In particular, it sheds light on so-called "transition gaps," where progress halts between stages despite substantial investment, pointing to the importance of institutional, political, and logistical conditions in shaping project trajectories.

The MLCCM comprises seven core variables, organized across two analytical dimensions:

- A three-level performance chain, capturing the intended sequential transformation from physical infrastructure to regional economic impact.
- Four CSFs, each moderating the transitions between these levels by shaping the feasibility, efficiency, or sustainability of the causal progression in specific contexts.

2.4.1 Defining the Core Variables

The Three-Layer Performance Chain

These three stages, port performance, supply chain integration, and regional economic impact, are defined in this thesis as the core variables of the MLCCM.

- **Level 1: Port Performance** refers to the operational capacity and service quality of a port's physical infrastructure. Beyond cargo throughput, its contribution to the performance chain stems from improved turnaround times, scheduling reliability, and service diversification, which enhance the port's competitiveness within global liner shipping networks.

- **Level 2: Supply Chain Integration** assesses the extent to which the port is functionally embedded in wider regional and international logistics networks. It covers both physical connectivity (road, rail, multimodal access) and institutional connectivity (customs processes, cross-border logistics coordination).

- **Level 3: Regional Economic Impact** measures the degree to which upstream gains in port and logistics performance transit into sustained economic benefits, such as increased trade volumes, higher FDI inflows, industrial development, and employment growth in the host region.

These stages are defined independently before introducing the moderating factors. These three levels represent the core variables in the MLCCM, capturing the progression from operational outcomes to broader economic impacts. Their interaction is, however, shaped by a set of contextual moderators.

The Four Critical Success Factors (CSFs)

The MLCCM incorporates four Critical Success Factors that influence the strength and direction of linkages between these three levels:

- **CSF 1: Governance Factors** - the regulatory, legal, and administrative quality of the host environment, including procurement transparency, regulatory enforcement, and legal certainty, all of which affect investor confidence, operational reliability, and policy alignment.

- **CSF 2: Geopolitics Factors** - intergovernmental strategic objectives, by China or the host nation, that shape port project design, location, and long-term function. Strategic priorities may override commercial viability, distorting the intended development pathway.

- **CSF 3: Hinterland Conditions** - demand-side fundamentals that determine the viability of a port's logistics function, encompassing:

Economic gravity: the industrial capacity, market size, and trade activity of the hinterland;

Logistics accessibility: the quality of road, rail, and inland waterway infrastructure linking the port to inland destinations.

- **CSF 4: Project Design Factors** - internal design features and managerial capacity of the project itself, such as financing arrangements (e.g., debt structure), operational models (e.g., PPPs vs. state ownership), and the capability of the operating entity.

These factors are analyzed as moderators in the MLCCM, linking context to observed outcomes.

2.4.2 Explaining the Relationships Between Variables

The MLCCM conceptualizes the relationships among its seven core variables through two interrelated mechanisms. The first is a linear causal sequence, wherein the three level performance chain represents a stepwise development logic. Improved Port Performance (Level 1) enhances operational efficiency and service reliability, which facilitates more robust Supply Chain Integration (Level 2). In turn, effective integration into supply chains becomes the necessary foundation for generating sustained Economic Impact (Level 3), including growth in trade, investment, and employment. Within this configuration, each level serves as both the outcome of its predecessor and the prerequisite for the next, forming a cumulative chain of causality.

The second mechanism concerns the role of Critical Success Factors (CSFs), which function as moderating variables that shape the feasibility, strength, and direction of transitions between levels. These factors do not directly produce performance outcomes. Rather, they influence the CSFs under which causal effects can materialize. For instance, strong regulatory institutions and coherent policy environments may enable the conversion of physical port capacity into broader supply chain connectivity. Conversely, limited hinterland infrastructure may impede the realization of economic benefits, even in the presence of efficient port operations.

Each CSF operates within a distinct domain. Geopolitical and Strategic Factors reflect state-level interests and influence project conception, location, and long-term function. The central proposition of the MLCCM is that the ultimate outcomes of port projects are not determined solely by the presence of infrastructure, but by the dynamic interaction between this three-level performance chain and the four CSFs that shape this interaction.

2.4.3 Final Framework Presentation

Figure 4 presents the complete analytical framework, integrating the three levels of the performance chain, port performance, supply chain integration, and regional economic impact, with the four Critical Success Factors (CSFs) as moderating variables. In this model, the CSFs influence the transitions between levels, shaping how operational improvements at the port transit into broader economic outcomes.

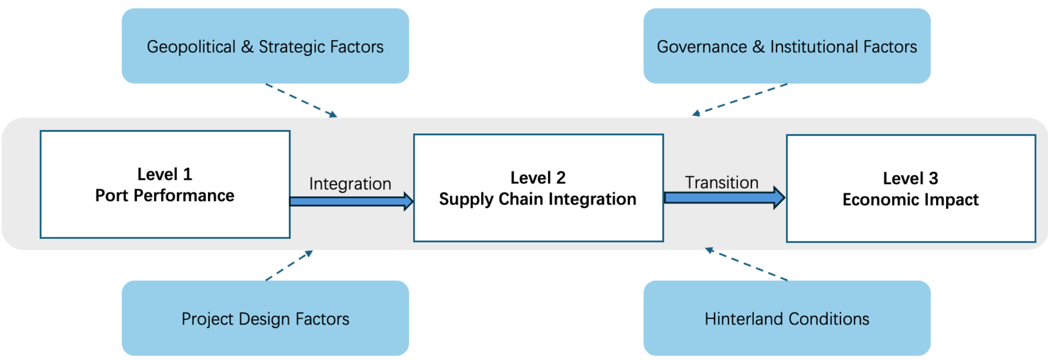

Figure 4 The Multi-Level Causal Chain Model for MSR Port Project Analysis

The placement of CSFs in the framework reflects their primary domain of influence. For example, Geopolitical and Strategic Factors often shape project initiation and early-stage design, while Hinterland Conditions tend to affect the conversion of logistical efficiency into economic returns. However, in practice, most CSFs exert influence across multiple stages.

This integrated framework provides a structured basis for the empirical chapters that follow. Chapter 3 will operationalize the MLCCM by defining each variable, suggesting measurable indicators, and identifying potential data sources. The subsequent comparative case studies will apply the framework to trace performance through the three levels and assess how specific CSFs have shaped success or failure at each transition. By incorporating contextual moderators into a causal model, the MLCCM not only explains why MSR port projects produce divergent outcomes, but also serves as a diagnostic tool to inform future port investment and policy decisions.

2.5 Conclusion

This chapter has developed the conceptual foundation for the thesis by integrating key insights from the literature into a structured analytical framework. This chapter first established the strategic and developmental context of the MSR and introduced the idealized Port-Connectivity-Growth nexus. Based on observed outcome divergences across MSR port projects, it identified four categories of CSFs: geopolitical dynamics, governance quality, project design, and hinterland; that commonly interfere with the theoretical causal pathway.

To address these discrepancies, this chapter introduces the MLCCM as the central theoretical contribution of the study. The MLCCM traces how port development is expected to drive broader outcomes, progressing from port performance to supply chain integration, and ultimately to regional economic impact. Along this path, it incorporates four CSFs influence each stage of the process.

By adding these CSFs, the MLCCM provides a more detailed and evidence-based explanation for why the results of port-led development can vary so widely across different settings.

The next chapter turns to the research methodology. It outlines how the MLCCM is implemented using a nested comparative case study design. This includes the reasoning behind case selection, the approach to data collection, and the analytical techniques used to identify causal patterns across the selected port projects.

Chapter 3: Research Methodology

This chapter sets out the research strategy employed to examine the Multi-Level Causal Chain Model (MLCCM) introduced in Chapter 2. The methodological approach is designed to trace causal linkages across three analytical levels, Port Performance (Level 1), Supply Chain Integration (Level 2), and Regional Economic Impact (Level 3), and to assess how these linkages are shaped by four Critical Success Factors (CSFs): governance, geopolitics, hinterland conditions, and project design.

The chapter proceeds in five sections. Section 3.1 outlines the nested mixed-methods comparative case study design used to investigate the three selected ports, Piraeus, Hambantota, and Gwadar, within the context of the Maritime Silk Road. Section 3.2 describes the operationalization of the MLCCM variables, specifying how each construct is measured and linked to the empirical analyses in Chapters 4 and 5. Section 3.3 details the data sources and collection procedures, covering both quantitative port performance indicators and qualitative documentary evidence. Section 3.4 explains the analytical techniques used to examine causal relationships and assess the moderating role of CSFs, including within-case process tracing and cross-case comparison. Section 3.5 presents the triangulation strategy, integrating multiple data types and sources to enhance the validity of findings.

By making explicit how each empirical step connects to the MLCCM, this chapter ensures methodological transparency and provides a coherent bridge between the theoretical framework in Chapter 2 and the case-based findings in Chapters 4 and 5.

3.1 Research Design

This study adopts a nested mixed-methods comparative case study design to empirically examine the MLCCM introduced in Chapter 2. The design is nested in the sense that the same analytical structure, three sequential levels (Port Performance → Supply Chain Integration → Regional Economic Impact), is applied consistently across all three cases, while within each level, multiple data sources and analytical lenses are combined.

The comparative element enables the identification of both common mechanisms and context-specific variations in how MSR-related port investments transit into broader economic outcomes. By holding the overall analytical framework constant while varying the context, the research isolates the role of CSFs, governance, geopolitics, hinterland conditions, and project design, as potential moderators in the MLCCM.

The mixed-methods approach integrates quantitative performance metrics (e.g., container throughput, modal connectivity indices, trade value changes) with qualitative documentary evidence (e.g., government policy documents, corporate disclosures, project evaluations, and media reports). This integration serves two purposes. First, it enables within case triangulation, where multiple forms of evidence are used to validate patterns at each level. Second, it supports cross case comparison, where the same variables and evidence types are used to evaluate consistency or divergence across cases.

The three cases, Piraeus (Greece), Hambantota (Sri Lanka), and Gwadar (Pakistan), were selected because they each occupy a strategic position along the Maritime Silk Road and have undergone significant MSR-related infrastructure investment. At the same time, they differ markedly in their geopolitical, governance, and hinterland contexts, providing a natural basis for examining how Critical Success Factors (CSFs) may condition the MLCCM from port development to regional economic outcomes. A further consideration in case selection was the availability of reliable quantitative and qualitative data across a sufficient time horizon to enable both pre- and post-investment comparison.

This design choice ensures that the empirical analysis in Chapters 4 and 5 is methodologically consistent across cases, while still capturing the diversity of outcomes and pathways that emerge from differing CSFs.

3.2 Operationalization of the MLCCM

This section transits the conceptual structure of the MLCCM introduced in Section 2.4 into measurable variables and indicators for empirical testing. The model comprises three sequential levels: Level 1, Port Performance; Level 2, Supply Chain Integration; and Level 3, Regional Economic Impact. The links from Level 1 to Level 2 and from Level 2 to Level 3 are hypothesized to be moderated by four Critical Success Factors: Geopolitics, Governance, Hinterland, and Project Design.

Each variable is defined by its theoretical role and its empirical representation. For Level 1, the focus is throughput growth, cargo diversification, and investment scale and timing. Indicators are TEU volume and annual growth for Piraeus, total cargo tonnage and Ro-Ro units for Hambantota and Gwadar, the share of non-containerized cargo, and dated measures of capex, concession timing, and commissioning year. For Level 2, the variables capture the degree of inland and multimodal integration. Indicators are the presence and frequency of rail and road corridors, the availability of multimodal terminals and services, mean vessel to release time and number of procedural steps, the adoption of pre-declaration and risk management in routine use, and evidence of value added logistics and tenancy near the port. For Level 3, the variables track economy wide outcomes with a focus on FDI attraction and employment generation. Indicators are annual FDI inflows in USD and documented job estimates or sectoral employment signals, interpreted with the evidence standards set out in Chapter 5.

Time windows, lags, and thresholds are specified in the tables and applied consistently across cases. In all tables, timing refers to the dated commissioning of assets, the start of corridor and customs measures, and the before and after milestone windows used to read outcomes; dates are recorded to the nearest full year and aligned to the relevant Level 1 and Level 2 milestones to keep cases comparable. Where comparable series for mean vessel to release time are unavailable, the analysis uses the policy go live windows for pre-declaration and risk management and the customs dimension of the LPI as contextual evidence. Quantitative series are verified against operator statements, recognized institutional reports, and government materials already cited in the thesis to support case-level judgments.

The Critical Success Factors are operationalized as moderating variables using dated documentary evidence. Governance is assessed through the scope and timing of institutional coordination, regulatory alignment on customs and corridor management, and the degree of cooperation among port authorities, state agencies, and operators. Geopolitics considers the stability of the external political and security environment, including political risk events, sanctions or policy shocks, and security incidents along corridors. Hinterland refers to market size and physical accessibility that shape inland reach, taking into account population and economic gravity, terrain and network constraints, and the location of inland hubs. Project Design captures ownership, financing, and operational design features that link terminals with inland services and procedures, including digital and process design, integration of rail and road services, public and private risk allocation, and the commissioning timeline.

Tables 2 to 5 present the complete operationalization matrix, linking each MLCCM variable to its indicators, primary data sources, collection procedures, cross checks, time windows, and the locations where the evidence is used in Chapters 4 and 5. This structure ensures a clear trail between the theoretical framework and the empirical findings.

Variable Level	Level 1: Port Performance		
Variable Name	Throughput Growth	Cargo Diversification	Investment Scale & Timing
Operational Definition	Change in port traffic relative to a baseline year, capturing capacity utilization and market reach	Expansion of handled cargo types indicating operational flexibility	Magnitude and sequencing of port-related capital expenditure and concessions
Primary Indicator(s)	TEU volume and annual growth rate (Piraeus); Total cargo tonnage and Ro-Ro units (Hambantota, Gwadar)	Share of non-containerized cargo; Ro-Ro volume	Capex amount (USD/EUR); Concession dates; Commissioning year
Primary Data Source(s)	Piraeus: Clarksons Research port statistics. Hambantota: SLPA/HIPG annual reports. Gwadar: GPA/government reports, HIPG updates	Port authority or operator reports (HIPG, SLPA; PPA where applicable)	Concession agreements, HRADF materials; Clarksons project lists; CMPort/COSCO disclosures
Collection procedure / access path	Extract annual series for each port from the primary source; Harmonies to calendar years; Align with investment milestones	Extract category breakdowns where available; Piraeus treat as contextual, since L2 corridor mix carries the main variation	Compile project list and timelines; Map commissioning dates to L1 and L2 inflection points
Cross-check source	Operator/authority summaries and prior academic or institutional reports already cited	Port master plans and operator fact sheets already used in Ch.4	Official announcements and operator reports already cited
Time window	Investment-pre and post-investment periods used in Ch.4; same span carried into Ch.5 where needed	Same as throughput series	Contract year to first full operating year after commissioning
Evidence location (Ch.4 / Ch.5)	4.1.1–4.1.3; 5.1–5.3	4.1.2; 4.2.1–4.2.4 (context link) 5.1–5.3 (as supporting context)	4.1.4; links forward to 4.2 and 5.1–5.3

Table 2 Operationalization Matrix Level 1

Table 2 presents the three variables, throughput growth, cargo diversification, and investment scale and timing, define what counts as Level 1 evidence. Start with the operational definition to fix scope, then use the primary indicators to identify the exact series used in Chapter 4. The primary data sources and the collection procedure show where the series came from, how they were harmonized to calendar years, and how commissioning and concession dates were mapped to Level 1 and Level 2 inflection points. The cross check field records the validation source. The time window states the pre and post investment periods applied across cases. The evidence location row points to the specific subsections in Chapter 4 and to the places where the same series are referenced again in Chapter 5.

Variable Level	Level 2: Supply Chain Integration		
Variable Name	**Hinterland Connectivity**	**Customs & Clearance Efficiency**	**Logistics Service Availability**
Operational Definition	Strength and reliability of inland connections and service reach	Procedural and institutional capacity to process cargo without delay	Availability of value-added logistics in port proximity
Primary Indicator(s)	Presence and frequency of rail and road corridors; multimodal terminals and services	Mean vessel-to-release time; number of procedural steps; pre-declaration and risk management in routine use	Presence of FTZ/bonded facilities; Scope of value-added services; tenancy structure
Primary Data Source(s)	Railway operator announcements; corridor documents; Transport/rail industry sources already cited (e.g., RailFreight; UIRR)	EU ICS2/TAXUD and AADE materials for Piraeus; ASYCUDA/NSW and HIPG procedural notes for Hambantota; national customs materials and documented issues for Gwadar	Port development plans; Logistics zone operator documents; Concessionaire materials already cited
Collection procedure / access path	Record opening dates, frequency, corridor endpoints, and inland nodes; “presence + frequency” as the minimum evidence of integration	Extract procedure maps and dated notices; Identify when pre-declaration and digital exchange came into effect; Align to corridor milestones	Note facility types and functional scope; Confirm operational status and tenant mix where disclosed
Cross-check source	DG MOVE/TEN-T or national transport documents already used	Port operator guidance and government circulars already cited	LPI (country-level) as contextual reference already cited
Time window	Same years as L1 plus corridor commissioning years	Policy go-live dates and nearest full years	Latest plan year plus most recent operating year
Evidence location (Ch.4 / Ch.5)	4.2.1, 4.2.4; 5.1–5.3	4.2.2; 5.1–5.3	4.2.3; 5.1–5.3

Table 3 Operationalization Matrix Level 2

Table 3 present the degree of inland and multimodal integration. For hinterland connectivity, presence together with frequency is the minimum evidence of integration, with corridor endpoints and inland nodes recorded where available. Customs and clearance efficiency is read through dated adoption of pre declaration and risk management and the number of procedural steps; policy go live dates anchor the observation window. Logistics service availability is established from port development plans and operator documents that show facilities, value added functions, and tenant mix; the LPI is used only as country level context. The collection and cross check fields explain provenance and validation. The time window combines corridor commissioning years and the nearest full years around policy changes. Evidence locations point to Sections 4.2 and 5.1 to 5.3.

Variable Level	Level 3: Regional Economic Impact	
Variable Name	FDI Attraction	Employment Generation
Operational Definition	Inflows of FDI linked to port and logistics activities	Direct and indirect jobs associated with port operations and linked sectors
Primary Indicator(s)	Annual FDI inflows (USD)	Documented job estimates; sectoral employment signals
Primary Data Source(s)	National investment agency reports; UNCTAD series already in references	Operator statements where available; National or regional labor statistics; prior impact studies already cited
Collection procedure / access path	Extract national FDI series; Identify port/logistics-related inflows when disclosed at project level	Use documented estimates where reported; Otherwise, triangulate sectoral signals consistent with evidence standards in Ch.5
Cross-check source	Government economic surveys and prior studies already cited	Prior impact assessments (e.g., studies cited in Ch.5)
Time window	10–15 year span covering pre/post L2 milestones	Same span as FDI or nearest available
Evidence location (Ch.4 / Ch.5)	5.1–5.3; synthesised in 5.4	5.1–5.3; synthesized in 5.4

Table 4 Operationalization Matrix Level 3

Table 4 sets out the economy wide outcomes. FDI attraction relies on national FDI series and, where disclosed, inflows linked to port or logistics activities. Employment generation uses documented job estimates when available and otherwise triangulates sectoral signals consistent with the standards stated in Chapter 5. The time window spans ten to fifteen years around the relevant Level 2 milestones to reduce the risk of misreading short term shocks. The evidence location row maps these series to Sections 5.1 to 5.3 and to the synthesis in Section 5.4.

CSF	Governance	Geopolitics	Hinterland Conditions	Project Design
Operational definition	Alignment across port management, national policy, and logistics governance	External political and security environment affecting corridor stability and investor expectations	Market size and physical accessibility shaping inland reach	Ownership, financing, and operational design features shaping integration
Documentary indicators	Formal coordination mechanisms; Regulatory clarity on customs and corridor management; Operator authority cooperation	Political risk events; Sanctions or policy shocks; Security incidents along corridors	Population and economic gravity; Terrain and network constraints; Location of inland hubs	Concession scope; Integration of rail/road services; Digital and process design; PPP risk allocation
Primary documentary sources	Government policy papers and notices; AADE/ICS2 or ASYCUDA/NSW materials; Operator authority MOUs already cited	Think-tank and government materials already cited for each case; Documented incidents in existing sources	National census and statistical yearbooks; Transport network documents already cited	Concession agreements, operator disclosures, government tenders already cited
Collection procedure / access path	Extract dated measures that change coordination or compliance load; Record scope and timing	List dated events with corridor relevance; Align to L2 and L3 timing	Compile stable structural indicators and note binding constraints near corridors	Extract clauses and scope that link terminal, inland services, and procedures; Record commissioning year
Cross-check source	Operator reports and recognised institutional briefings already in the thesis	Multiple reputable analyses already cited in the thesis	Maps and transport plans already used in Ch.4	Official announcements and operator materials already used
Coding note (Ch.4 vs Ch.5)	In Ch.4, directional reading for L1→L2; In Ch.5, moderates whether L2 gains convert to L3 outcomes	In Ch.4, explains friction or delay in L1→L2; In Ch.5, moderates breadth and durability of L3	In Ch.4, conditions the feasibility of L2; In Ch.5, moderates scale and spread of L3	In Ch.4, supports or constrains L1→L2; In Ch.5, moderates intensity and sectoral spread of L3
Evidence location (Ch.4 / Ch.5)	4.3 (directional assessment); 5.1–5.3 (moderation)	4.3; 5.3 and case sections	4.3; 5.1–5.3	4.3; 5.1–5.3

Table 5 Operationalization Matrix CSFs

Table 5 organizes the Critical Success Factors as dated documentary moderators. The operational definition fix the scope of each factor, the documentary indicators as the concrete signals to code. Primary documentary sources list the repositories for each case. The collection procedure records how events and measures were dated and aligned to Level 2 and Level 3 timing, and the cross check field links to operator reports and recognized institutional materials already used in the thesis. The coding note explains how each factor is read directionally in Chapter 4 and as a moderator in Chapter 5. Evidence locations point to the exact subsections where each item enters the analysis.

3.3 Data Collection

Data collection follows Table 2-5. The aims are comparability and triangulation. Each variable has a defined indicator, a primary source, a collection procedure, and a cross-check. At least two independent sources support each judgement. The window covers pre-investment and post-investment periods. Series are harmonized to calendar years. Evidence locations in Chapters 4 and 5 match the tables.

For Level 1 throughput growth, Piraeus uses container TEU time series from Clarksons Research. Hambantota uses total cargo tonnage and Ro-Ro units from SLPA and HIPG reports. Gwadar uses total cargo tonnage from GPA and government reports, with small TEU counts where disclosed. Annual values are extracted, aligned to commissioning milestones, and cross-checked against operator summaries already cited. These series anchor Section 4.1 and feed into Chapter 5 where needed.

For Level 1 cargo diversification, cargo category breakdowns are used where official series exist. Hambantota provides Ro-Ro and other non-container flows in operator materials. Piraeus remains container-focused, so diversification is treated as context and linked to corridor mix under Level 2. Gwadar shows limited variety, which is recorded as such. Category splits are copied from primary operator sources and confirmed with port plans or fact sheets already in use.

For Level 1 investment scale and timing, concession scope, capex amounts, and commissioning years are compiled from concession agreements, HRADF materials, Clarksons project lists, and operator disclosures. Project timelines are mapped to shifts in Level 1 and Level 2. Official announcements and operator reports already cited provide the cross check.

For Level 2 hinterland connectivity, the record includes the presence and frequency of rail and road corridors and the location of inland nodes. Primary inputs are railway operator announcements, corridor documents, and transport industry sources already cited. Opening dates, scheduled frequency, corridor endpoints, and named multimodal terminals are noted.

TEN-T and national transport plans already in the thesis serve as structural cross-checks. Presence and frequency form the minimum evidence of integration.

For Level 2 customs and clearance efficiency, procedure maps and go-live dates of digital systems are documented. Piraeus is read through ICS2, AADE, and ICISnet or EORI materials already cited. Hambantota is read through ASYCUDA World, the national single window, and HIPG process notices. Gwadar is read through national customs materials and documented operational issues in existing sources. Where a comparable "days to release" series is not available, the policy implementation window and the customs component of LPI are used as proxies. Institutional changes are aligned with corridor commissioning and port scheduling practice.

For Level 2 logistics service availability, FTZ and bonded facilities, value-added service scope, and tenant profiles are identified. Primary inputs are port development plans, logistics zone operator documents, and concessionaire materials already cited. Operating status is confirmed where disclosed. LPI remains a country-level context only and does not replace facility-level reading.

For Level 3 FDI attraction, national FDI series are extracted from national investment agencies and UNCTAD series already in the references. Project-level disclosures that identify port or logistics inflows are flagged and aligned to Level 2 milestones. For Level 3 employment generation, documented job estimates are used where reported. If no series exists, sectoral signals are triangulated from official labor sources and prior impact studies already cited. The evidence standard is consistent with Chapter 5.

For the CSFs, as moderating variables, collection follows Table 5. Governance is recorded as dated measures that change coordination or compliance burdens, read from government notices and operator authority documents already used. Geopolitics is recorded as dated events that may affect corridor stability or investor expectations, read from government and think-tank sources already in the thesis. Hinterland conditions are recorded as stable structural indicators of market size and accessibility from census and transport network documents already cited. Project design is recorded from concession scope, financing and ownership clauses, and the integration of inland services or digital processes in agreements and operator disclosures. In Chapter 4 these records support directional assessments for the L1 to L2 reading. In Chapter 5 the same records moderate whether Level 2 gains transited into Level 3 outcomes.

Each variable has a recorded access path and a cross-check in the tables. Where a direct metric is not observable, a proxy already used elsewhere in the thesis is adopted and the limitation is stated. This procedure reduces single-source bias and keeps the evidence chain auditable from the tables to the sections in Chapters 4 and 5.

Figures in Chapters 4 and 5 follow the sources and variables listed in Tables 2 to 5 and are constructed as annual line charts without smoothing. Figure 6 reports container throughput for Piraeus using official port statistics compiled by Clarksons Research; the series is aligned to calendar years, with milestones marked at the nearest full year. Figures 7 and 8 report Hambantota's total cargo and Ro-Ro vehicles from official port authority statistics, with Ro-Ro levels corroborated by the 2023 media report cited in the text; the two figures share the same window for comparability. Figure 9 reports Gwadar's total cargo using official port and government records listed in Table 2; the commissioning year and policy milestones appear as vertical markers. Figure 10 compares Colombo and Hambantota on the same unit and window using the national port authority series already cited in the chapter. Figure 11 reproduces the quarterly Liner Shipping Connectivity Index for Greece, Pakistan, and Sri Lanka on its native scale rebased to one hundred in the first quarter of 2023, consistent with the source. Figure 12 reproduces the Land Sea Express corridor geography from operator materials and public rail corridor records listed for Level 2. Figure 13 presents the World Bank LPI country scores on their native scale and notes methodological changes when relevant. Figure 17 reports the Attica GVA series from ELSTAT regional accounts with the cross-check described in Chapter 5; COSCO and BRI milestones are shown as dated markers. Figure 19 reports annual FDI inflows in USD from the national statistical and monetary authorities listed for Level 3, aligned to the

Level 2 milestone window used in Chapter 5. Figures 20 and 21 implement the traffic-light synthesis based on the classification rule stated in Section 3.4 and the dated evidence cited in Chapters 4 and 5.

3.4 Data Analysis Techniques

Analysis follows the three levels of the MLCCM and the variables in Tables 2 to 4. The CSFs in Table 5 are used as moderating variables. All quantitative series are aligned to calendar years. For each port, a baseline precedes the major MSR investment. The same observation windows are used in Chapters 4 and 5 to keep cases comparable. The chapter applies one decision rule across cases and reports the traffic light color coding in the summary figures. All analyses are performed at the port level, and CSFs are applied to each case separately.

Level 1 focuses on port performance. Throughput growth, cargo composition where applicable, and investment timing are read from annual series and dated project milestones. Trend breaks are identified by visual inspection and by comparing average growth before and after the baseline. Where cargo diversification is not comparable across ports, it is treated as contextual and linked forward to the Level 2 reading. Level 2 tests whether Level 1 gains transit into supply chain integration within the observation window by aligning corridor commissioning dates and customs policy start windows with Level 1 milestones and by checking for regular inland services and predictable handoffs. Level 3 tests whether the Level 2 configuration transits into regional outcomes by aligning FDI and employment series to the same window and by looking for sustained movements rather than one time shocks.

The traffic light coding uses the same rule for both links and makes the figures in Chapters 4 and 5 reproducible. For the link from Level 1 to Level 2, green is recorded when capacity upgrades are paired with usable corridor access and basic procedural alignment, and when regular inland services and predictable handoffs are evident in the window. Yellow is recorded when only part of this configuration holds, for example when effects are narrow or sector specific around port adjacent or road based facilities and when rail based connectivity or inland nodes are missing. Red is recorded when inland reach remains weak, procedures do not stabilize, and no improvement in hinterland accessibility is visible relative to the pre investment period. For the link from Level 2 to Level 3, green is recorded only when three conditions hold together within the window, namely predictable procedural governance, reliable multimodal hinterland access, and a project design that binds capital and operating incentives. Yellow is recorded when only some of these conditions hold and effects remain narrow or fade with distance. Red is recorded when inland reach is weak, clearance is variable, and regional indicators show no durable change. All labels must hold for at least two consecutive post baseline years within the window. Each judgement is triangulated with at least two independent sources, and all dates follow the timing conventions in Tables 2 to 5.

CSFs enter in two stages that mirror the empirical chapters. In Chapter 4 they provide directional reading for the first link at the port level. In Chapter 5 they are treated as moderating variables that help explain why similar Level 2 configurations transited into different Level 3 outcomes. The method is comparative process tracing. Factor configurations are compared across the three ports using dated institutional and operational records aligned to the same windows as the quantitative series.

The approach is triangulated throughout. Quantitative trends are interpreted within institutional and geopolitical records. Documentary claims are grounded in measurable series or dated events. Chapters 4 and 5 present the results in the order of the MLCCM and refer back to the operational definitions in Chapter 3.

Chapter 4: From Level 1 to Level 2 Port Performance and Supply Chain Integration

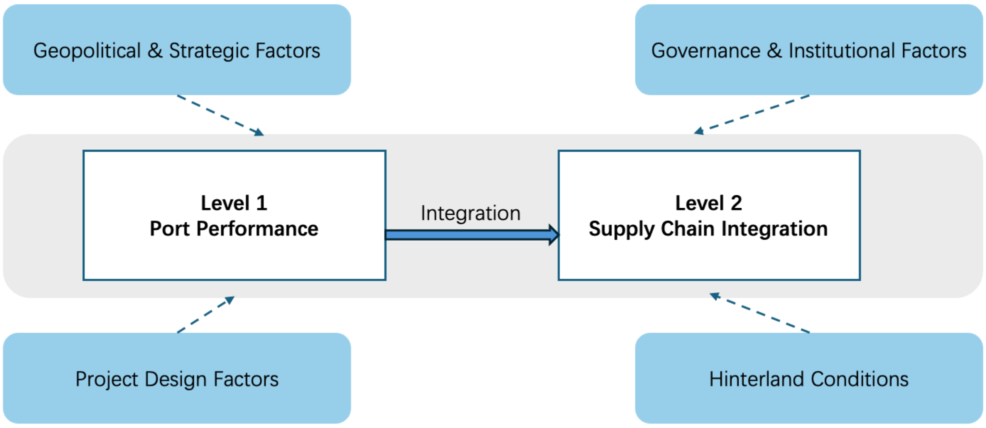

Figure 5 Moderating role of Critical Success Factors (CSFs) in the transition from Level 1 to Level 2.

This chapter examines the first stage of the MLCCM, tracing how changes in port performance (Level 1) contribute to supply chain integration (Level 2) across the three case ports. The analysis addresses Sub Questions 1 and 2 by identifying patterns in operational output, cargo handling structures, and investment trajectories, and by evaluating how these developments influence Hinterland Connectivity, customs procedures, and logistics service availability.

As illustrated in Figure 5, the transition from Level 1 to Level 2 is shaped by four Critical Success Factors (CSFs): governance and institutional arrangements, geopolitical and strategic conditions, hinterland characteristics, and project design features. These CSFs either enabling, constraining, or conditioning the observed linkages between operational improvements and supply chain integration.

The chapter proceeds in three sections. Section 4.1 analyses Level 1 port performance through container throughput growth, cargo diversification, and the scale and sequencing of MSR investments. Section 4.2 examines Level 2 supply chain integration by assessing hinterland transport corridors, customs clearance efficiency, and the availability of value-added logistics services. Section 4.3 synthesizes the findings by applying the CSF framework to explain variations in the L1→L2 transition across cases. Together, these analyses establish the empirical foundation for Chapter 5, which investigates the subsequent transition of supply chain integration into regional economic impacts.

4.1 Port Performance (Level 1)

This section examines how MSR investments have shaped port capacity and operational output in Piraeus, Hambantota, and Gwadar, focusing on throughput trends, investment structures, and operator control.

4.1.1 Piraeus: Container Throughput and Terminal Expansion

Piraeus Port experienced a major turnaround following COSCO Shipping's acquisition of operational rights for Terminals II and III in 2008, a 51% equity stake in 2016, and an expansion to 67% in 2021. Supported by substantial modernization investments, these measures significantly boosted container handling capacity and operational efficiency.

As shown in Figure 6, based on official port statistics compiled by Clarksons Research, annual container throughput rose from 864,895 TEUs in 2009 to over 6 million TEUs in the early 2020s (Clarksons Research, 2022; Global Connectivities, 2024). This sustained growth demonstrates the direct impact of targeted infrastructure upgrades and strategic operator involvement on restoring Piraeus's competitiveness within the Mediterranean.

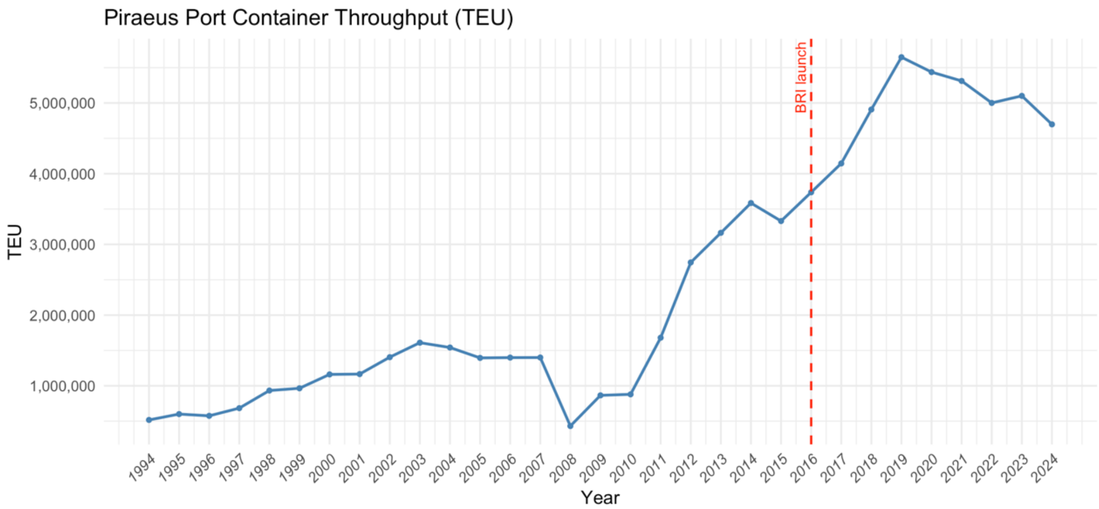

Figure 6 Annual Container Throughput of Piraeus Port (1994-2024), in TEUs.

Source: Clarksons Research, official port statistics for Piraeus.

4.1.2 Hambantota: Cargo Diversification and Ro-Ro Growth

Developed as a greenfield MSR project, Hambantota Port's Phase I was financed with approximately USD 360 million. In 2017, China Merchants Port Holdings took operational control under a 99-year lease, accompanied by a USD 950 million equity injection (Clarksons Research, 2022).

Since 2018, the port has broadened its operational profile, with notable growth in Roll-on/Roll-off (Ro-Ro) traffic. Figure 7, based on official port authority statistics, shows total cargo volume rising from 530,000 tonnes in 2018 to nearly 2.9 million tonnes in 2024. Figure 8 indicates that Ro-Ro throughput surpassed 700,000 vehicles by 2023 (Daily Mirror, 2023). Together, these trends point to Hambantota's growing role as a regional automotive and general cargo hub.

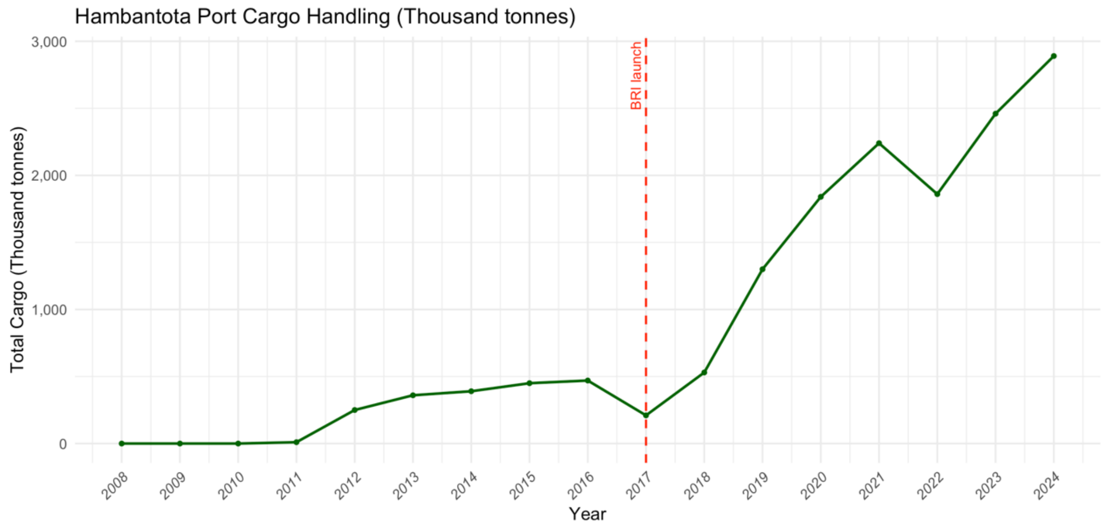

Figure 7 Annual Cargo Handling at Hambantota Port (2008-2024), in Thousand Tonnes.

Source: Sri Lanka Ports Authority; Hambantota International Port Group.

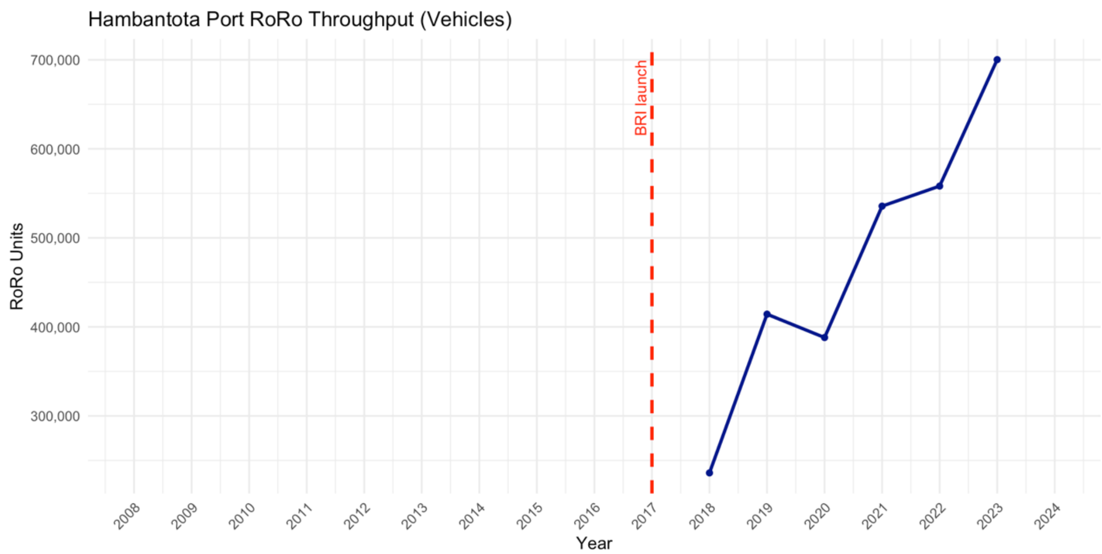

Figure 8 Annual Ro-Ro Vehicle Throughput at Hambantota Port (2018-2023).

Source: Hambantota International Port Group; Sri Lanka Ports Authority.

4.1.3 Gwadar: Ambition Amid Volatility

As a flagship project of the China Pakistan Economic Corridor (CPEC), Gwadar Port is planned to reach 150 berths and an annual handling capacity of 400 million tonnes by 2045. The development blueprint includes a floating LNG terminal, cargo tunnels, and a 2,292-acre special economic zone, with Phase II construction valued at approximately USD 1.02 billion (Clarksons Research, 2022; CPIC Global, 2024).

In reality, throughput performance has been inconsistent, revealing a gap between investment ambition and operational outcomes. Figure 9, based on official port and government data, shows cargo volumes peaking at around 1.43 million tonnes in 2011 before declining sharply. While occasional rebounds occurred, such as in 2023, sustained growth has been hindered by infrastructure bottlenecks, limited Hinterland Connectivity, and geopolitical instability.

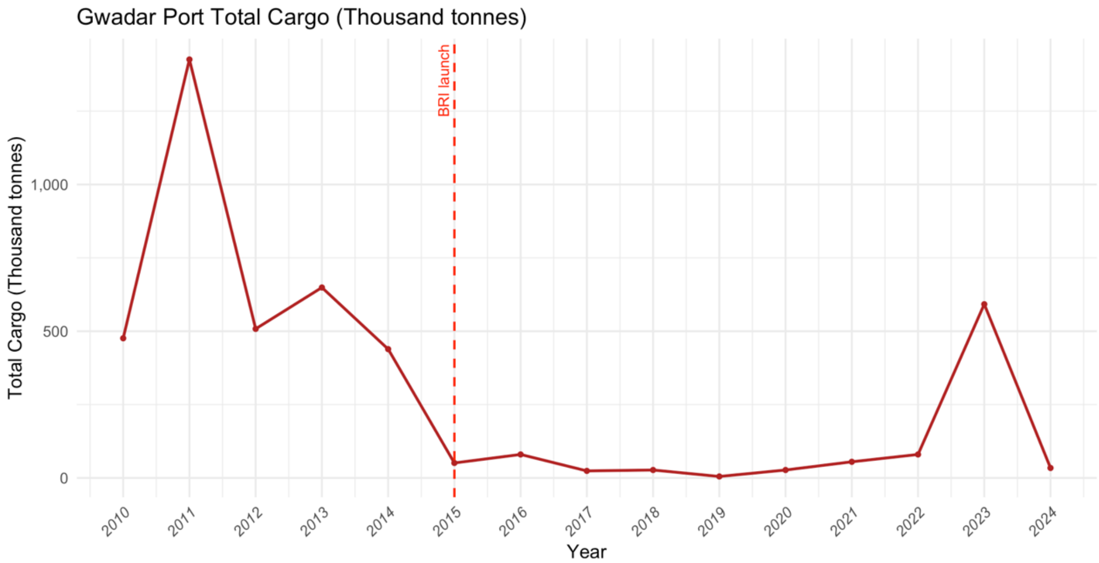

Figure 9 Total Cargo Handled at Gwadar Port (2010-2024), in Thousand Tonnes.

Source: Gwadar Port Authority; Government of Pakistan.

4.1.4 Comparative Analysis: Investment Types and Performance Outcomes

The three ports demonstrate distinct MSR investment pathways, shaping markedly different performance outcomes. Piraeus represents a targeted upgrade of an existing facility under a privatized concessionaire, leveraging efficient management and alignment with major trade routes to deliver rapid TEU growth. Hambantota began as a greenfield project before acquisition, using cargo specialization, particularly in Ro-Ro to achieve steady volume gains. Gwadar, also a greenfield port, remains in phased development but has struggled to transit large scale investment into sustained throughput due to governance bottlenecks, security risks, and limited hinterland links.

These patterns suggest that infrastructure spending alone is insufficient to guarantee performance improvements. Under the MSR framework, port success depends on local institutional capacity, integration with regional logistics corridors, and the geopolitical environment.

Indicator	**Piraeus (Greece)**	**Hambantota (Sri Lanka)**	**Gwadar (Pakistan)**
Project Type	Upgrade of existing terminal	Greenfield + subsequent upgrades	Greenfield (ongoing)
Operator (Post-BRI)	COSCO Shipping (67%)	China Merchants Port Holdings	China Overseas Port Holding Company
Initial Major Investment Year	2008 (concession), 2016 (equity)	2010 (construction), 2017 (operational lease)	2007-present
Headline Investment	€294M (upgrade) + €88M equity + €29M guarantee	$360M (Phase I) + $950M equity acquisition	$1.02B (Phase II construction)
TEU Throughput (2024)	~6.2 million TEUs (est.) (Clarksons, 2022)	N/A	N/A

Total Cargo Throughput (2024)	N/A	2.89 million tonnes (Clarksons, 2022)	~0.59 million tonnes (Clarksons, 2022; CPIC, 2024)
Ro-Ro Throughput (2023)	N/A	700,201 vehicles (Daily Mirror, 2023)	N/A
BRI Operational Control Year	2016	2017	2013 (Gwadar handover)
Performance Highlights	Leading regional hub; highest TEU growth	Strategic Ro-Ro diversification; consistent volume rise	Weak throughput; investment-performance gap
Challenges	Local resistance to Chinese control	Debt and sovereignty concerns	Governance, security, Hinterland Connectivity

Table 6 Summary of Investment Scale and Type across the Three Ports.

4.1.5 Comparative Summary of Performance Indicators

Across the three MSR ports, performance outcomes diverge sharply despite comparable levels of Chinese investment. Hambantota, while showing cargo specialization and notable Ro-Ro gains, still operates at a scale far below Colombo, which consistently handles over 70 million tonnes annually, which highlighting the gap in achieving transshipment competitiveness or integrated trade connectivity (Figure 10).

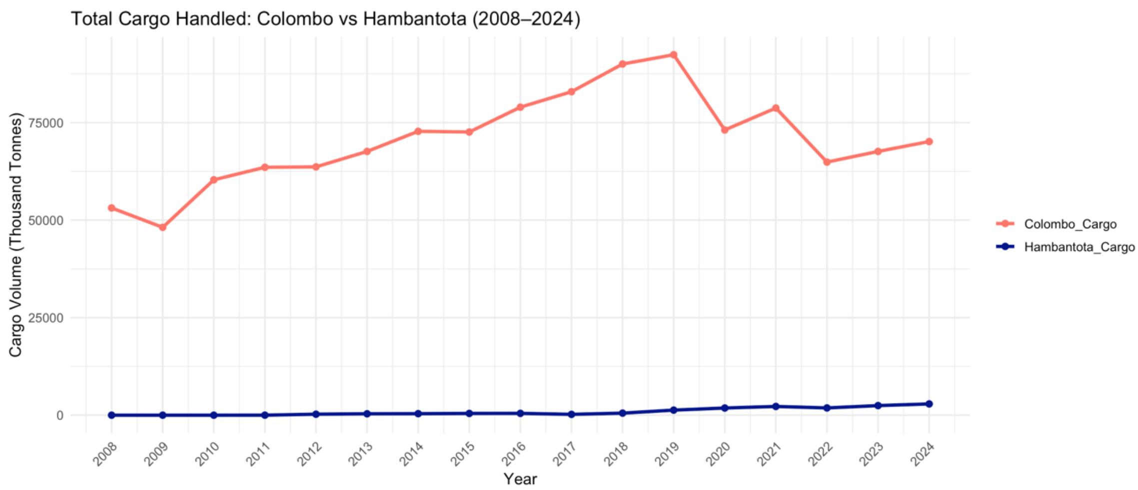

Figure 10 Total Cargo Handled: Colombo vs. Hambantota (2008-2024)

Source: Sri Lanka Ports Authority.

Piraeus exemplifies capacity expansion aligned with strategic trade routes, delivering sustained container growth and regional hub status. Gwadar remains constrained by volatility, marked by low throughput and persistent operational bottlenecks.

These contrasting trajectories underscore that infrastructure input alone is insufficient. Governance quality, market alignment, and geopolitical stability emerge as decisive determinants of port performance. The following LSCI analysis examines how such differences in Level 1 outcomes are reflected at the national connectivity level, testing the L1→L2 linkage within the MLCCM framework.

4.1.6 Liner Shipping Connectivity Index (LSCI) Comparisons

The Liner Shipping Connectivity Index (LSCI) measures a country's integration into global shipping networks. As a national-level indicator, LSCI captures aggregated maritime connectivity and may not directly reflect performance at individual ports.

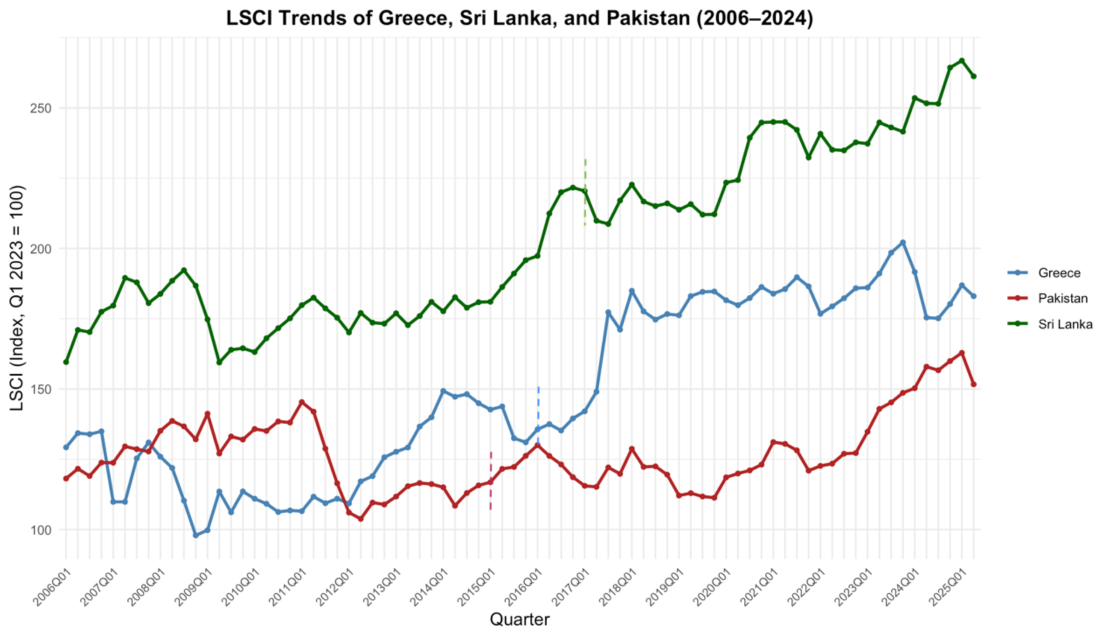

Figure 11 Quarterly LSCI trends for Greece, Pakistan, and Sri Lanka (2006-2024, Q1 2023 = 100).

Source: UNCTAD, Liner Shipping Connectivity Index (LSCI).

Greece shows a marked upward shift in LSCI post-2016, aligning with COSCO's investment and operational control in Piraeus. The port's rapid upgrade and traffic growth have transited into improved national connectivity, illustrating the success of targeted MSR investment when linked to a dominant national gateway.

In contrast, Sri Lanka maintains the highest LSCI overall, but this is driven by Colombo Port rather than Hambantota. Despite large-scale Chinese investment, Hambantota contributes little to national connectivity due to its limited volume and transshipment relevance. This highlights how the national index can mask underperformance at newly built ports.

Pakistan's LSCI trajectory shows modest, irregular growth with no observable link to Gwadar's development. Karachi and Port Qasim remain the primary contributors, while Gwadar's influence remains negligible due to infrastructure delays, weak hinterland links, and fragile governance.

These findings underscore the limits of using LSCI as a proxy for port-level outcomes, especially in countries with entrenched port hierarchies. While Piraeus's impact is clearly visible in Greece's LSCI, Hambantota and Gwadar remain largely absent in national-level gains. A complete evaluation therefore requires complementing LSCI with port-level throughput data and contextual factors such as governance quality, market demand, and integration capacity.

4.2 Supply Chain Integration (Level 2)

This section evaluates whether port infrastructure improvements have led to meaningful integration with inland logistics and national trade corridors. It highlights key enablers and bottlenecks, across rail, road, and institutional frameworks, that determine whether ports can function as multimodal trade gateways under the MSR.

4.2.1 Integration with Hinterland and Trade Corridors

Piraeus Port (Greece)

Piraeus leads the three cases in L2 hinterland integration, having established a stable cross-border rail network with high-frequency operations. Through COSCO's subsidiary, Ocean Rail Logistics, direct services link Piraeus to Skopje, Belgrade, Budapest, Bratislava, and Enns, bypassing traditional EU freight corridors and reducing transit times relative to Northern European ports.

Figure 12 Land-Sea Express: Rail Corridor from Piraeus to Inland Europe

Source: UIRR (2021); Ocean Rail Logistics.

By 2020, over 1,300 trains were operated annually, achieving competitive two-way utilization. Despite partial electrification of Greek rail lines limiting speed gains, the port demonstrates how coordinated investment, operational control, and multimodal integration can transit terminal upgrades into broader supply chain transformation.

Gwadar Port (Pakistan)

Gwadar remains the least integrated, with hinterland connections largely conceptual. Despite its strategic location, it lacks functional rail and road links to the Balochistan hinterland and the national ML-1 railway. The Gwadar Rail Freight Connectivity Project, approved in 2024, aims to connect the port to a new railway yard and the ML-1 network, but no operational dry ports exist and most inland transport still relies on limited road capacity. Until the Gwadar-Quetta-ML-1 corridor becomes operational, the port's role in regional supply chains will remain largely theoretical.

Hambantota Port (Sri Lanka)

Hambantota shows partial progress, primarily via road infrastructure. The port is connected to the national highway network through the Magampura Expressway, complemented by an internal four-lane system and planned elevated cargo routes linking to Colombo and the southern hinterland. Rail connectivity remains minimal: a single-track line is used for rail wagon imports only, and no direct rail link to Colombo exists. While future plans include multimodal integration through Mattala Airport and enhanced warehousing, the absence of direct rail services constrains its logistics role.

Comparative Insight

Piraeus stands out as the only case with fully functional hinterland integration, serving as a model for transiting port investments into regional supply chain transformation. Hambantota remains in transition, and Gwadar is effectively isolated. This divergence illustrates that without complementary inland systems, institutional maturity, and aligned logistics strategies, port upgrades alone cannot ensure L2 connectivity. However, physical links are only part of the equation, customs efficiency and procedural alignment are equally critical for achieving full L2 integration.

4.2.2 Customs Clearance Efficiency and Procedural Barriers

Customs procedures are a critical determinant of whether ports can function as effective trade gateways. This section compares the clearance regimes of Gwadar, Hambantota, and Piraeus, focusing on (1) mode of operation and digitalization, (2) time requirements, and (3) recent reforms and their limitations.

Gwadar Port: Fragmented Oversight and Limited Digitalization

Despite infrastructure investments under CPEC, Gwadar’s clearance process remains dominated by manual documentation, unpredictable duties, and limited IT integration (Tianjin Unilion, 2024). Government assessments in 2025 note the absence of real-time cargo tracking, delays in payment processing, and weak inter-agency coordination (Pakistan Today, 2025). While reforms such as AI-enabled tracking and Ro-Ro feasibility studies have been announced, implementation remains nominal, with no measurable reduction in clearance time. The absence of streamlined digital systems reduces Gwadar's appeal as a transshipment or gateway hub, regardless of physical capacity improvements.

Hambantota Port: Gradual Procedural Modernization

Hambantota has undertaken targeted reforms to expedite clearance, including digital document submission, decoupling customs from port payments, and extended service hours, allowing vehicle clearance within one working day for pre-approved shipments (HIPG, 2024). Ro-Ro cargo benefits from dedicated yards and automated import pass issuance. However, general cargo procedures still rely on manual inspections and staggered approvals, with no full integration between customs and inland transport systems (ADB, 2022). The resulting two-stage clearance process adds transit time compared to benchmark ports.

Piraeus Port: Fully Integrated Digital Control

Piraeus operates a highly automated and predictable customs regime. All containers require pre-declaration at least 24 hours before unloading, with longer lead times for hazardous goods (PPA, 2024). Its customs IT system enables parallel clearance and rail dispatch, allowing cargo to reach Central Europe in 6-7 days (RailFreight, 2021). The system is fully linked with inland multimodal services, supported by a transparent legal framework and scale advantages, providing a MSR benchmark for clearance efficiency.

Comparative Perspective

Across the three cases, clearance efficiency directly shapes each port's role within regional supply chains. Piraeus demonstrates the benefits of a fully digital, multimodal-aligned system; Hambantota illustrates incremental procedural gains; Gwadar shows that without integrated systems, physical infrastructure alone cannot secure competitive turnaround. These institutional differences are also reflected in national-level logistics performance indicators (see Section 4.2.3), highlighting the long-term influence of customs regimes on port hinterland integration.

4.2.3 Logistics Performance Index (LPI) and Inland Access

The Logistics Performance Index (LPI), published by the World Bank, is a composite measure evaluating trade logistics capabilities across six dimensions: customs clearance, infrastructure quality, international shipments, logistics competence, tracking and tracing, and timeliness (World Bank, 2023). High LPI scores generally correspond to lower trade costs and greater inland logistics reliability, crucial enablers for seaports seeking to integrate with broader supply chains.

However, caution is needed in interpreting national LPI data. First, Sri Lanka was not ranked in the 2016 edition, and Pakistan was excluded from the 2023 edition, resulting in missing data points. Second, the LPI is a national-level indicator, which may overstate the logistics capacity surrounding specific ports, particularly Gwadar, situated in the underdeveloped Balochistan region, and Hambantota, located outside Sri Lanka’s main economic corridors.

Figure 13 below presents the overall LPI trends for Greece, Pakistan, and Sri Lanka from 2007 to 2023. Greece consistently outperforms the other two countries, with a score of 3.3 in 2023, while Pakistan shows a decline since 2016 (2.8 in 2016 → 2.4 in 2018). Sri Lanka remains relatively stable but never exceeds 2.8 during the same period.

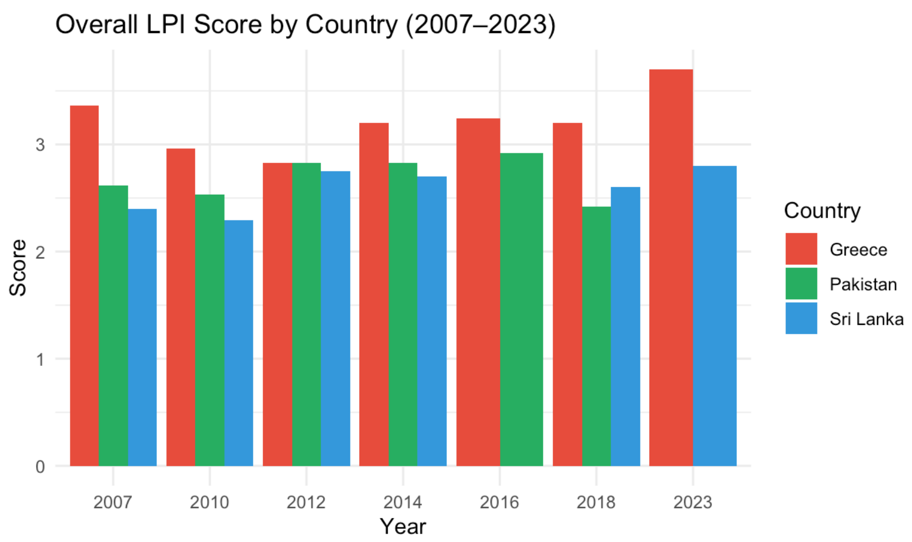

Figure 13 Overall LPI Score by Country (2007-2023)

Source: World Bank.

Figure 13 Longitudinal comparison of LPI scores (2007-2023) for Greece, Pakistan, and Sri Lanka. Note: Sri Lanka is missing from 2016 rankings; Pakistan is missing from 2023. National scores may overstate logistics conditions in underdeveloped port regions such as Gwadar and Hambantota.

Piraeus Port benefits from Greece's relatively high LPI score, which reached 3.3 in 2023. This performance reflects the country's strengths in customs clearance, infrastructure quality, and multimodal connectivity (World Bank, 2023). The port is seamlessly connected to the European rail network, including key inland nodes such as Thessaloniki and Skopje, enabling cargo to reach landlocked Central and Eastern European markets in less than a week (RailFreight, 2021). Such connectivity allows Piraeus to extend its maritime advantages into the hinterland, reinforcing its role as a logistics hub with regional reach and illustrating how a high-LPI environment facilitates deep integration between seaport operations and inland supply chains.

Hambantota Port operates in a national context where Sri Lanka's LPI score stood at 2.7 in 2023, positioning it in the mid-range among South Asian economies. Although the port is not integrated with the national rail system, it benefits from upgraded highways linking it to

Colombo, where customs clearance and container handling facilities are concentrated (HIPG, 2024). This road-based access supports Hambantota's specialization in Ro-Ro vehicle logistics and transshipment. However, the moderate national LPI and absence of multimodal connectivity limit its ability to function as a fully integrated inland-access port, constraining its potential to attract more diversified cargo flows.

Gwadar Port presents the most challenging inland access conditions among the three cases. Pakistan's last recorded LPI score was 2.4 in 2018, one of the lowest in South Asia (World Bank, 2018). The port remains disconnected from the national rail grid, and although the ML-1 railway project is expected to enhance connectivity along the Karachi Peshawar corridor, no confirmed extension to Gwadar has been announced (Pakistan Today, 2025).

Figure 14 Pakistan's railway network

Source: Financial Times, 2024, adapted from OpenStreetMap contributors

Figure 14 Proposed ML-1 railway under the China Pakistan Economic Corridor. While intended to improve national connectivity, the current alignment does not reach Gwadar, highlighting its logistical exclusion.

Furthermore, poor road conditions in Baluchistan, difficult mountainous terrain, and recurring security concerns severely limit freight viability to key inland economic centers such as Quetta or Punjab. These weaknesses in national logistics performance transit into structural barriers for Gwadar's development as a transshipment hub or inland distribution node, demonstrating how a low-LPI environment constrains the ability of port infrastructure to generate wider supply chain benefits.

From a comparative perspective, LPI performance shapes a port's ability to expand operations and integrate with inland markets. In high LPI contexts such as Piraeus, strong logistics systems enable Level 1 (port performance) gains to transit more effectively into Level 2 (supply chain integration), attracting transnational supply chains. In low LPI or governance constrained settings such as Gwadar, structural bottlenecks weaken the impact of maritime infrastructure improvements. Hambantota occupies an intermediate position, with sectoral strengths but limited multimodal connectivity. These differences are explored further in Section 4.2.4, drawing on documentary and field evidence to show that sustainable port development requires not only maritime capacity but also coherent logistics governance and inland infrastructure alignment.

4.2.4 Documentary Evidence on Multimodal Connectivity

While quantitative indicators such as throughput and LPI scores provide important insights into port performance, they cannot fully capture the operational reality of maritime inland integration. This section therefore examines documentary evidence from authoritative and first-hand sources, assessing the extent to which multimodal connectivity is effectively established in the three case ports. The findings reveal marked disparities in physical integration, institutional coordination, and the transition of port capacity into inland logistics functionality.

In Gwadar, multiple documentary sources confirm the absence of a functioning multimodal interface. Reports from DW (2024) and the SCMP interactive project on the Belt and Road Initiative indicate that while plans exist for a direct rail connection from Gwadar through Mastung and Quetta to Chaman, no tangible implementation progress has been recorded. The most significant transport investment under the China Pakistan Economic Corridor, the ML-1 railway, remains focused on the Karachi-Lahore-Peshawar axis, bypassing Gwadar entirely. As a result, the port depends heavily on insecure and underdeveloped road networks, a condition compounded by customs delays and governance bottlenecks. These sources substantiate earlier quantitative observations that Gwadar's hinterland access is severely constrained, leaving it as an isolated maritime node with minimal multimodal coordination.

In Piraeus, documentary evidence illustrates a sharply contrasting model. Sources including RailFreight (2021) and the International Union for Road-Rail Combined Transport (UIRR, 2021) detail COSCO's integration of port and rail operations through the acquisition of PEARL and the establishment of Ocean Rail Logistics. This investment enabled the Land Sea Express, a high frequency rail freight corridor linking Piraeus with inland European markets via Skopje, Belgrade, Budapest, and Vienna. Between 2014 and 2020, annual train services increased from just 64 to over 1,300, achieving competitive Asia Europe transit times of 25-26 days. Although infrastructural constraints persist, particularly incomplete electrification along the Ikonio-Idomeni section, the service consistently maintains high backhaul utilization and supports diversified cargo flows, including electronics, automotive, and manufacturing goods. These records corroborate the port's role as a strategically integrated multimodal hub.

In Hambantota, official data from the Hambantota International Port Group (HIPG, 2025) and sectoral studies (Fernando & Bandara, 2021) confirm that, despite significant investment in multipurpose terminals and growth in LPG, cement, and container throughput, inland connectivity remains limited. The port lacks any direct rail linkage and has only partial integration into Sri Lanka's expressway network, with most distribution relying on road transport. No operational dry ports or multimodal hubs have been established, and logistical activity remains concentrated in Colombo. These findings validate earlier assessments that Hambantota's operational success at quay level has not transited into deeper supply chain integration, a pattern resembling Gwadar's constraints, albeit under more stable security conditions.

Taken together, the documentary evidence reinforces the performance disparities identified in Sections 4.2.1-4.2.3. Piraeus benefits from an operationally mature multimodal system aligned with inland transit corridors, whereas Gwadar and Hambantota remain constrained by limited or incomplete Hinterland Connectivity. These sources also highlight dimensions often absent from quantitative indicators - such as project delays, operational frequency, and cost structures - which are critical to understanding Level 2 integration. This integrated evidence base forms the empirical foundation for the comparative evaluation presented in Section 4.3.

Table 7 below synthesizes the key infrastructure investments, logistics performance outcomes, and identified barriers for each port, based on the validated documentary sources discussed in this section.

Port	**Infrastructure Investment (Status)**	**Logistics Efficiency Outcome**	**Identified Barriers or Disconnects**
Gwadar	Deepwater port fully constructed with expanded quay capacity; CPEC-led ML-1 investment bypasses Gwadar	Minimal cargo throughput; Poor hinterland access	Lack of local industrial activity; Poor customs performance; Limited rail connectivity; High regional insecurity
Piraeus	Significant COSCO investment; Upgraded terminals;	High-volume rail integration and competitive transit times;	Infrastructure gaps on Corridor X (non-

	Multimodal network established via Land Sea Express	Persistent congestion at regional bottlenecks	electrified segments); Rising costs of Balkan transit
Hambantota	Multipurpose port with new energy, breakbulk, and container terminals; “Five-Pillar” development strategy implemented	Surging cargo volumes (LPG, cement, TEU transshipment), but limited full hinterland integration	No direct rail connection; Slow container yard upgrades; Political competition with Colombo

Table 7 Multimodal Connectivity: Documentary Evidence Summary

Sources: Compiled from DW (2024), SCMP (2024), RailFreight (2021), UIRR (2021), Fernando & Bandara (2021), HIPG (2025).

4.3 Transition from Level 1 to Level 2 under the Four CSFs

This section tests whether Level 1 gains enter Level 2. The four CSFs set the context, governance, hinterland, project design, and geopolitics. The question is whether capacity gains turn into operating corridors and predictable procedures within the window.

Classification follows the rule and the timing in Section 3.4. Evidence uses the windows in Tables 2 to 5. Each judgement uses at least two independent sources and combines data with dated records. The synthesis appears in Figure 15, outcomes are summarized in Table 8.

4.3.1 Governance and Institutions L1→L2

Governance asks whether procedures are adopted, enforced, and kept stable. Piraeus shows routine pre-clearance and coordinated rail dispatch. Procedures are regular and link the quay to inland services, this supports a successful transition. Hambantota has improvements for specific flows, but key clearance remains centered elsewhere. Process stability is uneven which supports a partial transition. Gwadar shows fragmented roles and irregular coordination, routine links from port to inland are missing, this leads to a failed transition.

4.3.2 Hinterland Conditions L1→L2

Hinterland tests whether the port connects to markets through reliable corridors and nodes. Piraeus is tied into rail services on the Land Sea Express, with recognized inland stops and scheduled trains, which supports a successful transition. Hambantota holds sector specific throughput with road dispatch, but no rail link and no multi-node network, which supports a partial transition. Gwadar has no rail integration and weak road access relative to trunk routes. Market reach does not improve over the baseline, which supports a failed transition.

4.3.3 Project Design L1→L2

Project design is whether capital covered the connectors and whether handoffs were planned together. Piraeus linked terminal upgrades with rail assets and operations. Quay gains feed inland schedules, which supports a successful transition. Hambantota focused spending inside the port estate. Connectors beyond the gate are limited, which supports a partial transition. Gwadar built port capacity first and left connectors unfunded or not service-ready, which supports a failed transition.

4.3.4 Geopolitics and Strategic Alignment L1→L2

Geopolitics tests whether the external setting allows reliable inland services. Piraeus benefits from a stable policy frame that lowers cross-border frictions, which supports a successful transition. Hambantota faces macro and political pressures that add volatility to network building, which supports a partial transition. Gwadar faces security and policy uncertainty that raises transit risk and deters regular services, which supports a failed transition.

4.3.5 Synthesis Judgement

Capacity alone does not deliver integration, where procedures are stable, connectors are funded, and the external setting is predictable, Level 1 gains convert to Level 2. Procedures centralize off-site, connectors lag, or risks are high, transitions are partial or fail. Figure 15 shows the composite view. Table 8 reports the outcomes by port.

Port	Port Capacity Growth	Observed Inland Connectivity	Transition Outcome
Gwadar	Full deep-sea port, multiple MSR expansions	Severely under connected; No direct rail, weak road access	Failed transition
Hambantota	Multimodal quay expansion and cargo diversification	Partially effective; Localized reach, weak multimodal access	Partial transition
Piraeus	High throughput, COSCO-led terminal upgrades	Well-connected to rail corridors via Land Sea Express	Successful transition

Table 8 Summary of Transition from Port Capacity to Inland Connectivity

4.4 Conclusion

The three cases show distinct transition patterns from Level 1 port performance to Level 2 supply chain integration. Piraeus shows a smooth transition. Throughput growth coincides with regular inland services on the Balkan rail corridor and with predictable handoffs. Hambantota shows only partial integration. Ro-Ro activity is strong, yet the container segment lacks scale and inland reach relies mainly on roads with no effective rail service. Gwadar does not achieve the transition. Activity at the quay remains limited and functional hinterland connectivity is absent while major CPEC rail works are still pending.

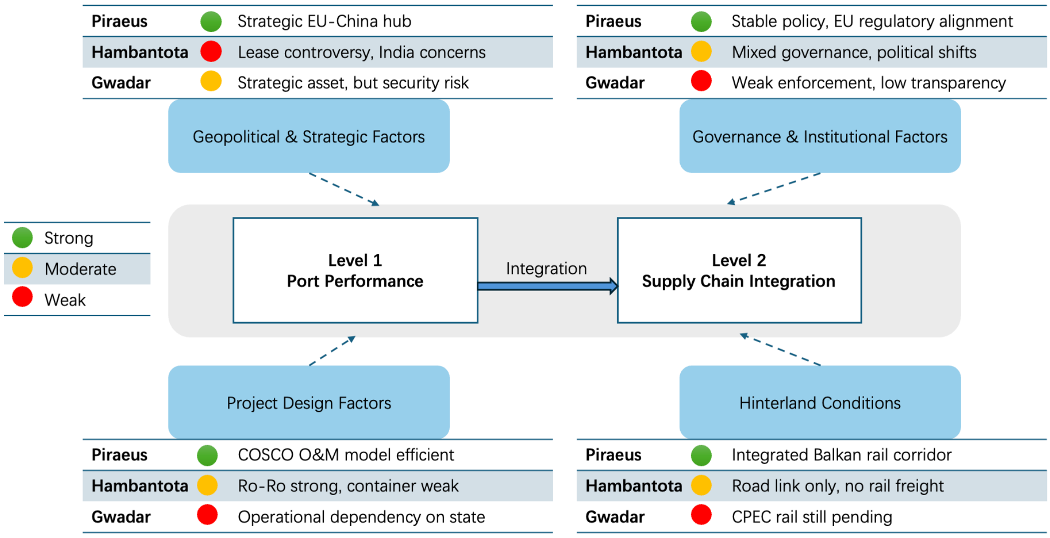

Figure 15 Comparative Illustration of CSF Influence on L1→L2 Transition (Piraeus, Hambantota, Gwadar)

Note: Colors follow the three category rule in Section 3.4.

Figure 15 presents the Critical Success Factors around the transition from Level 1 to Level 2. Colors indicate the strength of each CSF by port. Green means strong and enabling. Yellow means mixed. Red means weak or adverse. Piraeus shows strong geopolitics as a strategic EU China hub, strong governance with stable policy and EU alignment, strong project design through an efficient COSCO operations model, and strong hinterland access via the integrated Balkan rail corridor. Hambantota shows mixed conditions. Its Ro-Ro is supported by project design, while governance remains uneven and hinterland access relies on roads without effective rail freight. Gwadar shows weak conditions across most dimensions. Security and governance risks persist, operations depend on the state, and the CPEC rail connection is still pending.

Chapter 5: From Level 2 to Level 3 Supply Chain to Regional Economic Impact

This chapter examines the second link in the MLCCM. The question is whether integration at Level 2 has transited into regional economic impact. The chapter does not restate the Level 2 configuration, it treats the evidence in Chapter 4 as given and tests the pass through to Level 3.

Variables, observation windows, and color coding follow Section 3.4 and are kept identical to Chapter 4. The same three category decision rule, timing conventions, and minimum duration apply.

The analysis uses a comparative, triangulated design. Operational records and performance data are read alongside policy and institutional documents. Regional indicators provide the territorial lens. The aim is to identify signals that are consistent with the timing and nature of Level 2 integration.

Interpretation uses the four Critical Success Factors as moderating variables. Governance and institutional capacity, hinterland conditions, project design, and geopolitics and strategic alignment condition the effectiveness, breadth, and persistence of pass through. Their role is to shape the path from port operations to regional outcomes. Figure 16 illustrates how these factors moderate the link from Level 2 to Level 3.

The chapter mirrors the structure in Chapter 4. Section 5.1 reports regional outcomes for Piraeus, Hambantota, and Gwadar within the observation window. Section 5.2 examines the concrete routes and procedures through which Level 2 integration reaches inland markets, including scheduled rail or road services, customs pre declaration and risk management, and the operation of inland depots and logistics parks. Section 5.3 applies the three category rule in Section 3.4 to test whether Level 2 gains transited into Level 3 outcomes and explains the results with the Critical Success Factors. Section 5.4 concludes.

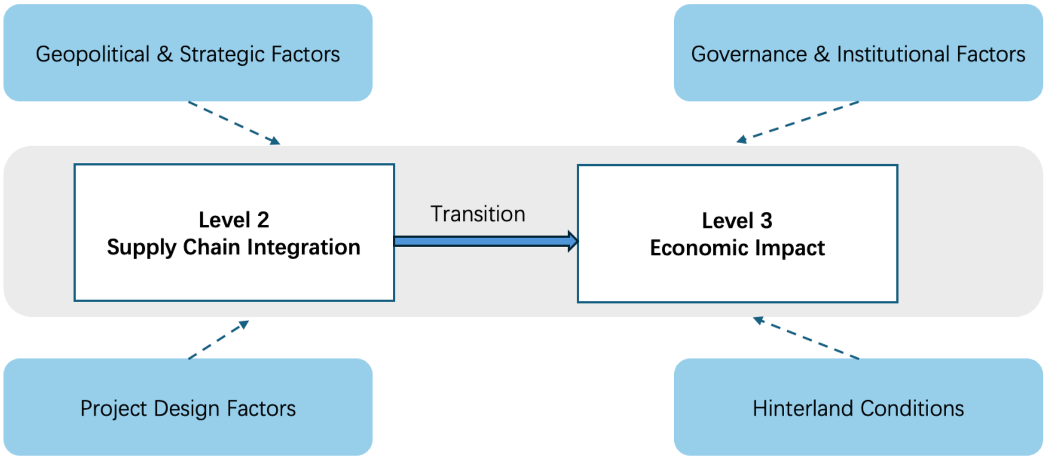

Figure 16 Moderating role of Critical Success Factors (CSFs) in the transition from Level 2 to Level 3

5.1 Regional Economic Impact (Level 3)

This section tests whether Level 2 supply chain integration has transited into regional economic impact. The reading covers Attica, the Southern Province, and Balochistan. The aim is to identify outcomes that are consistent with the timing and nature of multimodal integration rather than to attribute all change to the port alone. This sets the baseline for case-by-case assessment.

Evidence combines regional accounts, investment and employment signals, and sector structure. Where subnational GVA or PGDP is published, those series anchor the reading. Where accounts are incomplete, proxies are used with care, including throughput, tenant profiles, and observed service use. Each signal is read against the sequence of Level 2 milestones to avoid spurious inference. This keeps the analysis comparable across the three territories.

Interpretation follows the CSFs, as moderating variables. Governance and institutional capacity shape clearance predictability. Hinterland conditions set market reach. Project design aligns services with demand, while geopolitics frames risk and compliance. The case write-ups apply this lens to the observed outcomes and prepare the ground for the channel tests in Section 5.2.

5.1.1 Piraeus: Regional economic impact

This section tests whether supply-chain integration at Piraeus (Level 2) has transited into regional outcomes in Attica (Level 3). Attica hosts Greece's largest port and its main logistics hub. The setting offers a clear view of how infrastructure, operational integration, and governance relate to territorial performance.

ELSTAT reports that Attica remains the top contributor to national gross value added through 2022, with updated series released in 2025 (ELSTAT, 2025). Eurostat provides a consistent regional time series that confirms the same pattern and supports cross-checking in Section 5.4 (Eurostat, 2025). Over the last decade, the regional account is resilient despite macroeconomic shocks. Trade and logistics linked to Piraeus are part of that resilience.

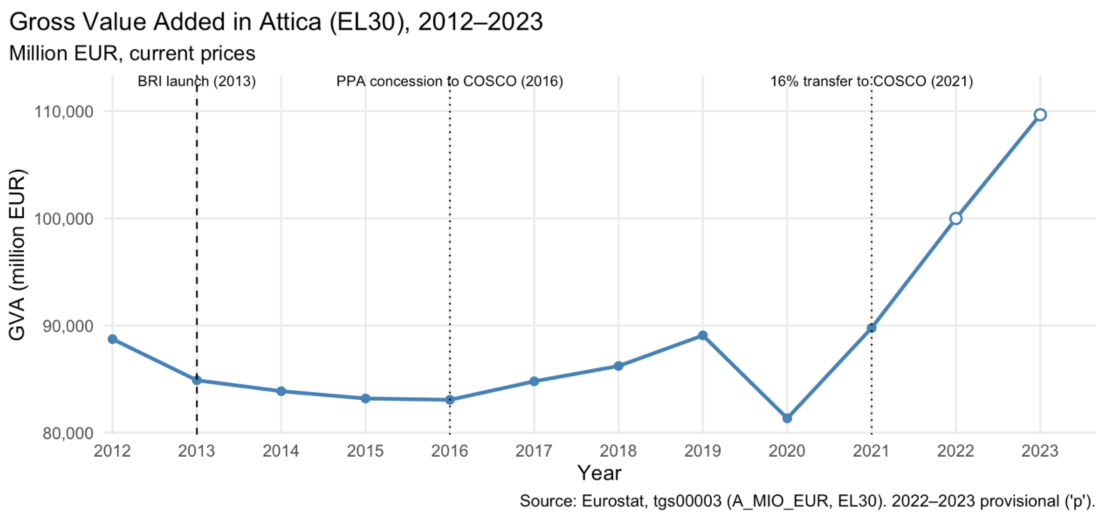

Figure 17 Gross value added (GVA) in Attica (EL30), 2012-2023, with key BRI and COSCO milestones.

Note. Data in million euros, current prices. Vertical dashed and dotted lines indicate the launch of the BRI (2013), COSCO's acquisition of a 51% stake in Piraeus Port Authority (2016), and the transfer of an additional 16% shareholding to COSCO (2021). Source: Eurostat (nama_10r_3gva, accessed August 2025).

Prior assessments outline the mechanism. IOBE estimates positive GDP and employment effects associated with the 2016 concession to COSCO, with the strongest signals in logistics and shipping related services (IOBE, 2016). The study predates recent investments, but the channel it identifies remains relevant. Integration at the port side supports the expansion of trade-related services along the corridor.

Institutional and investment milestones reinforce this path. In 2021 the Hellenic Republic Asset Development Fund transferred an additional 16 percent stake in Piraeus Port Authority to COSCO after mandatory investments were completed (HRADF, 2021). A contemporaneous report documents the transaction and its context (Reuters, 2021). These steps signal commitment to long-term capital and infrastructure delivery that underpins Attica's role.

Taken together, regional accounts, prior impact modeling, and transaction records indicate a positive, though uneven, conversion from Level 2 to Level 3 in Attica. The direction is present, while magnitude varies with sectoral cycles and external shocks. Corridor mapping that frames this reading is discussed in Section 5.2.1.

Figure 18 Western Balkans - Eastern Mediterranean Core Network Corridor.
Source: European Commission, Directorate-General for Mobility and Transport (DG MOVE), Western Balkans - Eastern Mediterranean Corridor map, TENtec, 2024.

5.1.2 Hambantota: Regional economic impact

This section tests whether supply chain integration at Hambantota (Level 2) has transited into regional outcomes in Sri Lanka's Southern Province (Level 3). The port profile is Ro-Ro concentrated, and container operations have only recently begun (SLPA, 2024). Physical access is anchored by the E01 Southern Expressway, which links the port to Colombo and the airport network (Ministry of Highways, 2023). There is no operational rail freight connection, as noted in national transport planning and project updates (ADB, 2022). Customs processes operate under ASYCUDA World and the national single window, with operator-level procedural adjustments described in recent port communications (HIPG, 2024). The operational configuration is discussed in Section 5.2.1 and Section 5.2.2.

Regional signals are read at the provincial scale because district-level gross value added is not available as a time series. Provincial GDP is therefore used as a proxy for territorial outcomes, consistent with current statistical practice (DCS, 2024). Central Bank releases report that the Southern Province maintains a mid-tier share of national output and records a modest increase between 2022 and 2023 (Central Bank of Sri Lanka, 2022, 2023, 2024). The sectoral profile remains weighted toward agriculture and services, while manufacturing and higher value-added logistics play a smaller role (DCS, 2024). The provincial statistical handbook notes high self-employment and informality, and it reports limited formal employment in modern logistics and manufacturing clusters (Southern Province Government, 2022).

The pattern implies a narrow pass through from Level 2 to Level 3. Road access via the E01 is strong and Ro-Ro volumes are high, yet the absence of rail and mid-range customs performance limit reach and predictability beyond the quay. Provincial GDP rose modestly, and the economy remains weighted toward agriculture and services with limited higher-value logistics or manufacturing. The predominance of self-employment and informality further constrains diffusion. Under the MLCCM, the case qualifies as a partial L2→L3 transition; a stronger conversion would require more predictable clearance, a rail or equivalent high-capacity inland corridor, and a more diversified cargo and service mix within the concession.

5.1.3 Gwadar: Regional economic impact

This section tests whether supply chain integration at Gwadar (Level 2) has transited into regional outcomes in Baluchistan and the Gwadar District (Level 3). Chapter 4 documents constraints in hinterland connectivity, low throughput, and procedural bottlenecks. The Eastbay Expressway improved road access in 2022, yet rail integration is absent. The implications for multimodal reach are discussed in Section 5.2.1 and Section 5.2.2.

Direct regional accounts are limited. The Pakistan Bureau of Statistics (2024) does not publish a consistent gross value added or GDP time series for the district or the province that would isolate port effects. Proxies are therefore used. These include port throughput, sectoral composition, and tenancy in the free zone.

Operational scale remains small. The Gwadar Port Authority (2024) reports about 506,800 tons of bulk cargo and 1,162 TEU in 2023. National comparators underscore the gap. Karachi Port Trust (2024) reports annual volumes that, together with Port Qasim Authority (2024), exceed 75 million tons, which places Gwadar at the margin of Pakistan's maritime economy.

Sectoral and industrial signals point in the same direction. SMEDA (2021) describes a local economy centered on fisheries, basic warehousing, and port-linked logistics, with negligible higher value manufacturing. The Gwadar Free Zone Company (2023) records limited tenancy, with most firms focused on storage and re-export rather than processing or assembly.

Within the MLCCM, these features weaken the Level 2 to Level 3 conversion. The absence of rail connectivity and documented weaknesses in customs and clearance reduce the spatial reach and persistence of spillovers. Employment gains concentrate in port operations, trucking, and informal services. Clear evidence of clustering, technology transfer, or export diversification is not present in the current record, as noted in World Bank (2023) and Asian Development Bank (2022).

5.1.4 Comparative analysis of Level 3 indicators

Attica shows the strongest signal. Regional accounts report sustained gross value added with resilience through shocks. Prior assessments identify logistics and shipping services as the main channels. The timing of institutional and investment milestones aligns with the persistence of the signal. On balance, the case meets the threshold for a material transition from Level 2 to Level 3.

The Southern Province records a positive but narrow signal. Provincial GDP increases modestly. The sector mix remains weighted toward agriculture and services, and formal employment in higher value logistics or manufacturing is limited. Road access supports port-adjacent and vehicle-handling services, but diffusion inland is slow. The case reads as a partial transition.

Baluchistan shows the weakest signal. Subnational gross value added is not available as a time series, so proxies are used. Throughput is small and free-zone tenants focus on storage and re-export. Evidence of clustering or export diversification is limited. The regional economy remains only lightly connected to port operations. The case does not show a transition.

In comparative perspective, the magnitude and spread of Level 3 outcomes track the depth and reliability of inland access and the predictability of clearance. Where services are regular and procedures are stable, signals are stronger. Where access is narrow and practice adds variance to lead times, signals are weak. The documentary record on firm entry and spillovers in Section 5.2.4 corroborates these differences and sets up the channel tests in Section 5.2 and the transition tests in Section 5.3.

5.2 Evidence Base for L2→L3

This section tests how Level 2 integration transits to regional outcomes with the Critical Success Factors as context. Governance indicates whether procedures remain predictable.

Geopolitics sets the scope for diffusion. Hinterland determines market reach and physical accessibility. Project Design ties services and risk so that inland operations can scale.

Evidence is organized along four lines within the observation windows in Section 3.4. Corridor reach and service frequency on rail and road. Customs and clearance predictability through pre declaration and risk management. Logistics capability and inland access through depots, logistics parks, and other multimodal nodes. Documentary records on firm entry and spillovers in the surrounding regions. Each line presents Piraeus, Hambantota, and Gwadar side by side to keep comparisons direct, and case profiles are not repeated.

This section does not assign final colors. It assembles the dated evidence needed for the transition test in Section 5.3.

5.2.1 Corridor Reach and Service Frequency

This section examines how corridor reach enables or constrains the conversion of Level 2 gains into Level 3 outcomes. Evidence follows the approach in Chapter 4 and focuses on service presence, service frequency, inland nodes, and commissioning dates. Figure 19 shows the Western Balkans - Eastern Mediterranean core network corridor that frames the European case.

At Piraeus, corridor-enabled pass-through rests on rail control and regular services. Since 2019 the port group has controlled Ocean Rail Logistics and PEARL, which operate block trains to Thessaloniki, Skopje, Belgrade, and Budapest (Hellenic Competition Commission, 2020). These services align with the Orient East Med branch of TEN-T and position Piraeus as a southern gateway to Central and Eastern Europe (RailFreight, 2021). Terminal rail scheduling and pre-arrival routines reduce dwell times and stabilize time-sensitive flows (Piraeus Container Terminal, n.d.). This combination strengthens the pass through from Level 2 efficiencies to regional activity in Attica.

At Gwadar, corridor reach is road-dominant. The Eastbay Expressway opened in 2022 and links the port to the Makran Coastal Highway (Government of Pakistan, 2024). The proposed

Gwadar-Quetta-ML-1 freight link remains at feasibility with no confirmed financing or start date (Dawn, 2024). In this setting, long-haul access is costlier and less reliable, which weakens the pass-through to Level 3 outcomes (Transport & Communications Bulletin for Asia and the Pacific, 2023).

At Hambantota, the network is also road-centric. The E01 Southern Expressway extension provides continuous motorway access to Colombo and the southern districts and shortens transit times for vehicle carriers and bulk cargo (Road Development Authority, n.d.). No rail link connects the port to the national network; the Beliatta-Hambantota section remains at the design stage without a confirmed timeline (Ministry of Transport, 2023). Ro-Ro flows are steady, and container services have only recently begun at modest scale (HIPG, 2023; COSCO Shipping Ports, 2024). Without rail, hinterland penetration is limited and the potential for manufacturing and distribution clusters is lower. Broad Level 3 gains will depend on deeper multimodal reach and tighter integration with the national logistics grid (Chatham House, 2020).

5.2.2 Customs and Clearance Performance

Customs procedures condition how Level 2 improvements transited into Level 3 outcomes. The reading focuses on pre-arrival screening, documentary integration, and the link between border processing and inland dispatch. The evidence is presented for each case and is aligned with the approach in Chapter 4.

At Piraeus, the EU Single Window Environment for Customs links the national system to Union databases through the EU CSW-CERTEX hub. The linkage reduces duplicate submissions and allows customs to retrieve supporting certificates across agencies (European Union, 2022). Import Control System 2 extends advance risk analysis by requiring an Entry Summary Declaration before arrival and by widening modal coverage under staged releases (European Commission, 2024). The Greek customs authority aligns ICISnet with these frameworks and ties access to EORI registration to ensure a common technical gateway (AADE, n.d.). These measures standardize data exchange and shorten handoffs between terminal operations and customs, which stabilizes time-sensitive inland dispatch from Piraeus toward the Balkans and Central Europe.

At Gwadar, the formal architecture centers on the Pakistan Single Window. The planned Port Community System is designed to integrate with the existing WeBOC platform and to digitize document exchange among port users and authorities (Pakistan Customs, 2024). Reports from the trade press indicate that actual vessel-to-release times remain longer than at Karachi or Port Qasim, with repetitive document handling and higher rates of physical inspection (Pakistan Today, 2025). Forwarder notes describe delays linked to tariff classification and duty payment clearance that extend dwell times and complicate vessel scheduling (Tianjin Unilion, 2024). The gap between the intended digital flow and observed practice raises cost and time uncertainty and weakens the pass-through from Level 2 operations to wider regional activity.

At Hambantota, Sri Lanka Customs operates ASYCUDA World as the backbone for electronic declarations. The platform supports import, export, and transit modules under the Customs ICT Directorate (Sri Lanka Customs, n.d.). The national single-window interface offers a consolidated entry point for traders to access requirements and submit documents to border agencies (Sri Lanka Customs, n.d.). Country-level benchmarking shows only moderate performance at the frontier, with the customs component below the overall logistics score (World Bank, 2023). In a network that is road-dominant, such procedural frictions narrow the spatial reach of flows and limit the durability of spillovers from port side gains.

Taken together, the legal frameworks, implementation notices, and operating records point in one direction. Piraeus benefits from mature pre-arrival screening and a single window link that lowers procedural uncertainty and supports coordinated inland dispatch. Gwadar faces delayed roll-out and inconsistent practice that keep clearance times high and schedules volatile. Hambantota works within a functioning digital stack, yet performance remains middling by global standards, which constrains the conversion of Level 2 gains into sustained Level 3 outcomes. These conditions interact with the CSFs and are considered again in Section 5.3.3.

5.2.3 Logistics Capability and Inland Access

This section reads logistics capability and inland access as channels that condition the pass-through from Level 2 to Level 3. The Logistics Performance Index (LPI) provides national context on customs, infrastructure, international shipments, logistics competence, tracking and tracing, and timeliness (World Bank, 2023). Interpretation remains cautious. Sri Lanka is missing from the 2016 edition, and Pakistan is not reported in 2023. The LPI is national rather than port specific, so conditions around Gwadar and Hambantota may be overstated relative to the country average.

Piraeus operates in a higher LPI setting and pairs that context with concrete inland access. Greece recorded an overall LPI score of 3.3 in 2023 (World Bank, 2023). The port is connected to the European rail network with regular services to inland nodes such as Thessaloniki and Skopje, which supports time-consistent access into Central and Eastern Europe (RailFreight, 2021). Operator control over Ocean Rail Logistics and PEARL since 2019 strengthens schedule reliability and coordination with terminal operations (Hellenic Competition Commission, 2020). Documentary evidence on the Land Sea Express reports more than 1,300 trains operated in 2020, which signals scale on the inland leg (UIRR, 2021). In combination, the national logistics setting and the rail corridor network support a strong pass through from port operations to inland markets. Figure 12 illustrates the corridor geography.

Hambantota operates in a mid LPI setting and a road-dominant network. Sri Lanka's overall LPI score stood at 2.7 in 2023 (World Bank, 2023). The E01 Southern Expressway links the port to Colombo and the southern districts and reduces road transit times, but there is no operational rail connection to the national network (Ministry of Transport, 2023). Operator materials note that customs and container handling capacity remain concentrated in Colombo, which shapes routing and service design at Hambantota (HIPG, 2024). This configuration supports large Ro-Ro flows yet limits deeper inland integration for time-sensitive or rail-dependent cargo.

Gwadar operates in the most constrained inland environment among the three cases. Pakistan's last reported LPI score was 2.4 in 2018, which reflects weaker national logistics capability (World Bank, 2018). The ML-1 upgrade is planned along the Karachi-Peshawar corridor, but no confirmed extension to Gwadar has been announced, as shown by current route plans and reporting (Pakistan Today, 2025). The port remains disconnected from the rail grid. As a result, long-haul access depends on slower and costlier road moves, which narrows the functional hinterland and reduces service diversity.

In comparative perspective, national logistics capability and actual inland access move together. In high LPI contexts, inland services and data systems help Level 1 gains transited into Level 2 integration and sustain regular inland reach, as seen at Piraeus. In low LPI or governance constrained contexts, structural bottlenecks weaken the pass through from multimodal potential to realized inland access, as seen at Gwadar. Hambantota sits between these poles, with sectoral strength in Ro-Ro but limited rail-based reach. The next section draws on documentary evidence of firm entry and spillovers to test whether these access patterns align with observed changes in activity..

5.2.4 Firm Entry and Documentary Evidence

Quantitative indicators show trends but miss how firms actually use the network. Documentary sources help fill that gap. They record service frequency, tenant profiles, and operating practice that do not appear in national indices. The reading below uses the same sources already cited in Chapter 4 and in Sections 5.1-5.2.

In Piraeus, records describe a rail led model that supports firm activity along inland corridors. RailFreight reports COSCO's integration of port and rail operations through PEARL and Ocean Rail Logistics and documents the Land Sea Express services into Central and Eastern Europe (RailFreight, 2021). UIRR notes an increase from 64 trains in 2014 to more than 1,300 in 2020, with diversified cargo including electronics, automotive, and manufacturing goods (UIRR, 2021). These operations indicate stable two way utilization and regular schedules that lower risk for third-party logistics and related services. The pattern is consistent with the Attica signals reported in Section 5.1.1.

In Hambantota, operator and sector studies point to growth at the quay but limited inland diffusion. HIPG reports expansion in multipurpose handling and sustained flows in LPG, cement, and containers, while confirming that distribution relies mainly on expressway links rather than rail (HIPG, 2025). Fernando and Bandara describe an operational focus at the port with weak links to inland hubs and continued concentration of higher-value logistics activity in Colombo (Fernando & Bandara, 2021). The evidence suggests that firm entry is present at the terminal side yet thinner in the wider province.

In Gwadar, documentary sources emphasize missing links and a narrow tenant base. DW and the SCMP Belt and Road project report planned rail alignments from Gwadar toward Mastung and Quetta but no tangible progress, while the ML-1 upgrade remains focused on the Karachi-Lahore-Peshawar axis (DW, 2024; SCMP, 2024). The free-zone operator records limited tenancy, with firms oriented to storage and re-export rather than processing or assembly (Gwadar Free Zone Company, 2023). These observations align with the throughput scale and sector profile discussed in Section 5.1.3.

Taken together, the documentary evidence mirrors the disparities seen in Sections 4.2.1-4.2.3. Piraeus shows an operationally mature multimodal system aligned with inland corridors. Hambantota records terminal level gains without deep inland anchoring. Gwadar remains constrained by missing rail links and a tenant mix that offers few spillovers. These sources also capture project delays, service frequency, and cost structures that national indices cannot observe. The combined record supports the cross case tests in Section 5.3 and the synthesis in Section 5.4.

5.3 Transition from Level 2 to Level 3 under the Four CSFs

This section applies the rule and the observation windows in Section 3.4. It tests whether Level 2 integration converts into Level 3 outcomes under the four CSFs. Evidence follows the windows in Tables 2 to 5 and uses the material in Sections 5.1 and 5.2. Each judgement relies on at least two independent sources. The synthesis appears in Figure 19. Case evidence for each CSF is reported in Tables 9 - 11.

5.3.1 Governance and Institutions L2 → L3

Governance asks whether stable and enforced procedures lower frictions so that firms respond within the window.

In Piraeus, the Single Window environment and staged ICS2 deployment support pre-arrival processing and regular dispatch. Terminal operations and rail services connect in routine. Regional signals appear on time and persist across periods, which supports a successful transition. See Table 9.

In Hambantota, ASYCUDA and the national single window operate, yet overall efficiency is mid-range. Process variance raises time risk and narrows the spatial reach of gains. Effects hold near the port but weaken with distance, which supports a partial transition. See Table 11.

In Gwadar, the Pakistan Single Window and the port community system are planned but not fully in force at the port. Vessel to release time is long and handling is repetitive. Costs and timing variance suppress private responses. No durable regional change is visible, which supports no transition. See Table 10.

5.3.2 Hinterland Conditions L2 → L3

Hinterland conditions set market reach and scale.

In Piraeus, operator-controlled block trains link the port to Thessaloniki, Skopje, Belgrade, and Budapest within the TEN-T network. Some last-mile limits remain in parts of the Western Balkans, yet the corridor runs at scale and regional signals endure, which supports a successful transition. See Table 9.

In Hambantota, expressway access serves nearby markets, but there is no rail link. Ro-Ro flows gain, while long-haul manufacturing logistics do not. Effects are stable at the quay and near road nodes, but diffusion is narrow, which supports a partial transition. See Table 11.

In Gwadar, road access improved after the Eastbay Expressway, but there is no rail integration and no confirmed link to ML-1. The functional hinterland remains local and road based. Signals do not persist beyond port-adjacent activity, which supports no transition. See Table 10.

5.3.3 Project Design L2 → L3

Project design asks whether assets, services, and processes move together so that logistics integration anchors private responses.

In Piraeus, equity control tied to mandatory investment integrated terminal, rail, and digital processes. Regular block trains and pre-arrival routines form the near term channel from Level 2 to Level 3. Signals are continuous after commissioning, which supports a successful transition. See Table 9.

In Hambantota, the concession scaled Ro-Ro fast and added multipurpose capacity, yet the scope remains specialized. Quay side activity is steady, but inland diversification is limited, which supports a partial transition. See Table 11.

In Gwadar, early phases prioritized basic handling and real estate leasing. The narrow functional scope limits value added activity and weakens transmission to the regional economy. Signals do not extend beyond operations and low-skill services, which supports no transition. See Table 10.

5.3.4 Geopolitics and Strategic Alignment L2 → L3

Geopolitics and policy alignment shape investor expectations and the durability of flows.

In Piraeus, EU scrutiny of strategic assets coexists with a compliance oriented path. The focus is service performance rather than expansion. Integration gains are preserved and firms keep using the corridor, which supports a successful transition. See Table 9.

In Hambantota, a foreign owned concession maintains operations through macro volatility and focuses on vehicle transshipment and energy services. Level 2 activity is stable but does not push a broader industrial build out, which supports a partial transition. See Table 11.

In Gwadar, security risk in Baluchistan and regional competition raise perceived risk. Investors shorten horizons and prefer low profile uses. Spillovers stay small and do not persist, which supports no transition. See Table 10.

5.3.5 Synthesis Judgement

Taken together, the four CSFs condition both scope and persistence of the Level 2 to Level 3 transition. Piraeus combines stable procedures, a working hinterland network, and aligned project design under a predictable external setting, so conversion occurs and endures. Hambantota records specialized success that remains narrow without rail and with mid-range procedures. Gwadar is constrained on all four dimensions and shows no transition.

CSF	Piraeus case: observed features	L2 → L3 transition channel	Primary evidence
Governance & Institutional Capacity	Launch of EU Single Window (Reg. EU 2022/2399); ICS2 Release 3 extended to maritime, road, and rail with deployment	Reduces border procedural uncertainty; stabilizes expected clearance times; enables	Regulation (EU) 2022/2399 (EU, 2022); DG TAXUD ICS2 documentation (2024); AADE guidelines for

	windows; AADE implementation	synchronization of port inland timings	deployment (AADE, n.d.)
Hinterland Conditions	ORL/PEARL block trains connecting Thessaloniki-Skopje-Belgrade-Budapest; bottlenecks in Western Balkans last-mile/transit capacity	Moves cargo inland, yet corridor constraints dampen spillover speed and reach	RailFreight (2021); Transport Community corridor and bottlenecks report (2024)
Project Design	2016-2021 share transfers linked with mandatory investment obligations; equity-integrated operator incentives continue to drive service improvements	Service reliability (consistent schedules, reduced turnaround) forms the proximate enabler of L2 → L3	HRADF release (2021); Reuters transaction report (Oct 2021); PPA Annual Report notes equity commitments
Geopolitics & Strategic Alignment	EU scrutiny over strategic infrastructure and Chinese investments exists, but has not reversed integration; emphasis shifts to compliance and service performance	Preserves integration gains while aligning operations with EU standards, focusing on service rather than expansion	European Parliament research on TEN-T and MSR (2023a, 2023b); TEN-T corridor policy framework

Table 9 CSFs, as moderating variables, in the Piraeus case.

CSF	Gwadar-specific condition	Mechanism affecting L2→L3 transition	Net effect on L3 outcomes
Governance	Weak institutional capacity in customs administration and free zone regulation; limited inter-agency coordination between Gwadar Port Authority, Gwadar Development Authority, and Pakistan Customs (Pakistan Today, 2025; Gwadar Free Zone Company, 2023).	Increases transaction costs and uncertainty for investors; delays clearance and undermines the competitiveness of time-sensitive cargo.	Constrains industrial cluster formation; deters manufacturing investment.
Geopolitics	Gwadar's role in the China Pakistan Economic Corridor (CPEC) is contested by regional security dynamics, including insurgent activity in Balochistan and strategic competition in the Arabian Sea (Charter Cities Institute, 2024; Small & Johnston, 2023).	Perceived political risk discourages long-term FDI commitments and encourages short-term or low-profile commercial uses.	Limits capital inflows and technology transfer; reinforces focus on low-value re-exports.
Hinterland	Absence of operational rail links; road network limited to Makran Coastal Highway and Gwadar-Besima segment; high inland transport costs	Restricts market reach to regional road-served zones; undermines economies of scale for industrial production.	Reduces attractiveness for processing industries requiring reliable, long-

	(Government of Pakistan, 2024; Dawn, 2024).		haul supply chains.
Project Design	Initial port and free zone phases prioritized basic cargo handling and real estate leasing over integrated logistics and industrial facilities (Gwadar Port Authority, 2024; SMEDA, 2021).	Narrow functional scope reduces potential for value-added activities within the port complex.	Keeps L3 outcomes confined to operational and low-skill service jobs.

Table 10 CSFs, as moderating variables, in the Gwadar case.

CSF	**Hambantota: Observed Features**	**L2→L3 Transition Channel**	**Primary Evidence**
Governance & Institutional Capacity	National-level trade facilitation systems (ASYCUDA, National Single Window) operational but Customs efficiency scores remain in the mid-range; clearance times and predictability remain variable.	Moderate procedural efficiency limits the reliability of time-sensitive supply chains, constraining higher-value manufacturing and export growth.	World Bank LPI (2023); Sri Lanka Customs (2024); National Single Window Portal (2023)
Hinterland Conditions	Direct access to E01 expressway and proximity to Hambantota International Airport (HRI); absence of	Efficient Ro-Ro distribution to domestic markets but limited capacity for	Road Development Authority (RDA) Project Portfolio (2024); Ministry

	operational rail link; long-haul road transport faces cost and capacity bottlenecks.	large-scale inland industrial dispersal.	of Transport Planning Documents (2023)
Project Design	Concession model under CMPort/HIPG prioritized rapid Ro-Ro scale-up and initiated container handling; cargo profile remains heavily vehicle-centric with limited diversification.	Specialization generates steady throughput growth in niche segments but limits spillover into diversified regional production.	CMPort Interim & Annual Reports (2022-2024); HIPG News Releases (2023)
Geopolitics & Strategic Alignment	Foreign-owned concession maintained operational stability through Sri Lanka's macroeconomic volatility; strategic focus on vehicle transshipment and bunkering services (energy hub positioning) over large-scale asset expansion.	Stability in core operations sustains L2 activity but dampens incentives for broader industrialization or infrastructure roll-out.	HIPG Thematic Briefs (2023); Daily FT & Colombo Page Industry Reports (2023-2024)

Table 11 CSFs, as moderating variables, in the Hambantota case.

Appendix A provides the extended comparative materials for Chapter 5, including dated documentary excerpts, additional cross-case comparisons, and data notes that support the labels reported here.

5.4 Conclusion

The cross-case reading shows that the conversion from Level 2 to Level 3 depends on how the CSFs, as moderating variables, work in combination. Where procedural governance is predictable, multimodal hinterland access is reliable, and project design aligns incentives and services, port-side gains transited into regional outcomes. Piraeus meets this configuration and records a material transition. Hambantota shows a partial transition anchored in road access and Ro-Ro specialization. Gwadar shows minimal transition under constrained access and uneven practice.

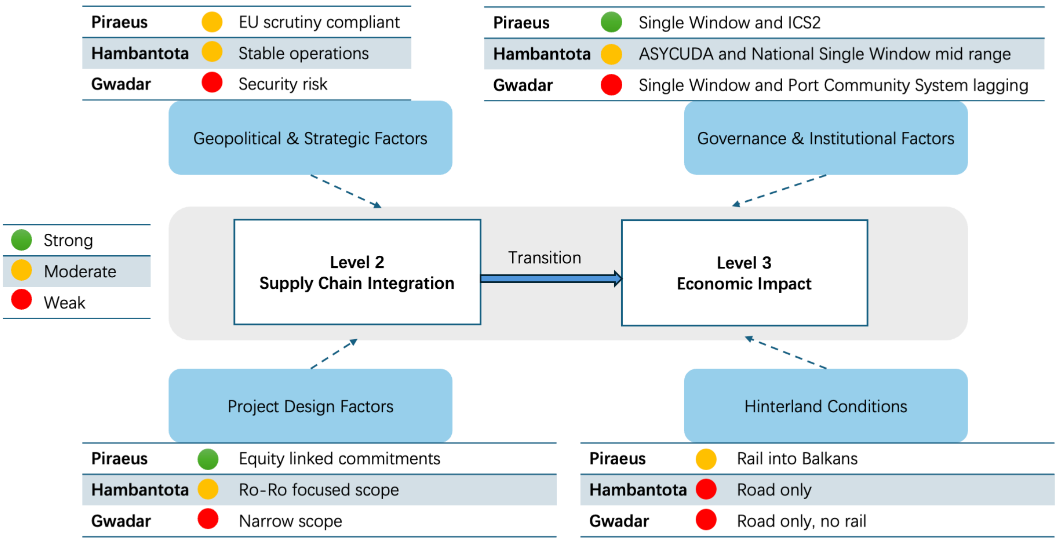

Figure 19 Level 2 to Level 3 transition - CSF-moderated synthesis across cases.

Note: Colors follow the three category rule in Section 3.4.

These contrasts set the ground for policy interpretation. Governance reduces variance in lead times, hinterland conditions set the market horizon, project design shapes service reliability and scope, and geopolitics frames risk. The evidence suggests that durable regional effects require predictable clearance tied to a multimodal corridor and an investment model that commits capital to integration rather than stand-alone assets. These implications feed directly into Chapter 6.

Chapter 6: Discussion and Conclusion

This chapter answers the full MLCCM chain. When do Level 1 port performance gains transit into Level 2 supply chain integration, and when does Level 2 transit into Level 3 regional economic impact? The answer is twofold. L1→L2 occurs when capacity upgrades are paired with corridor access and basic procedural alignment. L2→L3 occurs only when procedural governance is predictable, multimodal hinterland access is reliable, and project design binds capital and operating incentives. In the cases, Piraeus meets both thresholds. Hambantota crosses L1→L2 in a narrow form and reaches L3 only partially. Gwadar does not pass either threshold. The CSFs, as moderating variables, shape the scope and persistence of both links.

6.1 Restating the Research Question and Overall Answer

This chapter restates the central question: How and to what extent do the four Critical Success Factors - geopolitics and strategic alignment, governance and institutional capacity, hinterland conditions, and project-specific design - account for the divergent outcomes of Maritime Silk Road port projects, and under what specific conditions do these projects succeed in generating sustained regional economic benefits? The answer is that the four CSFs explain the divergent outcomes by moderating the two links in the chain. Sustained regional benefits arise only when procedures are stable and enforced, multimodal hinterland access, especially rail is reliable, and project design finances the connectors and coordinates the handoffs, and geopolitics sets the risk floor but works through these channels. Where one or more of these conditions are missing, effects are narrow or absent; where all hold, conversion occurs and persists (in Piraeus, versus the partial case of Hambantota and the non-transition in Gwadar).

6.2 Cross-Case Findings on the L1→L2 and L2→L3 Transitions

This section draws its answer from Chapters 4 and 5. Table 12 consolidates the two links for each port and reproduces the traffic-light labels reported in those chapters under the common rule and observation windows set in Section 3.4. The first link is treated as a precondition. The second link is the main test.

Case	L1→L2 status	L1→L2	L2→L3 status	L2→L3	Result
Piraeus	🟢	Operator-controlled block trains; Terminal–rail coordination; Usable corridor access	🟢	Predictable clearance; Reliable multimodal reach; Binding investment incentives	**Material transition**
Hambantota	🟡	Expressway access; Ro-Ro specialization; No rail link	🟡	Effects narrow and fade with distance; Mid-range procedural performance	**Partial transition**
Gwadar	🔴	Road-only inland reach; Small scale; Variable practice	🔴	No durable spillovers; Storage-oriented tenants; Weak channels	**No transition**

Table 12 Chain status across cases: L1→L2 and L2→L3

Note: Labels reproduce the results of Chapters 4 and 5 and follow the rule and windows in Section 3.4.

Piraeus

L1→L2 is in place. Operator controlled rail services and coordinated terminal rail operations sustain regular inland dispatch. L2→L3. Predictable clearance and scheduled trains support activity beyond the quay, and Attica records sustained signals in logistics and trade services. Scope is broad along the corridor and persistence is visible across cycles, though strength varies with bottlenecks and external shocks. This profile provides the reference for the partial and negative cases that follow.

Hambantota

L1→L2 exists in a narrow form. Expressway access is strong but there is no rail link to the trunk network. L2→L3 is positive but limited. High Ro-Ro volumes support port-adjacent services, while inland diversification is modest and mid-range procedural performance reduces predictability. Effects weaken with distance from the port and concentrate near the expressway. This partial pattern frames the lower bound observed in the next case.

Gwadar

L1→L2 has not been achieved. Inland reach is road-bound, throughput is small, and clearance practice is variable. L2→L3 is not present. Spillovers are confined to operations and informal services, with no clear evidence of clustering or export diversification. Without a high-capacity inland link and more predictable procedures, regional effects remain minimal. This outcome anchors the floor for the cross-case comparison.

Across cases, the size and spread of Level 3 outcomes track three conditions that must work together: predictable procedural governance, reliable multimodal hinterland access, and a project design that binds capital and operating incentives. Geopolitics sets the risk environment but acts through these routes and procedures. The next section examines scope and persistence and then interprets the contrasts through the Critical Success Factors.

6.3 Role of Critical Success Factors (CSFs)

This section summarize the four CSFs, as moderating variables, across the full MLCCM chain. The goal is to explain when Level 1 gains transit into Level 2 integration and when Level 2 transits into Level 3 regional impact. The reading is comparative and draws on the evidence in Chapters 4 and 5.

Governance and institutional capacity shape both links. For the L1→L2 link, alignment between customs timing and terminal operations enables regular inland dispatch. Piraeus meets this test through single-window use and advance screening that match train schedules. Hambantota runs a working digital stack but mid-range performance adds variance to release times and narrows inland reach. Gwadar shows gaps between design and practice that raise time risk and block stable handoffs. For the L2→L3 link, predictable procedures sustain corridor use and help regional activity persist beyond the quay. This sets the stage for how far gains can travel.

Hinterland conditions set the market horizon. For the L1→L2 link, a rail leg and usable inland nodes are decisive. Piraeus controls block trains on a functioning corridor. Hambantota relies on an expressway without rail. Gwadar depends on a single coastal road. For the L2→L3 link, scale and distance matter. Where flows move at rail scale, effects travel farther and last longer. Where access is road-only, effects remain local and fade with distance. This defines the spatial ceiling for spillovers.

Project design binds capital and operating incentives. For the L1→L2 link, equity control and mandatory investments in Piraeus align terminal assets, rail services, and digital processes. Hambantota's concession scaled Ro-Ro quickly but kept a narrow scope. Gwadar's early phases focused on basic handling and leasing. For the L2→L3 link, design that ties service reliability to investment keeps channels open and supports diffusion into inland activity. Where scope stays narrow, spillovers remain thin. This links asset choices to economic reach.

Geopolitics and strategic alignment frame risk but act through the other channels. For the L1→L2 link, scrutiny and security conditions affect permits, staffing, and service continuity. Piraeus followed a compliance-oriented path that preserved integration. Hambantota kept operations stable through cycles without a large inland build-out. Gwadar's higher security risk shortened investor horizons. For the L2→L3 link, the same risk profile shapes the persistence and scale of effects. This context conditions private commitments over time.

Taken together, the CSFs operate as a weakest-link system across both transitions. Durable Level 3 outcomes appear when predictable procedures, reliable multimodal reach, and binding project incentives work together. If any link fails at L1→L2, the chain breaks. If it holds at L1→L2 but fails at L2→L3, effects remain narrow and short-lived. This synthesis prepares the policy reading that follows.

6.4 Theoretical and Methodological Contributions

This thesis refines the MLCCM as a two-link chain with different failure risks. Level 1 gains are necessary but not sufficient for Level 2. Level 2 gains are necessary but not sufficient for Level 3. The four CSFs, as moderating variables, explain why links hold or break. Governance sets procedural predictability. Hinterland sets market reach. Project design aligns incentives with service reliability. Geopolitics frames risk through these channels.

Methodologically, the study turns the model into a replicable test. Chapter 3 maps each variable to indicators and sources. Chapters 4, 5 apply the same templates and triangulate series with documentary records. The traffic light synthesis and the scope persistence checks travel across sites with minimal data burden. Together they make the MLCCM testable beyond the three cases and ready for policy use.

6.5 Limitations

Data coverage is uneven across the three ports. Release schedules differ, and some series appear with delay. All quantitative data are aligned to calendar years with one baseline year set before the major MSR investment. Project and commissioning timelines are matched to annual series on a best-evidence basis, which can introduce small alignment error.

Measurement is not fully comparable across sources. Definitions for throughput, cargo types, and FDI differ by agency, and units are not uniform. Clearance time is not available as a consistent time series, so policy go-live windows and the customs dimension of the LPI are used as proxies. LSCI and LPI provide context only; both are composite and reported at the national level. Results based on these proxies should be read as directional rather than precise.

Causal attribution is bounded. The design relies on comparative process tracing, not statistical identification. Concurrent shocks and policy shifts can move trade and logistics independently of MSR investments, and reverse causality is possible. Qualitative materials may be selective; triangulation reduces, but does not remove, this risk. Evidence at Level 3 is deeper for Attica than for Hambantota and Gwadar, so cross-case comparisons combine direct measures and proxies and require caution. External validity is limited: the study supports analytical generalization about the MLCCM mechanisms, not statistical claims for all MSR ports, and outcomes will vary with governance, geopolitics, hinterland, and project design.

6.6 Future Research

Future work can deepen the evidence base. Firm level panels for tenants, logistics providers, and manufacturers along the corridors would allow matching entries and exits to commissioning dates and to customs changes. Micro time stamps on clearance, train dispatch, and truck gates can be linked to delay and price. Geocoded investment and employment at NUTS 3 or district scale, together with night lights and freight waybills, can cross check scope and persistence.

Methods can advance. Synthetic control can test both links of the MLCCM. Event study designs can measure the effect of single window upgrades or ICS2 deployments on dwell time and inland dispatch. Route capacity models can estimate the rail scale needed before Level 2 gains transited into Level 3. Bottleneck maps can be tied to threshold tests for diffusion.

The framework can be extended. Project finance variables can be coded to capture how capital commitments link to service reliability. Environmental and resilience metrics can track shocks and recovery. Inland dry ports and special economic zones can be modelled as separate nodes within Level 2. A wider MSR sample can test the weakest link claim at scale.

These directions set a concrete path to reduce uncertainty in measurement, to strengthen identification, and to generalize the MLCCM beyond the three cases studied here.

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Appendix A. Extended Comparative Materials for Chapter 5

This section synthesizes the evidence from Sections 5.1–5.3 to read cross-case patterns in the transition from Level 2 to Level 3. The magnitude and distribution of spillovers vary with the maturity and interaction of the four CSFs, as moderating variables. Where governance reduces variance in clearance time, hinterland access is reliable, and project design aligns incentives and services, the path from port operations to regional outcomes is visible. Where these conditions are partial or absent, signals are narrow or weak.

Attica shows the most complete configuration. Regular rail services, predictable clearance, and an equity anchored project design support persistent activity beyond the quay. The Southern Province shows a partial transition. Road access and Ro-Ro specialization sustain port-adjacent services, but inland diffusion is modest and procedural performance remains mid-range. Baluchistan shows minimal transition. Operational scale is small, inland access is road-bound, and tenants are storage-oriented. These contrasts are consistent with the channel tests in Section 5.2 and the CSF patterns in Section 5.3.3.

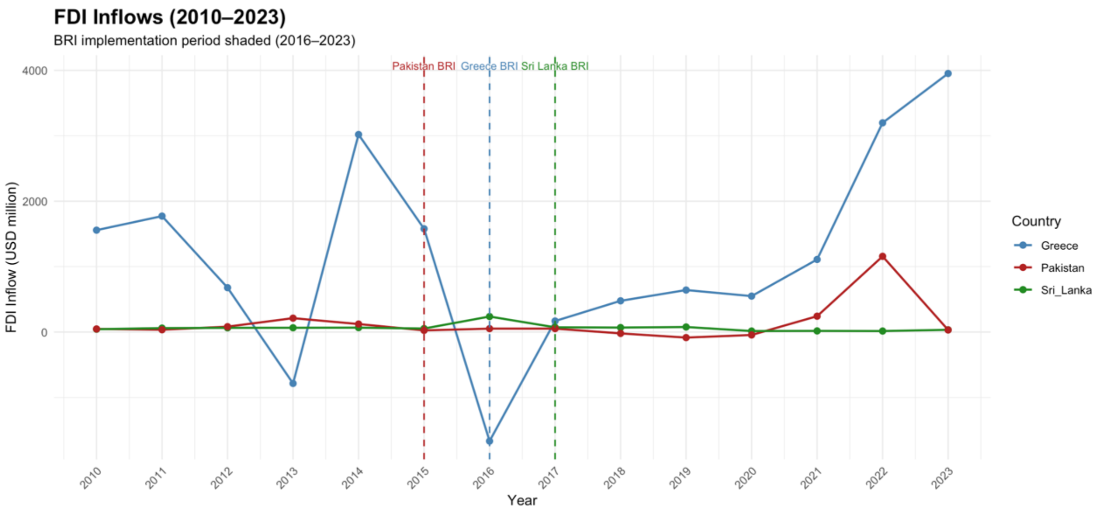

Figure 20 Annual FDI inflows to Greece, Pakistan, and Sri Lanka, 2010-2023

Source: UNCTADstat (Inward FDI flows, annual), downloaded [Jun 2025].

The cross-case CSF configuration can be summarized at a glance. The European case pairs mature procedural governance with multimodal reach and binding investment obligations. The Sri Lankan case combines a functioning digital stack with road-dominant access and a specialized cargo profile. The Pakistani case faces fragmented implementation, limited inland reach, and a narrow project scope.

CSF	Piraeus - Observed Features	Hambantota - Observed Features	Gwadar - Observed Features	Primary Evidence
Governance & Institutional Capacity	Mature EU-level procedural governance (Single Window, ICS2) ensuring high predictability and customs port integration.	ASYCUDA and National Single Window operational; customs efficiency moderate, predictability limited.	Procedural unpredictability; fragmented coordination across agencies.	European Commission (2024); HIPG (2023); Pakistan Today (2025)
Hinterland Conditions	Integrated ORL/PEARL rail network and diversified road links to Balkan/Central Europe.	Direct E01 highway link; HRI airport connection; no operational railway; cost and capacity constraints.	Incomplete rail link; reliance on single coastal corridor vulnerable to disruption.	RailFreight (2021); RDA (2023); China Briefing (2024)
Project Design	COSCO concession with binding investment clauses;	CMPort/HIPG concession expanded Ro-Ro operations; Container handling	Concession model with limited binding obligations; weak expansion incentives.	COSCO Annual Reports; HIPG News; Gwadar Free

	diversified cargo base.	initiated but concentrated.		Zone Co. (2023)
Geopolitics & Strategic Alignment	Stable EU-China cooperation; positioned as MSR-EU gateway.	Maintains operations through political cycles; prioritizes vehicle transshipment and fuel services.	Security risks and fluctuating bilateral dynamics under CPEC constrain investor confidence.	The People's Map (2024); Chatham House (2020); Charter Cities Institute (2024)

Table 13 Cross-case comparison of CSFs influencing L2→L3 transition

Source: Port authority data, government reports, industry publications, and international organization datasets.