

China's Belt and Road Initiative: Motivations for Strategic Decision-Making in Global Transport Operations from a Maritime and Marine Engineering Perspective

Çin'in Kuşak ve Yol Girişimi: Küresel Ulaştırma Operasyonlarında Denizcilik ve Deniz Mühendisliği Perspektifinden Stratejik Karar Alma Motivasyonları

Türk Denizcilik ve Deniz Bilimleri Dergisi

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ABSTRACT

China's Belt and Road Initiative (BRI), announced in 2013, is a mega project designed to enhance global transportation infrastructure and stimulate economic development. This study aims to identify and prioritize the key motivational sources driving China's BRI, with a particular focus on economic, political, and strategic considerations. Using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) systematic literature review and focus group methods, we identified 26 motivational factors, 16 of which are primarily economic in nature. Among these, 'New business opportunities for Chinese investors' emerged as the most significant driver. In addition to economic motivations, this study highlights the critical importance of marine engineering, ship risk management, and ship machinery innovations in the success of BRI's maritime routes. Safe, efficient maritime transportation is identified as a crucial element for ensuring the operational effectiveness of the Maritime Silk Road. The study further emphasizes the role of maritime safety protocols, infrastructure modernization, and risk mitigation strategies in achieving China's broader geopolitical and economic ambitions through the BRI. Our findings suggest that China's internal motivations, particularly those related to economic growth and maritime transport infrastructure, play a more prominent role than external factors. This underscores the need for policymakers, marine engineers, and transport operators to align their long-term strategies with China's ambitions, focusing on maritime safety, operational efficiency, and the global competitiveness of China's maritime technologies. The insights gained from this study contribute to a deeper understanding of the strategic importance of maritime infrastructure in shaping the future of global transportation systems under the BRI.

Keywords: Maritime Transportation, Belt and Road Initiative, ANP, PRISMA, Marine Engineering.

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ÖZET

Çin'in 2013 yılında duyurduğu Kuşak ve Yol Girişimi (BRI), küresel ulaşım altyapısını geliştirmek ve ekonomik kalkınmayı teşvik etmek amacıyla tasarlanmış dev bir projedir. Bu çalışma, Çin'in BRI'sini yönlendiren ana motivasyonel kaynakları, özellikle ekonomik, politik ve stratejik unsurlar açısından tanımlamayı ve önceliklendirmeyi amaçlamaktadır. PRISMA sistematik literatür taraması ve odak grup metodları kullanılarak, 26 motivasyonel faktör belirlenmiş olup, bunların 16'sı esas olarak ekonomik niteliktedir. Bu faktörler arasında 'Çinli yatırımcılar için yeni iş fırsatları' en önemli itici güç olarak ortaya çıkmıştır. Ekonomik motivasyonlara ek olarak, bu çalışma, BRI'nin deniz yollarının başarısında deniz mühendisliği, gemi risk yönetimi ve gemi makineleri inovasyonlarının operasyonel etkinliğini sağlamak için hayatı bir unsur olarak tanımlanmıştır. Çalışma ayrıca, Çin'in daha geniş jeopolitik ve ekonomik hedeflerine ulaşmasında deniz güvenliği protokolleri, altyapı modernizasyonu ve risk azaltma stratejilerinin rolünü vurgulamaktadır. Bulgularımız, özellikle ekonomik büyümeye ve deniz taşımacılığı altyapısına yönelik olan Çin'in iç motivasyonlarının dış faktörlerden daha önemli bir rol oynadığını göstermektedir. Bu durum, politika yapıcılar, deniz mühendisleri ve ulaştırma operatörlerinin, uzun vadeli stratejilerini Çin'in hedefleriyle uyumlu hale getirmeleri gerektiğini, deniz güvenliği, operasyonel verimlilik ve Çin'in deniz teknolojilerinin küresel rekabet gücüne odaklanmaları gerektiğini ortaya koymaktadır. Bu çalışmadan elde edilen bilgiler, BRI kapsamında deniz altyapısının küresel ulaşırma sistemlerinin geleceğini şekillendirmedeki stratejik önemine daha derin bir anlayış kazandırmaktadır.

Anahtar sözcükler: Deniz Taşımacılığı, Kuşak ve Yol Girişimi, ANP, PRISMA, Deniz Mühendisliği.

1. INTRODUCTION

BRI (Belt and Road Initiative) was first suggested in 2013 to promote cooperation and connectivity among nations through trade, investment, and infrastructure initiatives (Zhao, 2019; Han *et al.*, 2022; Zhang and Chen, 2022; Wu, 2022). BRI was launched by China, and covers three-quarters of nations (Huang, 2016), accounting for approximately thirty percent of the global Gross Domestic Product and more than fifty percent of the world population (Chan, 2017; Li *et al.*, 2022). Geographically, SREB (Silk Road Economic Belt) is divided into three main directions. China is connected to the Europe region via Central Asia and Russia on the first route (Baltic Sea). The second route, which passes via the Central Asia area and West Asia, connects China with Europe through the Mediterranean and the Persian Gulf. The third route, which passes via South Asia region and Southeast Asia, connects China with the Indian Ocean area. The MSR (Maritime Silk Road) also links China's coastal ports with the area of the Indian Ocean, which stretches from Africa to Europe, as well as the Pacific Ocean (Huang,

2016; Hafeez *et al.*, 2018; Peng *et al.*, 2022).

Regional collaboration is one of the initiative's primary objectives between China's authorities and the initiative's member states based on present and prospective bilateral and multilateral organizations along the route (Cieślik, 2020; Wu *et al.*, 2021; Wang and Lin, 2022). The SREB is China's attempt to link its underdeveloped western part to Europe via the area of Central Asia. The second part of the Chinese authorities' strategy is to construct a sea part of the initiative that will connect Southeast Asia -one of the fastest-growing regions- to provinces of China's south via ports and railroads (Hsu and Chien, 2022). The Chinese government's BRI program aims to provide access to important trading nations and areas in the Southeast Asia and the Middle East. By recreating ancient BRI, the project may also boost connectivity and economic cooperation among the participating countries along the route of the initiative as demonstrated in Figure 1. (Chen *et al.*, 2019; GFD, 2022; Bakhsh *et al.*, 2022).

In the detailed literature review, it was found that the background of the initiative and motivation of China was mentioned by Huang (2016), Kang

(2018), and Chan (2019), however, comprehensive studies related to motivation sources of China were not reached. The accomplishment of this enormous undertaking is well beyond comprehension given that China has a massive economy and production line (Huang,

2016). Figure 1. indicates that participation in the project is constantly growing, and the project idea is receiving worldwide attention. By March 2022, 147 countries have signed a Memorandum of Understanding (MoU) with China to be part of the initiative.

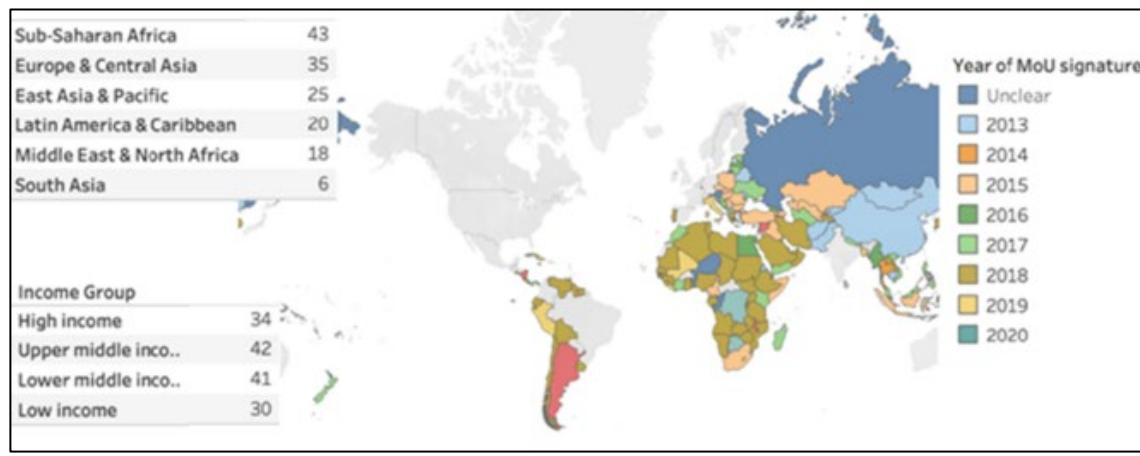


Figure. 1. Member Countries of the BRI (GFD, 2022)

The global transport network may change under Chinese leadership if China completes the project. Since the effort of the initiative has already had an impact on the economic conditions of various nations both member and non-member countries, it is clear that the project has the potential to alter more than just the world transportation order (Laurenceson *et al.*, 2019; Lin, 2019; Drysdale and Armstrong, 2021). Policymakers, logistics managers, and transport operators must understand China's motivation for developing this project in order to decide how to respond to recent developments relating to the program.

The study first examines the Strategic Management Process, the Concept of the Study, and the Theoretical Framework. The third section details the Research Methodology, followed by the Systematic Literature Review using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), Focus Group Studies, and the ANP (Analytic Network Process) method, with validation provided in the fourth section. In the fifth section, the focus shifts to Marine Engineering, Maritime Transportation Efficiency, and Maritime Safety. Finally, the Discussion and Conclusion summarize the study's key findings, emphasizing the strategic

implications for policymakers, engineers, and transport operators within the BRI framework.

2. THEORETICAL FRAMEWORK

In order to identify crucial success determinants in the internal and external contexts of firms, the practice of strategic management was first made popular half a century ago (Porter, 1980; Murcia *et al.*, 2022). The term "strategic management" described both the function of management and the possibility of strategic decision-making (Taylor, 1947; Simon, 1947; Koseoglu, 2022). Strategic management is a commonly preferred tool by researchers (Kazemi and Szmerekovsky, 2015; Elia *et al.*, 2015; de Fátima Teles and de Sousa, 2017; Elrahman and Al, 2017) for identifying internal and external challenges for transportation companies (Chandler, 1962; Andrews, 1971). In order to build the company's strategic posture, which is expressed via the statement of values, vision, purpose, and strategic objectives, the manager must be able to monitor and analyze the reality of the organizational context, both internal and external. The general corporate strategy may then be defined, and afterward, goals and particular activities can be suggested. As a result,

it is clear how crucial strategic alignment is throughout the entire procedure (Hit *et al.*, 2002; Bora *et al.*, 2017; Barbosa *et al.*, 2020). Strategic management is seen to be greatly facilitated by managers having a stronger awareness of current economic trends and the changing business environment, particularly in relation to consumers, rivals, financial needs, and regulatory bodies (Ju *et al.*, 2020; Murcia *et al.*, 2022).

The strategic management process is an iterative process with a number of phases, such as scanning the present environment and situation,

strategy formulation, putting those strategies into action, and evaluating strategies. Fig. 2. indicates that environmental scanning is the first phase of the strategic management process (Hitt *et al.*, 2016). To ascertain the evolution and projections of factors that will impact the success of the organization, both the internal and external environments should be examined (Chofreh *et al.*, 2021). The term "environmental scanning" means the possession and use of data on occurrences, relationships, patterns, and trends in the organization's environments.

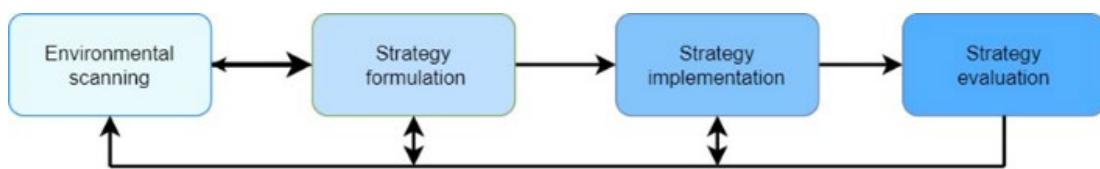


Fig. 2. Strategic management process (Chofreh *et al.*, 2021)

The transportation operators are immediately impacted by the BRI progress, the transportation investments made along the route, and the attitudes of the governments regarding the project. A clear understanding of China's view of the project will allow transport operators to make more coherent future decisions about the project. This study both explained the motivational sources of China and prioritized the motivational sources among themselves. Gathering information about events, trends, and external environment data required by the transportation businesses will be ensured within the framework of the BRI during the environmental scanning process, which is the initial step of the strategic management process in the study.

The idea of the survival-based theory consists the framework of the study and is used as a starting point of the research. The method employed by a company to prevent being wiped out by rivals is known as the survival-base theory (Gibcus, 2003). The core element of a survival strategy is that a company must constantly adjust to its competitive environment in order to survive. New paradigms for thinking about and behaving in the business world seem to emerge every decade (Brian, 1996). If transportation companies along the route of the BRI have been affected directly or indirectly by BRI

transactions, they should adapt to the changes in the transportation sector related to the project. In the literature on strategic planning, it is assumed that businesses would revise their plans in response to significant changes in the world economy and transportation sector. In this regard, the BRI is among the topics that have to be discussed and researched in the long-term plans for the ensuing ten to thirty years.

3. RESEARCH METHODOLOGY

Expert knowledge, existing literature review, survey, or any mix of the three are all viable options for developing the ANP (Analytic Network Process) model. In the first scenario, a group of experts debates and/or offers the ANP research elements and linkages for the choice. In this situation, to construct a reliable model, the study needs to specify who the selected experts are, their job titles, or provide any other justification to explain their 'expert' qualifications. Based on the second option to develop the ANP model, researchers can evaluate the existing literature and develop decision factors based on it (Mu *et al.*, 2020). As shown in Fig. 3 to determine the main motivation sources and develop the ANP model, as a data collection tool, focus group study and PRISMA

systematic literature review methods were preferred in the first part of the methodology. Step one demonstrates that pairwise comparison matrices were answered by the expert team and the weight of each subfactor was identified. To

reach the output of the study, supermatrix calculations were presented in the second step of the study. The last part of the methodology involves prioritizing the main motivational sources of the BRI.

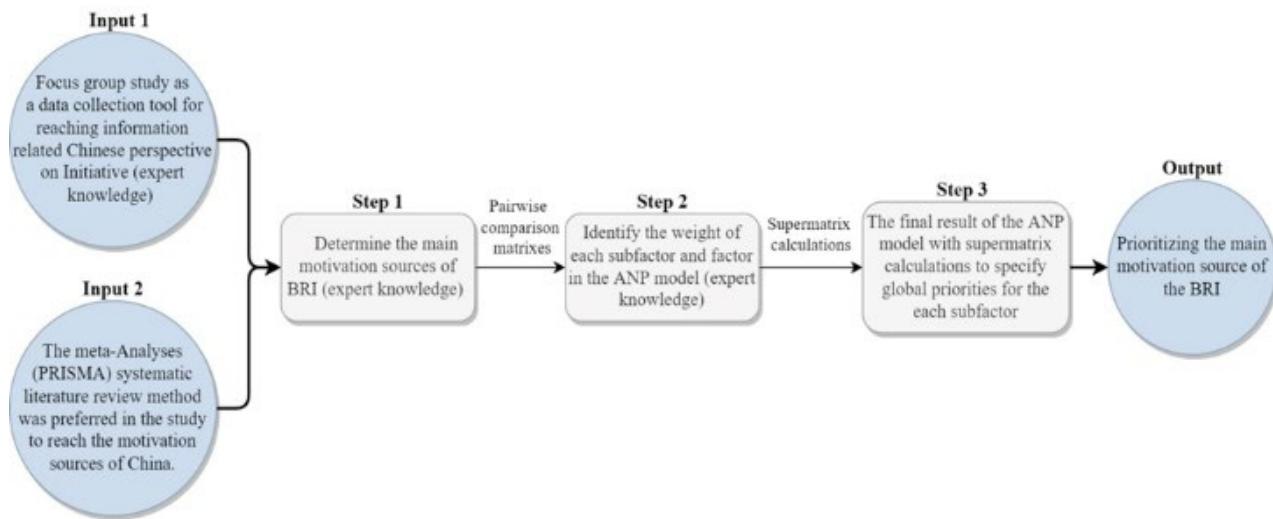


Figure 3. Research methodology

3.1. Systematic Literature Review approach as a Data Collection Tool

The systematic literature review technique was used to gather information from the literature in order to determine China's motivations to establish BRI. The PRISMA technique was used in the study to reach the motivation sources of China. The PRISMA approach is commonly preferred by researchers (Kalanlar, 2021; Frost *et al.*, 2022; Kim *et al.*, 2022; Innocenti *et al.*, 2022) applying a systematic literature review.

3.1.1. Inclusion-exclusion criteria with search strategies

Three literature databases were searched; Web of Science, Scopus, and Taylor & Francis to gather information from BRI-related studies. In the study, to reach more publications, keywords were determined from a more general perspective as "belt and road", and "one belt one road" keywords were preferred. The search technique used combinations of chosen words and phrases that were adapted for each database. The first announcement of the project was in 2013, therefore a sample of full-text articles in English covered between September 2013 and

December 2022 were chosen. Meeting abstracts, letters, grey literature, editorial materials, and proceedings papers were excluded from the sample of the review. The study includes only articles written in English.

3.1.2. Search procedure

The direction of the search process was determined using the PRISMA technique, which stands for recommended reporting items for meta-analyses and systematic literature review (Page *et al.*, 2021; Kalanlar, 2021). Fig. 4 indicates that the PRISMA systematic literature review.

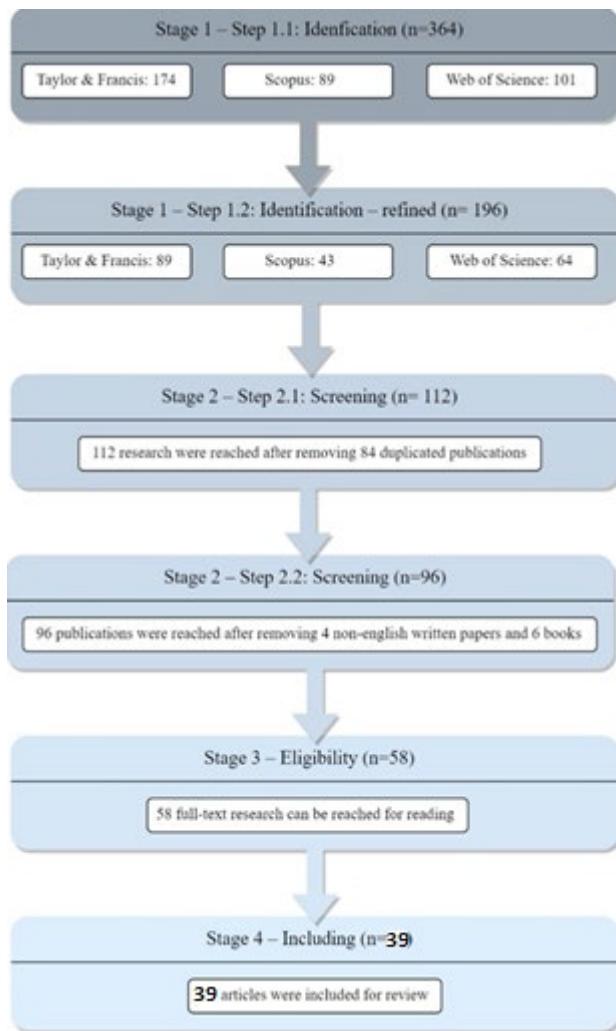


Figure. 4. PRISMA methodology for systematic literature review

The method includes four steps; 1- Identification; 2- Screening; 3- Eligibility; and 4- Including (Ortiz-Martinez *et al.*, 2019). Selected articles help to reach the main motivation sources of BRI from the perspective of China. As a result, 364 relevant research articles were reached in the databases at end of the first step. To reach the objective of the study, the research was narrowed down by using the keywords of “China”, “motivation”, “motivation of China”, “China’s motivation”, “China’s perspective”, and “perspective of China”. In social sciences papers containing these chosen keywords, there were 196 publications overall. In the second stage of the method, publications that are not written in English, duplicate publications, and research that has only an abstract were subtracted from the total list. Consequently, 96 articles were reached

at the end of second stage. In the eligibility part of the research method which covers stage 3, publications were separated by their subject, abstract, and title to remove irrelevant papers from the sample. 58 full-text articles were determined at the end of stage 3. In the last part of the PRISMA method, the eligibility of the complete texts of these publications was evaluated; as a consequence of this final step evaluation, there were 39 papers total in the review.

3.1.3. Findings

Considering the criteria of the study, 39 articles satisfied the requirements, as shown in the PRISMA diagram in Fig. 4. Table 1 lists the authors, motivation sources for China, year of publication, and ANP model code. PRISMA's systematic literature review process helped identify 15 Chinese motivational sources from the literature.

The Initiative's avowed goals are to maintain deeper economic relations, support understanding of mutual perspective, ensure world peace, increase cultural collaboration between participating countries, and strengthen political agreements and goodwill among member countries (Chang, 2016; Yu *et al.*, 2019) (Code E15).

Collaboration in energy transportation between participating countries of BRI and China has also become a critical subject between participating countries on the route and Chinese authorities (Wang and Lin, 2022; Huang *et al.*, 2021; Blah, 2018) (Code EN1).

By creating a multilevel intergovernmental structure for macro-policy discussions, this initiative realizes China's omnidirectional peripheral diplomacy (Cheng, 2016, Huang, 2016) (Code S2).

Trade and financial integration are designated as essential pillars of the BRI's economic agenda, with significant regional and global implications. The economy of China has slowed down after more than 30 years of exceptionally rapid expansion. The manufacturing sector in the country has a high level of excess capacity particularly in heavy sectors like steel, cement, and aluminum, owing to diminishing local and international demand, mostly from wealthy

nations. Despite the fact that China slashed over more than one billion job opportunities from 2016 to 2017 to cope with manufacturing excess capacity, growing foreign demand, or exports, are regarded as effective and urgent strategies to

support China's continued economic development. (Huang, 2018; Yu et al., 2020; Dai and Zhu, 2022; Nugent and Lu, 2021; Clarke, 2018; Deng, 2021; Yu et al., 2019) (Code E2).

Table 1. Determining China's motivation sources to create BRI from the PRISMA systematic literature review

Author	Year	Motivation Source of China	ANP Model Code
Wang and Lin	2022	Ensuring China's energy security	
Huang et al.	2021	with alternative transportation routes	EN-1
Blah	2018		
Cheng	2016	Improving economic and cultural relations between countries	E-15
Yu et al.	2019		
De Soyres et al.	2019	Reducing transport times	E-10
Blah	2018		
Chang	2016	Improving diplomatic relations	S-2
Huang	2016		
Cheng	2020	Leveraging initiative against claimant states in the South China Sea	S-3
Yu et al.	2020		
Dai and Zhu	2022		
Nugent and Lu	2021	Overcapacity problem	E-2
Clarke	2018		
Deng	2021		
Huang	2018		
Clarke	2018	China's willingness to use its cultural soft power	S-4
Rolland	2017		
Callaghan and Hubbard	2016	Combating terrorism, separatism, and religious extremism	G-2
Rehman and Noman	2021		
Kong et al	2021		
Haider et al	2021		
Clarke	2018	The desire for economic growth	E-1
Deng	2021		
Flint and Zhu	2019		
Rolland	2017	Reducing American influence in Asia	S-1
Clarke	2018		
Zhou and Esteban	2018		
Deng	2021		
De Soyres et al	2019	Reducing transport costs	E-9
Zhang et al	2017		
Eichengreen and Lombardi	2017	Desire to make the renminbi (RMB) a global currency in the world market	E-8
Blah	2018		
Rolland	2017		
Callaghan and Hubbard	2016	China's desire to ensure its border security	G-1
Rehman and Noman	2021		
Zhou and Esteban	2018	Desire to have the largest economy in the world to be the rule maker	E-13
Sharma	2019		
Cheng	2020	Helping global prosperity	E-14

The initiative was regarded as the top-level strategy for China's opening to the outside world since it attracted the interest of many nations across the world. China views the project as a lever to boost its recent low trend in growth rate and catch up to its previous economic growth rate (Haider *et al.*, 2021; Clarke, 2018; Deng, 2021; Kong *et al.*, 2021) (Code E1).

BRI is part of Beijing's geopolitical strategy of connectedness and cooperation, and project intent of diminishing the USA hegemony effect in Asia particularly (Flint and Zhu, 2019; Rolland, 2017; Clarke, 2018; Zhou and Esteban, 2018; Deng, 2021) (Code S1).

The initiative might strengthen Beijing's maritime dominance, potentially resolving the South China Sea (SCS) issue to some extent (Cheng, 2020) (Code S3).

It is anticipated that the project's planned investments will be finished by the time the transit times are reduced by, on average, 1.2 to 2.5 percent. However, due to this decline, trade expenditures will fall by 1.1 to 2.2 percent. While trade prices and transit times are anticipated to drop by an average of 1.7 to 3.2 percent among initiative member nations, this rate is anticipated to fall between 1.5 and 2.8 percent among non-member nations. In terms of transport expenses and time schedule, member nations are anticipated to gain more benefits from the initiative (De Soyres *et al.*, 2019; Blah, 2018) (Code E9, Code E10).

The rise of China's economic importance in recent decades has sparked a passionate debate about the position of the RMB (Renminbi) in international commerce. Since roughly 2005, Beijing has launched a number of measures purposed at increasing the global usage of RMB. These attempts intensified after the global economic crisis of 2008, and they have advanced significantly since 2009 (Zhang *et al.*, 2017; Blah, 2018; Eichengreen and Lombardi 2017) (Code E8).

Maintaining economic development is critical for the Chinese leadership's social harmony and regime security. As a result, improving living standards through economic growth is considered as a mean to address the difficulties linked with the "three evils" of extremism, separatism, terrorism, and extremism both in

China and outside. The initiative will assure the growth of the participating countries and assist in reducing the number of terrorist events near China's borders by investing in their economic development and transportation infrastructure (Callaghan and Hubbard, 2016; Rolland, 2017; Rehman and Noman, 2021) (Code G2, Code G1). Under the umbrella of "soft power", China's strategy of constructing the project on win-win ties with all member nations in peace, development, and cooperation is an effort to instill trust in the area and in all states (Clarke, 2018) (Code S4).

Through an infrastructure-building program in China's bordering areas, this project intends to reinforce Beijing's economic leadership. Overall, the initiative is a crucial maneuver for Beijing to maintain security and advance its power standing in the international system, allowing it to transition from a rule-taker to becoming a rule-maker (Zhou and Esteban, 2018; Sharma, 2019) (Code E13).

Not only does the initiative assist the economic development process of the member countries but also project aims at ensuring global prosperity (Cheng, 2020) (Code E14).

3.2. Focus group study

The research's second part is a focus group study to complete the identification of BRI's motivating sources from China's standpoint. In the study, an online focus group study is preferred due to the Covid pandemic and international participants by using www.focusgroupit.com. The study started on 2 December 2022 and the completion date of the focus group study is 5 December 2022. The online model of the focus group studies is a virtual version of a face-to-face one, with the researcher able to control talks (Dichabeng *et al.*, 2021). Participant group of online studies can read and comment on each other's replies at their leisure using online discussion boards (Williams, 2012). Since the research was asynchronous, participants were able to think about their replies more carefully than they could in real-time sessions, and they may even use web searches or other methods to help them decide. In comparison to the standard version of the focus groups (face-to-face), online focus group studies

usually need more participants. A standard focus group consists of 6–12 people who meet face-to-face to talk about a certain issue (Bloor *et al.*, 2001).

3.2.1. Preparation and organization

The systematic literature review in the preceding section of the study provided a certain point of view of China on the project, but a focus group study is required to complete the major motivating sources of the BRI. In the review section of the study, 15 incentive sources were identified, and this list provides the experts with a starting point for debate. A focus group is usually formed by six to twelve people (Fern and Fern, 2001; Stewart and Shamdasani, 2014; Kamberelis and Dimitriadis, 2013). The more participants involved in the focus group studies the more accurate information could be taken (Carspecken and Dennis, 2012). Participants of the focus group were selected based on their

expertise. Table 2 indicates that eleven participants were selected with experiences ranging from 16 to 32 years. Experts could be categorized into three groups; academicians, BRI consultants, and sector experts. Academicians include three professors and two associate professors, and their publications mainly focus on the BRI-related scientific works. Sector-related experts are international relations and transportation experts. The purpose of selecting business experts is to reach sectoral information in terms of BRI subjects. Four members of the focus group research are Chinese government consultants in BRI organizations, so they may reflect the Chinese perspective on BRI. A week prior to the meeting, detailed information of the appointment was given to the experts. The goal of the focus group study is to verify the literature review data and extend the previous research items (PRISMA study) and reach the background of the Chinese motivations to create BRI.

Table 2. Expert Profile

Job Title	Year of Service	Academic qualifications
Associate Professor	16	PHD
Committee member of BRI organizations	18	Master
Professor	26	PHD
International relation expert	19	PHD
Committee member of BRI organizations	28	PHD
Associate Professor	21	PHD
Committee member of BRI organizations	22	Master
Professor	28	PHD
Transportation expert	22	Master
Professor	32	PHD
Committee member of BRI organizations	26	Master
Associate Professor	16	PHD
Committee member of BRI organizations	18	Master

3.2.2. Discussion of the focus group

The information for the focus group research was gathered by: (1) asking each of the participants to express their views in order to determine China's perspective on the creation of the BRI in terms of external and internal aspects. (2) capturing the participants' spoken discussions; and (3) taking quick notes on the topics addressed. The

questionnaire is divided into three parts. The participants were asked to give personal information, such as their employment, academic qualification, and professional background in the first part of the questionnaire. In the second part of the focus group study, the experts examined the data taken from the literature and made comments on each finding. In the last section of the study, participants agreed on 26 incentive

sources including 15 literature review items. Table 3 demonstrates that in the focus group investigation, 11 incentive source items were identified. With an internal and external viewpoint, experts divided the motivation sources into seven groups: Economic, Energy, Security, Economic-2, Political, Security-2, and

Military. Experts were encouraged to share additional subjects or comments not covered in the focus group questionnaire and to provide any other suggestions in the final part of the study. The focus group meeting, which lasted three and a half hours with an intermission, included thirteen experts.

Table 3. Based on expert knowledge, China's motivational sources to create BRI

Motivation Source of China	ANP Model Code
New business opportunities for Chinese investors	EN-3
Strengthening the military presence along the project routes	A-1
Preventing piracy in the SCS	G-3
Increasing the international reputation of Chinese banks	E-7
Strengthening the China-Asia-Europe link	E-16
China's desire to increase the welfare level for its citizens	E-5
China's willingness to create an international safety network	G-4
New job opportunities for Chinese citizens	E-6
China's desire to avoid the middle-income trap for its country	E-4
China's desire to develop western regions within its own country's borders	E-11
Preventing immigration from the eastern part of China to the western part	E-12

3.3. Basic Concepts of Analytic Network Process

The Analytic-Network-Process (ANP) is an extension of the Analytic-Hierarchy-Process (AHP) that considers both inner (between components in the same cluster) and outer (between elements in different clusters) dependence when ranking alternatives (Saaty, 2005). The analytic network approach has been determined to be a multi-criteria decision-making strategy for addressing various complicated decision-making problems (Chen *et al.*, 2019). Interconnected clusters and their constituents are the building blocks of an ANP model. It is necessary to compare the model components in pairs in order to evaluate their relative relevance (Saaty and Vargas, 2006). The essential phases of the ANP technique are the calculation of supermatrices and weighted supermatrices. Assume that the ANP structure's control layer has criteria $P_1, P_2, P_3 \dots P_n$, $C_1, C_2, C_3, \dots C_m$ and C_i that contains n_i are element groups in the network layer, while $P_{i1}, P_{i2}, \dots P_{in_i}$ ($i = 1, 2, 3, \dots, m$)

is a factor group in the network layer. Compare the relevance of each factor in C_i to that in $C_j; P_{jl}$ ($j = 1, 2, 3, \dots, m; l = 1, 2, 3, \dots, n$), that is, treat P_{jl} as a sub-criterion under the control criterion P_s ($s = 1, 2, 3, \dots, N$), and build a judgment matrix. The eigenvector of the judgment matrix is created and expressed as a matrix using the eigenvector approach; that is, an unweighted supermatrix under criteria P_s is generated (Saaty, 2005).

$$W_{ij} = \begin{bmatrix} W_{i1}^{j1} & \dots & W_{i1}^{jn} \\ \vdots & \ddots & \vdots \\ W_{in}^{j1} & \dots & W_{in}^{jn} \end{bmatrix}$$

If the two-element sets are mutually exclusive, then $W_{ij} = 0$. Similarly, the supermatrix of each element's effect on the component group C_i under the criterion is determined by comparing components in elements group of other:

$$W = \begin{matrix} & \begin{matrix} C_1 & \cdots & C_m \end{matrix} \\ \begin{matrix} C_1 \\ \vdots \\ C_m \end{matrix} & \begin{bmatrix} W_{11} & \cdots & W_{im} \\ \vdots & \ddots & \vdots \\ W_{m1} & \cdots & W_{mm} \end{bmatrix} \end{matrix}$$

The weight matrix is calculated using the criteria P_s by comparing the relevance of each group of elements to those of the element group C_i (Sun and Bi, 2008; Wan et al., 2021; Wang and Wang, 2013; Du et al. 2010).

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1m} \\ \vdots & \ddots & \vdots \\ a_{m1} & \cdots & a_{mm} \end{bmatrix}$$

By multiplying the weighted matrix of A with the weightless supermatrix \bar{W} ; that is, $\bar{W} = AW$, the weighted matrix \bar{W} of W is produced. The steady-state supermatrix \bar{W}^n acquired after n iterations are then computed, and its column vector represents the stable weight of each element in the network layer under the criteria P_s , according to $\bar{W}^n = \lim_{n \rightarrow \infty} \bar{W}$ (Wan et al., 2021).

3.3.1. ANP model

The creation of the ANP model requires data from different methods of application. This study preferred PRISMA systematic literature review and Focus group study for data collection to create the ANP model. To determine the motivational sources of China; “Ensuring China's energy security with alternative transportation routes (EN1)”, “Improving

economic and cultural relations between countries (E15)”, “Reducing transport times (E10)”, “Improving diplomatic relations (S2)”, “Leveraging initiative against claimant states in the South China Sea (S3)”, “Overcapacity problem (E2)”, “China's willingness to use its cultural soft power (S4)”, “Combating terrorism, separatism, and religious extremism (G2)”, “The desire for economic growth (E1)”, “Reducing American influence in the Asia region (S1)”, “Reducing transport costs (E9)”, “Desire to make the renminbi (RMB) a global currency in the world market (E8)”, “China's desire to ensure its border security (G1)”, “Desire to have the largest economy in the world to be the rule maker (E13)”, “Helping global prosperity (E14)” items were determined by using PRISMA method. A Focus group study helped to determine other 11 items; “New business opportunities for Chinese investors (EN3)”, “Strengthening the military presence along the project routes (A1)”, “Preventing piracy in the South China Sea (G3)”, “Increasing the international reputation of Chinese banks (E7)”, “Strengthening the China-Asia-Europe link (E16)”, “China's desire to increase the welfare level for its citizens (E5)”, “China's willingness to create an international safety network (G4)”, “New job opportunities for Chinese citizens (E6)”, “China's desire to avoid the middle-income trap for its country (E4)”, “China's desire to develop western regions within its own country's borders (E11)”, “Preventing immigration from the eastern part of China to the western part (E12)”. In the focus group study, 26 items were categorized into internal and external motivation topics which is shown in Fig. 5 as an ANP model of the study.

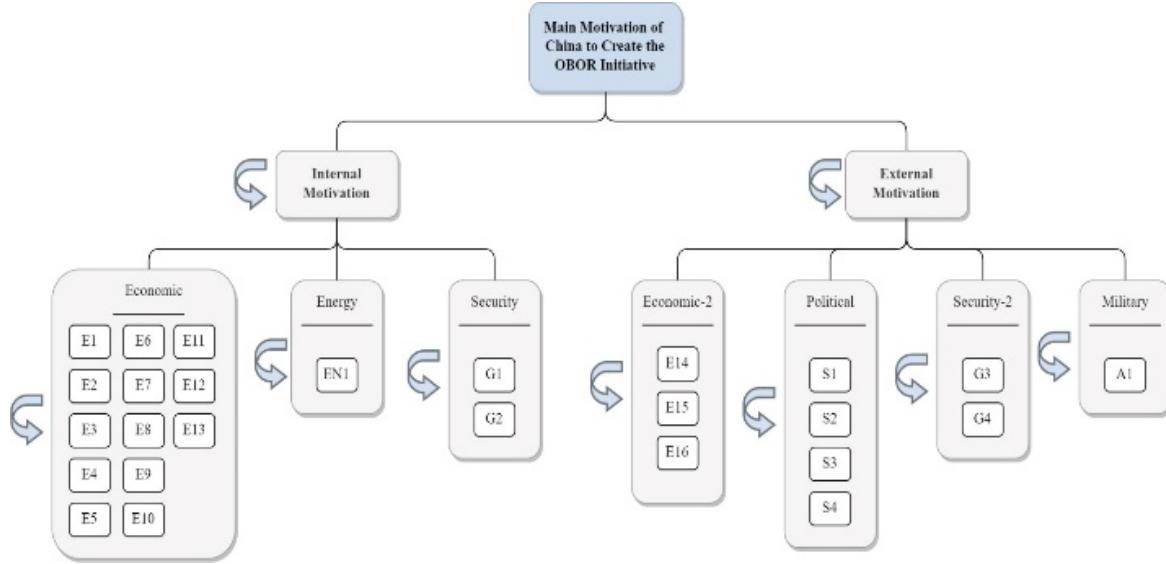


Figure. 5. ANP model of the study

Internal motivation has 16 sub-factors in three different sub-categories as Economics, Energy, and Security. On the other hand, Fig. 5 shows that external motivation has 10 sub-factors under four sub-categories as Economic-2, Political, Security-2, and Military. The weights of the parameters in the ANP model must be compared to each other in order to calculate their weights. Focus group experts answered the comparison matrices based on a 1-9 scale. The 307 pairwise comparisons that comprised 35 comparison matrices under 10 comparison sets were discovered based on the relationships between these parameters.

3.3.2. Relation Matrices of the ANP approach

The second step of the ANP model is the determination of the relation between the clusters and nodes. The Focus group as shown in Table 2 helped in the determination of relation matrices. Based on expert knowledge, there is a direct connection between Internal and External Motivation sources of the China. Relation matrices data were handled with the help of the Super Decision Program as shown in Fig. 6.

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	EN1	G1	G2	G3	G4	S1	S2	S3	S4	A1	
E1		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓														
E2	✓		✓																								
E3	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓														
E4	✓		✓		✓	✓	✓																				
E5	✓		✓	✓	✓	✓					✓	✓	✓														
E6	✓		✓	✓	✓	✓					✓	✓	✓														
E7	✓								✓																		
E8	✓		✓						✓																		
E9																											✓
E10																											✓
E11	✓																										
E12	✓																										
E13	✓	✓	✓	✓	✓	✓	✓	✓	✓																		
E14																											
E15		✓																									✓
E16		✓																									
EN1																											
G1																											✓
G2																											✓
G3																											✓
G4																											✓
S1																											✓
S2																											✓
S3																											✓
S4																											✓
A1																											✓

Figure 6. Relation matrices of the ANP model

3.3.3. Normalized data weight

The normalized weights of criterion and sub-criteria were derived by entering any of the following findings into the Super Decision software. Table 4 shows the pairwise comparison matrix of significant factors in connection to the aim.

Table 4. Matrix of pairwise comparisons of important criteria in relation to the goal

Purpose	Internal Motivation	External Motivation
Internal Motivation	1	5
External Motivation	0.2	1

In all cases, the incompatibility of criteria and sub-criteria was less than 0.1, suggesting that the prioritization of matrix comparisons was acceptable, and the reliability of responses had been confirmed; therefore, the allocated ratings were valid, and paired comparisons can be obtained. Table 5 demonstrate that the internal motivation criterion had the higher weight, with

a 0.83 relative weight, while the external motivation criterion had the lower weight, with a relative weight of 0.16.

Table 5. The main criteria normalized weight

Criteria of the Cluster	Normalized-weight	Rank
Internal Motivation	0.83	1
External Motivation	0.16	2

3.3.4. Sub-criteria are compared to the Main criteria in a pairwise comparison matrix

Table 6 shows the results of pairwise comparisons of the “Economic” cluster based on the separation of primary criteria (internal motivations and external motivations). With 0.208 degrees, the “E2- Overcapacity problem” sub-factor has the highest local weight within the “Economic” cluster. The sub-factor “E1- The desire for economic expansion” has a local weight degree of 0.164 and is ranked second in the comparison matrix for the “Economic” cluster. E4- China's desire to avoid the middle-

income trap for its country' has the lowest local weights among the matrices of pairwise comparisons for the "Economic" cluster. The

pairwise comparison matrices have a consistency ratio of 0.08, as an acceptable ratio for ANP comparison matrices.

Table 6. Matrix of pairwise comparisons of sub-criteria in the 'Economic' cluster

	E.1	E.2	E.3	E.4	E.5	E.6	E.7	E.8	E.9	E.10	E.11	E.12	E.13	Local weights
E.1	1	0.5	1	4	3	5	4	6	6	6	5	7	1	0.164
E.2	2	1	2	5	6	5	6	7	4	4	5	6	3	0.208
E.3	1	0.5	1	4	5	4	5	5	4	4	3	4	2	0.148
E.4	0.25	0.2	0.25	1	0.5	0.5	0.5	0.5	0.33	0.33	0.5	0.5	0.25	0.021
E.5	0.33	0.16	0.2	2	1	2	0.2	0.5	2	0.33	0.33	0.33	0.2	0.032
E.6	0.2	0.2	0.25	2	0.5	1	0.33	0.5	0.33	0.5	4	0.33	0.2	0.030
E.7	0.25	0.16	0.2	2	2	3	1	2	0.33	0.5	3	4	0.25	0.051
E.8	0.16	0.14	0.2	2	2	2	0.5	1	0.5	0.33	0.5	0.5	0.25	0.029
E.9	0.16	0.25	0.25	3	1/2	3	3	2	1	1	2	2	0.33	0.055
E.10	0.16	0.25	0.25	3	3	2	2	3	1	1	3	2	0.33	0.059
E.11	0.2	0.2	0.33	2	3	0.25	0.33	2	0.5	0.33	1	0.5	0.25	0.032
E.12	0.14	0.16	0.25	2	3	3	0.25	2	0.5	0.5	2	1	0.25	0.040
E.13	1	0.33	0.5	4	5	5	4	4	3	3	4	4	1	0.123

3.3.5. Sub-criteria are compared with sub-criteria in a pairwise comparison matrix

Table 7 shows the results of the matrix of comparisons of sub-criteria pairwise to the S1 sub-factors. Table 8 consistency ratio is 0 and it's acceptable for ANP studies. Based on the result of the sub-criteria that were examined using a comparison matrix., other 17 tables for each sub-factor could be demonstrated.

Table 7. S-1 sub-criterion matrix of pairwise comparisons of sub-criteria

	S-2	S-4
S-2	1	2
S-4	0.5	1

3.3.6 Each sub-normalized criterion's weight

Sub-criteria of the ANP model normalized weight were calculated for each cluster. E16 has the highest normalized weight in the "Economic 2" cluster with 0.493 degrees as shown in Table 8.

S1 is the most significant sub-factor in the "Political" cluster with 0.610 degrees. G3 has the highest normalized weight in the "Security 2" cluster with 0.666 degrees. E2 has the significant degree item in the "Economic" cluster with 0.208 degrees. G1 has the highest normalized weight in the "Security" cluster with 0.666 degrees.

Table 8. Normalized weight for each sub-criterion

Motivation Sources	Priority of the Main Motivation Source	Clusters	Cluster comparisons with respect to Internal Motivation	Sub-criteria	Normalized weight
Internal Motivation	0.83	Economic	0.62	<i>E.1</i>	0.164
				<i>E.2</i>	0.208
				<i>E.3</i>	0.148
				<i>E.4</i>	0.021
				<i>E.5</i>	0.032
				<i>E.6</i>	0.030
				<i>E.7</i>	0.051
				<i>E.8</i>	0.029
				<i>E.9</i>	0.055
				<i>E.10</i>	0.059
				<i>E.11</i>	0.032
				<i>E.12</i>	0.040
				<i>E.13</i>	0.123
External Motivation	0.16	Energy	0.23	<i>EN.1</i>	1
				<i>G.1</i>	0.666
				<i>G.2</i>	0.333
Motivation Source	Priority of the Main Motivation Source	Clusters	Cluster comparisons with respect to External Motivation	Sub-criteria	Normalized weight
External Motivation	0.16	Economic 2	0.26	<i>E.14</i>	0.195
				<i>E.15</i>	0.493
				<i>E.16</i>	0.310
				<i>S.1</i>	0.610
				<i>S.2</i>	0.176
		Political	0.51	<i>S.3</i>	0.130
				<i>S.4</i>	0.082
				<i>G.3</i>	0.666
		Security 2	0.13	<i>G.4</i>	0.333
				<i>A.1</i>	1
		Military	0.09		

3.3.7. Overall prioritization of the sub-factors

The last step of the study is to determine the sub-factors overall priority to rank them. The “New business opportunities for Chinese investors (E3)” item has the first rank with 0.146 degrees. Table 9 indicates that “Desire to have the largest

economy in the world to be the rule maker (E13)” has the second rank in the sub-factors overall priority. “Preventing immigration from the eastern part of China to the western part (E12)” has the lowest degree with 0.012057 in the motivation sources of China.

Table 9. The sub-factors overall priority

Sub-criteria	The sub-factors overall priority	Rank
E3- New business opportunities for Chinese investors	0.146201	1
E13- Desire to have the largest economy in the world to be the rule maker	0.122252	2
E2- Overcapacity problem	0.107140	3
E1- The desire for economic growth	0.087903	4
S1- Reducing American influence in the Asia region	0.084236	5
S2- Improving diplomatic relations	0.055840	6
A1- Strengthening the military presence along the project routes	0.048126	7
G3- Preventing piracy in the South China Sea	0.030806	8
E8- Desire to make the renminbi (RMB) a global currency in the world market	0.026225	9
S4- China's willingness to use its cultural soft power	0.023740	10
E7- Increasing the international reputation of Chinese banks	0.023477	11
S3- Leveraging initiative against claimant states in the South China Sea	0.022468	12
E16- Strengthening the China-Asia-Europe link	0.022396	13
E9- Reducing transportation costs	0.022191	14
E10- Reducing transport times	0.021294	15
E5- China's desire to increase the welfare level for its citizens	0.021169	16
E15- Improving economic and cultural relations between countries	0.020450	17
G4- China's willingness to create an international safety network	0.018792	18
E6- New job opportunities for Chinese citizens	0.018523	19
E4- China's desire to avoid the middle-income trap for its country	0.013386	20
E11- China's desire to develop western regions within its own country's borders	0.012057	21
EN1- Ensuring China's energy security with alternative transportation routes	0.011860	22
G2- Combating terrorism, separatism, and religious extremism	0.010521	23
G1- China's desire to ensure its border security	0.010081	24
E14- Helping global prosperity	0.009748	25
E12- Preventing immigration from the eastern part of China to the western part	0.009119	26

4. VALIDATION OF THE METHOD

Consistency ratio (CR) is the only measure that verifies the accuracy of the ANP model in contrast to pairwise comparison matrices of the ANP structure based on random index and Consistency Index (CI). A comparison matrix's consistency index for the ANP model is represented by the formula $CI = (\lambda_{\max} - n) / (n - 1)$. Max denotes the eigenvalue's highest degree, while n denotes the size of the matrix. The formalization of the relationship between the consistency index and random index results in the CR ratio of the ANP model (Yuksel and Dagdeviren, 2007). To guarantee a legitimate consistency ratio for the ANP model, the comparison matrix result should have a consistency ratio of less than 0.10. Using Saaty's (2005) Super Decision software, the consistency ratio of the comparison matrices was established in this study. Weighted degrees of all outcomes are based on appropriate consistency ratios since the consistency ratios of all pairwise comparison matrices in the research are less than 0.10 and this parameter shows that all comparison matrices are valid.

5. MARINE ENGINEERING, MARITIME TRANSPORTATION, AND MARITIME SAFETY PERSPECTIVES

The Belt and Road Initiative (BRI) is an ambitious global infrastructure development strategy by China, with far-reaching economic and geopolitical implications. The sub-factors identified in Table 9 of the analysis can be interpreted through the lenses of marine engineering, maritime transportation, and maritime safety, as these fields play a crucial role in supporting the project's maritime components, specifically the Maritime Silk Road. This section focuses on how key motivational sub-factors align with the goals and challenges of marine engineering, maritime transportation, and maritime safety.

5.1. Marine Engineering and Technological Advancements

Several of the economic and strategic priorities highlighted in the sub-factor rankings directly

impact marine engineering, particularly the development of advanced technologies for shipbuilding, navigation, and energy efficiency. For instance, the following sub-factors are crucial in this context:

E3 - New Business Opportunities for Chinese Investors (0.146201, Rank 1): This sub-factor emphasizes the potential for Chinese companies to invest in marine engineering innovations. New business opportunities could drive advancements in ship machinery, propulsion systems, and alternative energy sources (e.g., LNG or hybrid engines), which would increase operational efficiency and reduce environmental impact in maritime routes.

E16 - Strengthening the China-Asia-Europe Link (0.022396, Rank 13): Enhancing connectivity between these regions would necessitate major upgrades in maritime infrastructure, where marine engineering plays a key role in designing ports, dredging channels, and ensuring that ships can navigate efficiently.

E1 - The Desire for Economic Growth (0.087903, Rank 4): The focus on growth aligns with the need for improvements in marine engineering to handle larger and more sophisticated vessels, thus supporting China's broader economic goals.

5.2. Maritime Transportation Efficiency and Infrastructure Development

Maritime transportation is central to the BRI's success, as it forms the backbone of international trade along the project's oceangoing routes. Several sub-factors highlight China's goals in enhancing maritime logistics and transportation infrastructure:

E9 - Reducing Transportation Costs (0.022191, Rank 14): To achieve this, China would likely invest in more efficient port operations, better cargo handling technologies, and improved logistical networks. Maritime transportation systems must integrate advanced navigation technologies to reduce shipping times and fuel consumption, thereby cutting transportation costs.

E10 - Reducing Transport Times (0.021294, Rank 15): Minimizing transport times is another critical objective that marine engineers and transportation planners must address.

Investments in larger, faster, and more fuel-efficient ships will allow China to achieve this goal, further improving global trade connectivity.

E8 - Desire to Make the Renminbi (RMB) a Global Currency (0.026225, Rank 9): A strong maritime transportation network underpins this goal by facilitating international trade in Chinese currency. Efficient and safe shipping operations would be crucial to ensure that trade remains steady and reliable, thus boosting the RMB's global status.

5.3. Maritime Safety and Security Challenges

Ensuring safety is vital for the BRI's maritime routes, which traverse regions prone to piracy, geopolitical tensions, and environmental hazards. The following sub-factors underline the importance of maritime security and safety:

G3 - Preventing Piracy in the South China Sea (0.030806, Rank 8): The South China Sea is a strategically significant yet contentious area. Preventing piracy and ensuring the safety of ships passing through these waters requires the deployment of sophisticated maritime surveillance systems, improved shipboard security measures, and international collaboration to patrol these regions effectively.

A1 - Strengthening the Military Presence Along the Project Routes (0.048126, Rank 7): China's strategic interest in fortifying its military presence along BRI maritime routes aims to protect its vessels and ensure the security of key maritime chokepoints. This military presence can also deter potential security threats, including piracy and territorial disputes.

G4 - China's Willingness to Create an International Safety Network (0.018792, Rank 18): Establishing a cooperative maritime safety framework among BRI countries would enhance overall maritime safety. This would involve not only military cooperation but also agreements on search-and-rescue operations, environmental protection, and accident prevention protocols.

The analysis of sub-factors in the BRI project from marine engineering, maritime transportation, and maritime safety perspectives reveals that these fields are essential to the success of China's maritime ambitions. Marine engineering advancements will play a crucial

role in supporting efficient and safe transportation routes, while maritime transportation systems must focus on reducing costs and improving global connectivity. Meanwhile, ensuring the safety and security of shipping lanes, especially in regions prone to piracy and geopolitical tension, is vital for the project's sustainability. By addressing these issues, China can ensure that the Maritime Silk Road—an integral part of the BRI—remains as a safe, secure, efficient, and economically viable route for global trade.

6. DISCUSSIONS AND CONCLUSION

China's motivation for the Belt and Road Initiative (BRI) has often been viewed narrowly, but this study expands on all significant motivational sources. It is evident that the project has the capacity to transform more than just the global transportation system, as its implementation has already impacted the economic conditions of numerous member and non-member countries. In addition to economic motivations, it is essential for policymakers, logistics managers, marine engineers, and transport operators to understand China's rationale behind this initiative to effectively respond to the program developments.

This study employs the Analytic Network Process (ANP), which, through several steps, yields diverse insights into China's motivations. Researchers require comprehensive data to construct an ANP model, often collected through a variety of techniques. In this case, the PRISMA systematic literature review identified fifteen key sources of Chinese motivation. An integrated focus group study further highlighted eleven factors influencing China's decision to create the BRI. The primary objective of this PRISMA-Focus group combination was to fully comprehend China's internal and external motivations.

Twenty-six motivational sources were identified and then prioritized, showing China's internal motivations as more significant than external ones. The "Economic" cluster in the ANP model stands out, with the "Overcapacity problem (E2)" holding the highest degree among the thirteen economic sub-factors. Furthermore, the

study introduces other key clusters: “Energy”, “Security”, and “Marine Engineering”. The findings highlight that China's maritime ambitions, supported by advanced ship machinery and marine engineering innovations, are critical to maintaining the operational efficiency of the Maritime Silk Road—a core component of the BRI.

From the perspective of marine engineering, maritime transportation, and maritime safety, the BRI represents not only an economic and political endeavor but also a significant investment in infrastructure. The development and maintenance of safe, efficient shipping routes along the Maritime Silk Road are paramount to the success of the initiative. China's emphasis on maritime infrastructure, including port development, ship machinery innovations, and risk mitigation strategies, demonstrates the critical role these elements play in global trade. In terms of external motivations, four additional clusters were identified: “Economic 2”, “Political”, “Security 2”, and “Military”, with the “Political” cluster receiving the highest importance. According to ANP analysis results, the “New business opportunities for Chinese investors (E1)” emerged as the highest priority motivation. However, to realize this potential, China must not only focus on economic development but also invest in reducing shipping risks and preventing maritime accidents. This focus on maritime infrastructure is pivotal for China's capacity to dominate global transportation systems.

China's drive for global leadership is closely linked to the goal of becoming the world's largest economy and rule maker. To achieve this, the country must establish a robust and sustainable maritime infrastructure. The BRI focuses on modernizing seaports, shipping fleet incl. ship machinery, investing in marine engineering, and developing protocols to improve maritime safety and efficiency. The “Desire to have the largest economy in the world to be the rule maker (E13)” emerged as the second most important motivation in the analysis, further illustrating China's ambitions on the global stage.

The role of transport operators is increasingly significant in this context, as managers must be able to assess both internal and external factors

to develop a strategic posture that aligns with the dynamic business environment. This includes keeping pace with advancements in maritime technology, engineering, monitoring ship performance, and implementing best practices to mitigate ship-related risks. The BRI is a subject that must be continuously discussed when formulating long-term strategic decisions, especially in the areas of maritime transportation, which are central to the initiative's success over the next ten to thirty years.

Moreover, the integration of marine engineering with China's broader geopolitical and economic objectives provides critical insights into how transport operators, marine engineers, and policymakers can align their long-term plans with China's ambitions. Key considerations include improving maritime safety protocols, ensuring the reliability of maritime infrastructure, and enhancing the global competitiveness of Chinese maritime technologies.

Economic goals are the primary driving force behind China's creation of the BRI, followed by political and security motivations, with military concerns ranking lower. Although the initiative is framed as a global, win-win project, internal motivations related to economic growth and maritime transport infrastructure are significantly more critical than external ones. The results of this study offer valuable insights into how transport operators, marine engineers, and policymakers can align their long-term plans with China's ambitions, considering the critical role of maritime safety, ship reliability, and the broader implications for the global maritime economy.

In future research, further analysis can be conducted for each cluster in the ANP model using a variety of methodologies to explore the intricate connections between China's internal and external motivations. This is especially relevant in addressing the technical and operational challenges in maritime infrastructure development, marine engineering, and ship risk management which will be pivotal in ensuring the success of the Maritime Silk Road and the broader Belt and Road Initiative.

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CONTRIBUTION

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The author(s) declare that for this article they have no actual, potential or perceived conflict of interests.

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