Dry Port Location Factor Determination using Delphi in Peninsular Region

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Locating a dry port depends on various criteria such as distance, modes of transport, cost associated, environmental, geographical, and social concerns. The paper's primary purpose is to identify the location-specific attributes impacting dry port locations, particularly in peninsular India, where seaports are very close to each other. The paper's objective has been achieved through a four-cycle Delphi survey and criticality through linear ranking and consistency through Kendall's 'W'. Initially, the criteria are identified through a systematic literature survey. They are then sieved within a focus group consisting of five experts with experience of more than twenty years in port operations. Final vetting of the criterion is done through a Delphi survey; the experts with a mutual interest in the subject but from different backgrounds are included. The final vetted list is determined. In the last two rounds of the survey, the rankings were determined, a consensus was reached, and the final rank was obtained. The results indicate that proximity and economic criteria are the most crucial in the chosen geography, which contradicts the developed regions, where the environmental criterion dominates. However, the environmental criteria have been ranked third. Even though the Delphi method is an age-old method used in many literatures in different contexts, it is not used in a dry port problem in the peninsular region. Consensus building is significant in strategic decisions, like dry port location selection. Since this study involves multiple stakeholders from diverse backgrounds and a subjective opinion was required, the Delphi method and linear ranking have been adopted.

KEY WORDS
~ Dry port
~ Criteria determination
~ Location problem
~ Expert opinion
~ Delphi
~ Peninsular Region
~ India

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doi: 10.7225/toms.v11.n01.w05

Received on: Sep 11, 2021 / Revised on: Nov 12, 2021 / Accepted on: Jan 1, 2022 / Published online: Jan 15, 2022.

1. INTRODUCTION

Dry ports represent the most critical node which connects the seaport and production base. With increasing containerisation, the gateway ports have become congested and, in order to reduce the congestion at the bottlenecks at seaports, dry ports have been introduced to the transport system (Roso, 2008). Nineteen of the top thirty performing container ports are located in Asia compared to the rest of the world, indicating an increase in export-import trend in Asia (Hanaoka and Regmi, 2011), also requiring a strategic need for dry port studies, which influences international trade. Similar to any facility location problem, a dry port location is influenced by many criteria. The dry port locations have geographical significance as their locational features enormously help to reduce the transport network cost (Pham and Lee, 2019). Lamii et al. in their work explain the need to investigate dry port case studies and their performance (Lamii et al., 2020). The dry port location depends upon economic, social, environmental, site-specific, accessibility, nearness, policy interventions, and technological advancement. India has a vast hinterland, and the decadal (2009-2019) compounded annual growth rate (CAGR) of India was 7 % compared to the global CAGR of 4 %, according to the data consolidated from World bank data on 2/10/2021. The rapid increase in container volume has in turn boosted the production and export-import of commodities, and this has further congested our transport network. Developed countries have switched to a more sustainable model like rail and inland waterways. According to the planning commission report, the mode share of freight in India was 65 % rail and 35 % on the road network. The trend has now reversed 75 % on the roads and 12 % on the rail as per the NITI Aayog report (NITI Aayog and RMI, 2018). This change can be accounted for in India's Direct to Port scheme (Gujar, Adolf K.Y. Ng and Notteboom, 2019). In India, the government's changing policies have seriously affected the dry port sector, bringing it to the verge of a shutdown due to a lack of planning policies (Gujar, Adolf K Y Ng and Notteboom, 2019). The dry ports were under government control until the sector's privatisation in the late 2000s. The guidelines for opening a dry port by the Ministry of Commerce are age-old. According to the guidelines, a dry port is located based on the availability of land and a market study conducted by the interested parties(Vanden Bossche and Gujar, 2010).As the world is moving towards sustainable development goals, the social and environmental criteria also need to be considered while locating a facility.

Based on this, a literature review has been done, and the dry port studies in developed systems are achieving SDG goals. In this paper, we have formulated the factors that need to be considered for the peninsular region. The criteria chosen for dry port locations strongly depend upon the geographical features(Alena Khaslavskaya and Roso, 2020). One of the significant challenges in finding an optimised dry port location is the geographic variability of the influencing criteria (Nazemzadeh and Vanelslander, 2015). Identifying the specific criteria for a region is a significant challenge, and in this case, the peninsular region has seaports in close vicinity, so the choice of the experts for the criteria determination survey has to be done with proper care. Most of the articles have chosen the criteria based on insights from face-to-face interviews, or they have been randomly chosen. In this paper, the initial criteria are obtained from the literature. However, considering geography, an expert face-to- face opinion is sought to prepare the first list of criteria for the Delphi survey. Attempts to identify the criteria, based on various stakeholders opinions by combining various MCDM methods, have been made (Nguyen and Notteboom, 2016). However, a robust methodology has not been applied to select the criteria through an expert Delphi survey for vetting the factors.

A detailed review of the criteria is given in the upcoming sessions. Previous studies have used the Delphi technique for analysis of Spanish dry ports location by considering thirteen parameters (Núñez, Cancelas and Orive, 2013). Delphi is a time-consuming methodology but gives robust results. In this paper, we have used Delphi to identify the criteria and rank them. Delphi is an effective method in identifying critical criteria (Binoy, Naseer and Anil Kumar, 2020). The first two rounds of the Delphi survey have been used to finalise the criteria by considering the subjective opinion. The third and fourth rounds of the survey have been used to rank the criteria and, in this paper, we have used Kendall's 'W' value to find the consistency between each round and the Inter Quartile rank to determine the weight of main and sub-criteria. Dry port location studies have also evolved since 2007, and the traditional methods like Delphi, which are more robust, have been less frequently adopted.

2. LITERATURE REVIEW

A literature review to understand the various factors used are studied in the preliminary step, as well as various methods used for dry port location studies. Various literature papers have reviewed dry ports: their concept and functionalities have been elaborated by Varese et al.(Varese, Marigo and Lombardi, 2020) and Miraj et al., and the research trends in the area of dry ports have also been explored (Miraj et al., 2021). Future implications of dry port studies have been focused on as well (A Khaslavskaya and Roso, 2020). The literature review done for this paper can be categorised as follows:

1. Criteria used in various dry port location studies
2. Methods adopted for dry ports location factor selection.

2.1. Criteria Influencing the Location of Dry Ports

Dry ports are nodes known to reduce congestion (Roso, 2008) at the seaport and help reduce the transport system's environmental impact (Lättilä, Henttu and Hilmola, 2013). The optimal location of a dry port is crucial to reduce the network cost of a transport system (Ambrosino and Sciomachen, 2014). However, the optimal location can be near-production houses/origin (Ng and Cetin, 2012), mid-range (Ambrosino and Sciomachen, 2014), or anywhere in the transport system. The dry port location depends on various criteria, and it may be different for different stakeholders (Nazemzadeh and Vanelslander, 2015), and the criteria are influenced by its geographical boundary (Alena Khaslavskaya and Roso, 2020). ESCAP report suggests that when deciding upon a location of dry port, the crucial points and the criteria to be primarily considered are:

(a) inland capitals, provincial/state capitals;

(b) existing and potential industrial and agriculture centres;

(c) significant intersections of railways, highways, and inland waterways;

(d) intersections along trunk railways lines, major highways, inland waterways, and airports. (United Nations, 2012).

A literary work on the Chinese port of Tianjin used natural environment, operating environment, infrastructure status, and cost, supporting it with fifteen sub-criteria for evaluating four potential locations (Chun-hui Wang and Jin-yu Wei, 2008). Wei et al., in their paper, used infrastructure status, costs, operating environment as the main criteria and seven sub-criteria to evaluate the criteria without validating (Jinyu Wei, Sun and Zhuang, 2010). To evaluate eight provinces near Shanghai port, they considered criteria like GDP, total import / export value, fixed assets, freight volume, traffic route length, environmental protection, and policy-oriented coefficients (Li, Shi and Hu, 2011). To locate dry ports in China, Ka used six main criteria like transportation, economy, infrastructure, trade, and policy environment level criteria (Ka, 2011). Five main criteria, like development and operation costs, time, connectivity, environment, and regional economic development, as well as eleven sub-criteria, were used to locate logistic centres in Laos (Madan B. Regmi , Hanaoka, 2012). Studies have taken the distance and the volume of trade and have found that the ideal dry port location is not always near the production house (Ng and Cetin, 2012). Nunez et al., in their early stage of research, used fourteen sub-criteria for identifying the relevant criteria for locating dry ports in Spain (Núñez, 2013). Later, they expanded their identified list to four main criteria: economic, locational, accessibility, environmental, and forty-one other subfactors for identifying dry ports in Spain (Awad-Núñez et al. 2016). Ambrosio et al., to locate a dry port in the mid-range of the logistic network, considered handling cost, distance to rail and road networks, and expressed their view to expand the studies to longer-range dry ports (Ambrosino and Sciomachen, 2014). Zak et al. considered nine main criteria: the condition of transportation infrastructure, economic development, investment cost, level of transportation, investment attractiveness, social attractiveness, environmental-friendliness, safety and security as main criteria (Zak and Węgliński, 2014).

Yildirim et al. used only quantifiable criteria like distance, land cost, and slopes (Yildirim, BF and Emrah, 2014). Chang et al. attempted to locate a dry port near the Port of Dalian in China, using transportation conditions, regional economy, policy environment, environmental friendliness as the main criteria. They have also considered eighteen sub-criteria (Chang, Notteboom, & Lu, 2015). Nguyen et al. approached the dry port location problem from a stakeholder perspective by considering dry port users, service providers, and the dry port community. They considered twenty-two criteria, including transportation, operational, environmental, and accessibility-related criteria, both qualitative and quantitative, and evaluated three ICD locations in Vietnam province (Nguyen and Notteboom, 2016). Komchonrit et al. considered the logistic policy as the main criterion with fourteen sub-criteria, and the geographical determinants used were the transport node, transport link, production base, and consumption points (Komchornrit, 2017). Jeevan et al., in their paper, investigated the influential factors of dry port operations. They identified five categories of influencing criteria, like hinterland condition, service features, capacity, government policy, and information systems, and their respective sub-criteria. Findings suggested twelve criteria of significant importance to Malaysian dry port operations (Jeevan, Chen and Cahoon, 2018). Proximity to the road, rail slope, and land use were considered to locate dry ports in Iran (Abbasi and Pishvaee, 2018). Transportation functionality within the hinterland, investment cost, and eight sub-criteria were considered to locate Kocaeli port dry ports in Turkey. Connection to port, industry, transportation functionality, central position in the transportation network, investment cost, environment, and establishment process were the variables considered for evaluating five dry port locations in Turkey (M Saka and Cetin, 2020). Tadic et al., in their work, evaluated potential location by considering environmental, economic, infrastructural, and socio-economic criteria, also considering twenty sub-criteria to evaluate seven potential dry port locations in the Western Balkan Regions (S Tadic et al., 2020).

Most of the criteria considered can be categorised as location-based or network-based criteria. Transportation cost is the most significant factor; a cost function related to proximity, nearness, or accessibility is considered a network-based criterion. The economic cost considered can comprise land cost, development cost, etc., all of them location-based. The environmental factor is considered in studies in which pollution and congestion are determined as location or network-based; they are considered in terms of qualitative or quantitative criteria in most studies. Social criteria are the least considered factor, and their relevance is mentioned in the case of developing countries (Pham, Ma and Yeo, 2017). Several policy-level criteria, other IT-related criteria, and site-specific criteria have been considered as well.

The consolidation of the criteria in the reviewed literature are given in Table 1. If we notice the above studies, the researchers have approached the dry port location problem in different ways.

1. By considering quantifiable criteria and optimising the cost function to locate a dry port

2. By considering criteria randomly and evaluating the existing and proposed dry ports locations

3. By creating a hierarchical structure in selecting the criteria and evaluating the alternatives.

After carefully analysing the criteria in various literature, an approach to consider the factors as location-based factors needs to be selected, and these factors need to be integrated to the transport network to give a robust solution for dry-port location problem within a network.

Table 1.
Consolidation of the criteria considered in the reviewed literature.

No	Author	Transportation	Economic	Environmental	Proximity	Social	Other
1	(Wang, Chen and Huang, 2018)	x	x	x			
2	(J Wei, Sun and Zhuang, 2010)	x	x		x		
3	(Ka, 2011)	x	x		x		x
4	(Li, Shi and Hu, 2011)	x	x	x			
5	(Chang, Lu and Qi, 2011)	x	x	x			x
6	(Jovin J. Mwemezi, 2012)	x	x				
7	(Madan B. Regmi , Hanaoka, 2012)	x	x	x			
8	(Ng and Cetin, 2012)	x	x		x		
9	(Núñez, 2013)	x	x	x			
10	(Pekin and Macharis, 2013)	x	x		x		
11	(Ambrosino and Sciomachen, 2014)	x	x		x		
12	(Zak and Węgliński, 2014)	x	x	x		x	x
13	(Yildirim, BF and Emrah, 2014)	x		x		x	
14	(Z Chang, Notteboom and Lu, 2015)	x	x	x			x
15	(Awad-Núñez, González-Cancelas, et al., 2016)	x	x	x	x		
16	(Nguyen and Notteboom, 2016)	x	x	x	x		x
17	(Erbas, 2016)	x		x		x	
18	(Rahmato, 2016)	x	x	x			x
19	(Komchornrit, 2017)	x			x		x
20	(Pham, Ma and Yeo, 2017)	x	x	x	x		
21	(Jeevan, Chen and Cahoon, 2018)	x	x		x		x
22	(Abbasi and Pishvaee, 2018)	x					x
23	(Wang, Chen and Huang, 2018)	x	x		x		
24	(Pham and Lee, 2019)	x	x	x	x		
25	(Cetin and Saka, 2019)	x	x	x	x		
26	(S Tadic et al., 2020)	x	x	x		x	
27	(Komchornrit and Weerawat, 2020)			x			
28	(M. Saka and Cetin, 2020)	x	x	x	x		
	This paper	x	x	x	x	x	x

2.2. Various Methods for Dry Port Location Factor Selection

The dry port location selection involves two steps: 1. a method for selection of the factors 2. another method to select the alternative.

From the literature, the methods used for dry port location studies can be classified into three types: 1.Those using a single multicriteria method 2.Those using a combination method 3.Those using optimisation methods

2.2.1. Using a Single Multicriteria Method

Researchers started dry port location studies by using only one multicriteria method to evaluate the criteria; most papers do not mention the basis for choosing factors. In such studies, Wang et al. used ANP, Wei et al. used Fuzzy ANP, and Li Fang et al. used AP clustering and were validated for Chinese dry port. AHP was used to evaluate the parameters and the alternatives for locating dry ports in Laos (Madan B. Regmi , Hanaoka, 2012), and FCM was by Chang et al.; for inland terminals of port Tianjin in China (Chang, Lu and Qi, 2011). In an attempt to locate dry ports in Northern India, Ng et al. used the centre of gravity model (Ng and Cetin, 2012). Nunez. et al. used the Delphi method for weighing of the factors and found the interquartile value of the criteria chosen by conducting two rounds of the survey and proposed the scope of expanding this to a larger number of criteria (Núñez, 2013). Pekin et al. proposed a geographic information system (GIS)-based location model for Turkish dry port by taking transport price as the primary model choice variable in order to minimise the total sum of transport prices, and visualised the results using GIS maps (Pekin and Macharis, 2013). Ambrosiano et al. used integer programming (Ambrosino and Sciomachen, 2014) for their studies, while Zak et al. used ELECTRE for polish logistics centres by considering various criteria and regions (Zak and Węgliński, 2014). For locating dry ports in developing economies, criteria were equally weighted, alternatives were randomly chosen and evaluated using the Web HIPRE method and validated with the case of Vietnam (Nguyen and Notteboom, 2016). Jeevan et al.; used multiple regression for data analysis and the influential criteria of dry port operations using a web-based survey of Malaysian dry port stakeholders, finding twelve 12 criteria of significant importance (Jeevan, Chen and Cahoon, 2018). Saka et al. used the survey method by adopting AHPs two judgment scales to identify the best location in Kocaeli port in Turkey (Murat Saka and Cetin, 2020).These methods are usually adopted either to rank or weigh the factors selected: in such studies alternatives have not been chosen for analysis.

2.2.2. Using Combination Methods

Using combination methods refers to one method for weighing factor selection and the following method for alternative Evaluation. Ka used fuzzy AHP for factor weighing and ELECTRE for prioritising the alternatives among the chosen dry ports in China, and this was the first time the combination method was used for a dry port problem. AHP was used for factor weighing, and PROMETHEE for alternative ranking evaluated freight villages in Istanbul (Yildirim, BF and Emrah, 2014). Many researchers have used combination or hybrid methods to determine dry port location. A Delphi Bayesian network model was used in the case of Spanish dry ports in the research work of Nunez et al. (Awad-Núñez, González-Cancelas, et al., 2016). A hybrid CFA-MACBETH-PROMETHEE was used to evaluate potential dry ports in Thailand. The confirmatory factor analysis (CFA) method determines the importance of criteria and investigates the interrelations of logistic policy. For attractiveness of the dry port evaluation technique (MACBETH) is utilised to build weights, and PROMETHEE is engaged in ranking from the most to least attractive alternatives of dry port (Komchornrit, 2017). Pham et al. used Fuzzy Delphi to weigh the factors, and the TOPSIS method was adopted for evaluating dry ports in three provinces of Vietnam (Pham, Ma and Yeo, 2017). A green routing model was suggested for Vietnam by plotting the network using GIS software and calculating the emission using COPART software; in their paper, they calculated carbon dioxide, nitric oxide, and particulate matter (Pham and Lee, 2019). Tadic et al. used a hybrid grey MCDM model for locating dry ports in the Western Baltik region (S Tadic et al., 2020), while Komchornit et al. used the SEM -MACBETH-PROMETHEE method for the site selection of dry port in the Southern region of dry port (Komchornrit and Weerawat, 2020). Dry port terminal location selection applies the hybrid grey MCDM model (Snežana Tadic et al., 2020). In combination method a method is used for factor weighing and another method is adopted for alternative selection method.

2.2.3. Using Optimisation Methods

Most of the factors considered have relied upon network factors, i.e., quantifiable ones, and have used using optimisation methods. A network flow optimisation model for container depot integration used mathematical modelling in Dares Salaam port in Tanzania (Jovin J. Mwemezi, 2012). Fuzzy C-means clustering was used to choose the alternatives, and integer programming with a genetic algorithm was used for the port of Dalian dry ports (Z Chang, Notteboom and Lu, 2015). Dry port locations were found using GIS and hierarchical analysis and were introduced as the potential points, a multi-objective integer model, the location of the port, and the transportation modes used to transship the goods from/to the dry port were investigated (Abbasi and Pishvaee, 2018). For the case of Tianjin port, an integer programming model was developed to minimise the sum of the transportation costs and the fixed facility opening/closing costs (Wang, Chen and Huang, 2018). A robust MILP model was suggested by Tadic et.al for two-leg and three-leg flow mechanism, and the container route has been optimised to locate a dry port or intermodal terminals (Tadic, Krstic and Kovac, 2021). It is to be noted that most of the factors considered were quantifiable, and a lesser number of qualitative factors have been used when dealing with optimisation problems.

The criteria indicate that transportation and economic criteria are the most explored ones, which are usually quantifiable followed by proximity or accessibility, or nearness, which are dealt with as quantifiable (as distance or nos) or qualitative (quality of railway service), etc. The site-specific studies are few, and the attempt was made by Nunez et al. (Núñez, 2013) in their studies. The various methods adopted for the dry port study show that either one single multicriteria method or various multicriteria methods are used in the literature, but most studies have used a method for weighing and another method for an alternative selection. In this study, we have used the traditional Delphi method to select the criteria and finalise them. Delphi gives a robust result when there is an element of uncertainty. The experience level of the experts in this geographical area will influence the factor identification process. The Delphi method's first two cycles determine the factors, and the next two steps determine the factors' rank.

3. METHODOLOGY

The overall methodology for factor selection is given in Fig1 below. The first step involves an opinion survey to finalise the criteria for the Delphi survey, and the second part is the Delphi survey.

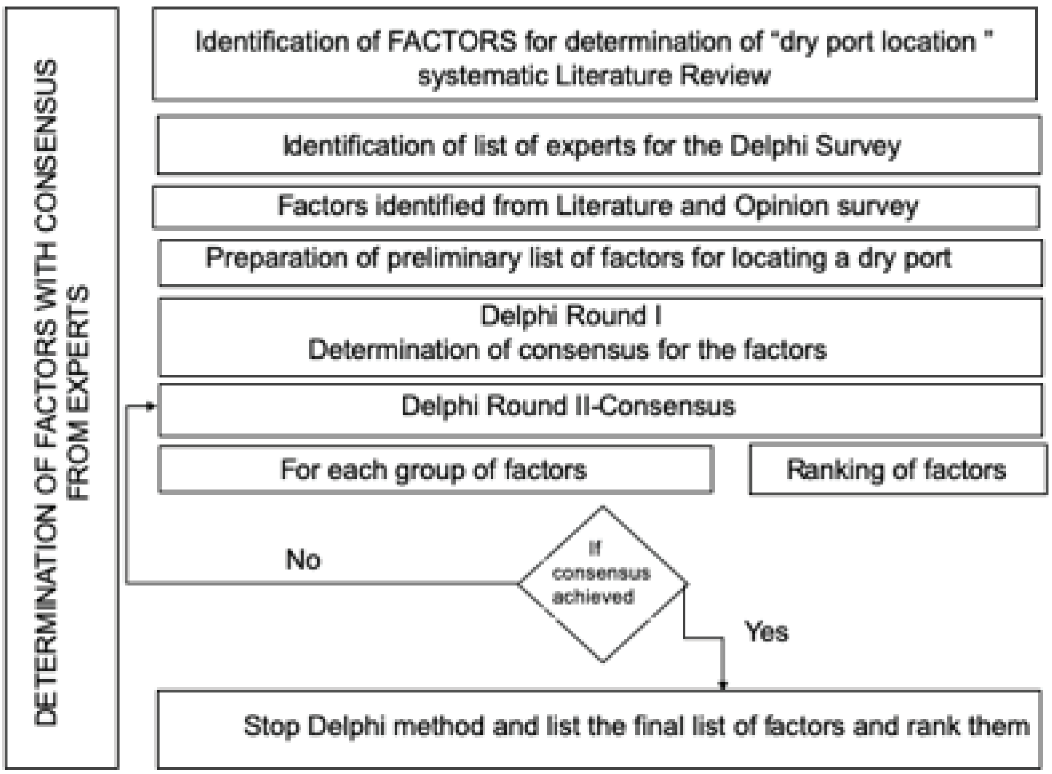

Figure 1.
Overall methodology.

3.1. Opinion Survey to Sieve the Criteria

A list of criteria has been selected, and an opinion survey has been presented for preparing a preliminary list. Only senior-level executives with nearly twenty years of port operations experience have participated in this phase. The outcomes include adding a few criteria concerning the geographical area and classifying the criteria into main and sub-criteria. One main opinion is to consider seaport and airport proximity, as we have considered the peninsular India, where the land area from east to the west extends only on an average of 150 km -450 km. There was an opinion not to consider airport connectivity, as few experts suggest that since we have been considering container port operations for further studies, commenting that the containers are not airlifted. An expert pointed out that the criteria selected may not apply to northern India since India's northern part has a different geography and land features than the peninsular region. There are more significant seaports and minor seaports in the southern peninsular region. Most dry ports in India function on lease land and incur a rental cost as part of the operational cost, which has been added to the list. A few experts suggest that environmentally sensitive areas are significant as there have been repeated cases of flooding in the three southern states of India, Kerala, Tamil Nadu, Karnataka. After considering the opinions, an initial list containing four main criteria and nineteen sub-criteria was prepared for the Delphi survey. Table 2 shows the criteria selected from the literature, as well as an expert opinion survey.

Table 2.
The preliminary list from Literature and Opinion survey.

Main Criteria	Sub Criteria	Explanation	Literature /Experts
Economic	Capital costs	Market value or land price where the dry port is situated	(Ka, 2011)(Madan B. Regmi , Hanaoka, 2012)
		The development price of land	Opinion Survey
	Operating cost	Construction cost involved in setting up of dry port	(Madan B. Regmi , Hanaoka, 2012)
		Rental Cost	Opinion Survey
Accessibility	Accessibility to the rail	Accessibility to freight transport networks: Quality of the railway	(Madan B. Regmi , Hanaoka, 2012) (Abbasi and Pishvaee, 2018)(Pekin and Macharis, 2013)
	Accessibility to major roads	To Highway and other roads	(Madan B. Regmi , Hanaoka, 2012) (Abbasi and Pishvaee, 2018)(Pekin and Macharis, 2013)
	Accessibility to airports	Distance to the nearest airport	(Madan B. Regmi , Hanaoka, 2012)
	Accessibility to seaports	Connection with one or more Seaports(experts expressed this concern due to the peninsular nature of Southern India)	Opinion Survey
	Accessibility to services	Accessibility to communication networks, the electrical grid and any other necessary utilities such as water, sanitation, etc.	(Rahmato, 2016)
	Accessibility to waterway	Inland waterways for promoting intermodal transportation	(Madan B. Regmi , Hanaoka, 2012)

Location	Belonging to an industrial area	It helps in making the process supply chain-oriented	(Erbas, 2016)
	Proximity to other logistics platforms	Proximity to other logistics platforms	(Ka, 2011)
	Proximity to market	Nearby market providing last-mile connectivity	(Madan B. Regmi , Hanaoka, 2012)
	Room for expansion	Future possibility of expanding the dry port	(Erbas, 2016) (Rahmato, 2016)(Pham, Ma and Yeo, 2017)
	Proximity to production centers and consumers	Nearness to production base and the consumers assuring stuffing/ de-stuffing easier at the origin	(Madan B. Regmi , Hanaoka, 2012)(Cetin and Saka, 2019)
	Proximity to SEZ or FTZs	SEZ and FTZs shall provide tax benefits to its users	(Madan B. Regmi , Hanaoka, 2012)(Pham, Ma and Yeo, 2017)
Environmental	Noise Pollution	Due to dry port operation	(Núñez, 2013)
	Air pollution	Due to dry port operation	(Núñez, 2013)(Henttu, Hilmola and Lättilä, 2010)
	Minimising congestion	Due to dry port operation	(Núñez, 2013)(Henttu, Hilmola and Lättilä, 2010)
	Away from urban centers	Due to container movement in urban areas	(Pekin and Macharis, 2013)(Abbasi and Pishvaee, 2018)

3.2. Delphi Survey

Over 2,600 papers have considered Delphi survey in different fields and on different application levels. In their study, Mac Carthy et al. did commendable work for the global location problem to identify five main critical criteria and ten sub-criteria from a list of thirteen primary criteria and over a hundred sub-criteria. They had used Delphi to reduce the factor list (MacCarthy and Atthirawong, 2003). Similarly, the critical criteria were determined for land value determination. The Delphi technique was used to reduce the number of criteria. They used the Relative Importance Index, which was determined, and critical criteria were identified (Binoy, Naseer and Anil Kumar, 2020). In the case of dry ports determination for dry ports, Nunez et al. identified fourteen criteria randomly and had determined the mean, median, and interquartile value to determine the weigh of each factor. They have also expressed their views on increasing the number of criteria as their scope of the study.

Any Delphi survey round will have multiple cycles, and each cycle will have a purpose. In this paper, the Delphi Cycle 1's purpose is to fix the criteria for dry port selection. There have been many suggestions, even after the expert opinion survey and the criteria list were modified after Delphi cycle one, and we have decided to go for another Delphi survey. The Delphi survey was conducted during Jun 2017 and Feb 2018. The last two rounds of the survey were meant to determine the rank of the criteria. In the second stage, Kendall's 'W' coefficient was used to check the consistency of the rounds, and the Interquartile range was found to find the rank of the criteria.

3.2.1. Selection of Panel of Experts

The first step of the Delphi survey is to identify a panel of experts from diverse areas and closely related to the research question. The choice of the right experts for Delphi studies is described as the most important, yet most neglected step (Kobus and Westner, 2016). The expert should be willing to commit to participation in all rounds of the survey (Flostrand, Pitt and Bridson, 2020). The size of a panel would depend on the homo/heterogeneity of the experts, and the homogenous panel would include ten to fifteen experts; this range expands with increasing heterogeneity to as many as several hundred (Skulmoski and Hartman, 2007). In the second step, the panellists are individually, for their insights, ranks, scale or any other relevant questions, designed to most effectively capture the answer to the research question. The inclusion of subjective questions and justification is implemented to the extent where the anonymity of panellists is not compromised. The third step is to aggregate the collected data from the preceding step. A consensus is required, and a detailed report provides the panel with relevant statistical values, including aggregation of reasoning statements. The panellist is sent the report and previous responses. Later this round of results is aggregated and checked for consistency (Flostrand, Pitt and Bridson, 2020).

This method is a well-established expert opinion method, and therefore the choice of the experts is very critical as they should have vast knowledge about the concept of dry port and the geography of the area. The panel consists of dry ports, port managers, industrial users, academicians who have expertise in the dry port sector, as well as maritime activities. The service providers, like customs house agents and freight forwarders are familiar with the dry port operations.

3.2.2. Delphi Cycle1

The list of criteria obtained from the opinion survey, as shown in Table 2, was given for the first Delphi survey. An option to add/delete the criteria was given in this round. The survey questionnaire was prepared in Feb 2018, and a trial was run among the researchers. The comments received have been used to bring brevity to the questionnaire.

The experts selected were approached through email and in person. The questionnaire was sent to fifty-five and twenty-four responded, which means that the response rate is less than 40 %. Most academic experts commented that, though they work in the transportation sector, they are not aware of the dry port operations and refrained from answering the questionnaire. The experts were contacted through email, and since the response rate was low, in-person interview was applied. On average, the interview took forty-five minutes to one hour, which helped develop a rapport among the experts and helped in further rounds of the survey. The challenge in the interview session was that many industry experts were unaware of the Delphi technique. All the experts were from the top management level, so it was challenging to get an appointment. The experts who participated were kind enough to share their vast knowledge in their expertise, which has also helped further survey rounds.

The experts expressed concern over the terms used as proximity, nearness, and accessibility as related to the criteria, adding that there should be clarity. The economic criteria should be renamed as financial criteria.The first round had four main criteria and eighteen sub-criteria, and after the first round, the list was expanded to five main criteria and twenty-four subsectors. The consolidated opinion of the experts after the first round is given in Table 3.

Table 3.
Comments received for Delphi Cycle 1.

ECONOMIC	It is financial factors and not Economic factors. Handling charges and storage charges will come. Cost for improvements in nearby transportation facilities. The parameter to be renamed as Financial parameters. Maintenance costs should be a separate head.
ACCESSIBILITY	Proximity to services like shipping lines. Proximity to export-oriented manufacturing factories. Proximity to the customs station. Containers through the air are not possible. Proximity to the nearest city. Accessibility and location are mutually exclusive.
LOCATIONAL	Landscape suitability like terrain Availability of skilled labour Social factors as another main criterion Power, water, and other essential infrastructure Availability of suitable land Social Factors Proximity to the customs station Service and capacity factors (inspection and clearances; storage, maintenance, and transfer
ENVIRONMENTAL	Water pollution is unimportant as it’s a dry port and not a seaport. Away from the environmentally sensitive area is unimportant Away from urban centers is unimportant

3.2.3. Delphi Cycle 2

From the feedback, the Cycle 2 Delphi questionnaire was prepared and sent to the same experts who had responded to Cycle1. The comments given by experts in the first round of the survey were incorporated. Explanation of each factor was given in detail as requested in Cycle 1. The response rate was quicker this time, as the rapport created had helped in the second round. The modified list of factors in the second round is given in Figure 2, and the changes are highlighted. Questionnaires were sent to twenty-four respondents in the first round, while eighteen responses were recorded in the second round of the questionnaire. In this round, we could find a more significant number of experts agreeing to the criteria chosen. The response rate of academicians had dropped significantly in this round. After the second round, the experts provided more insights, but the factor list remained with five main criteria and twenty-four sub-criteria. As consensus was not reached, we decided to go for the third round of Delphi. Reaching a consensus is a crucial step in Delphi (Barrios et al., 2021).

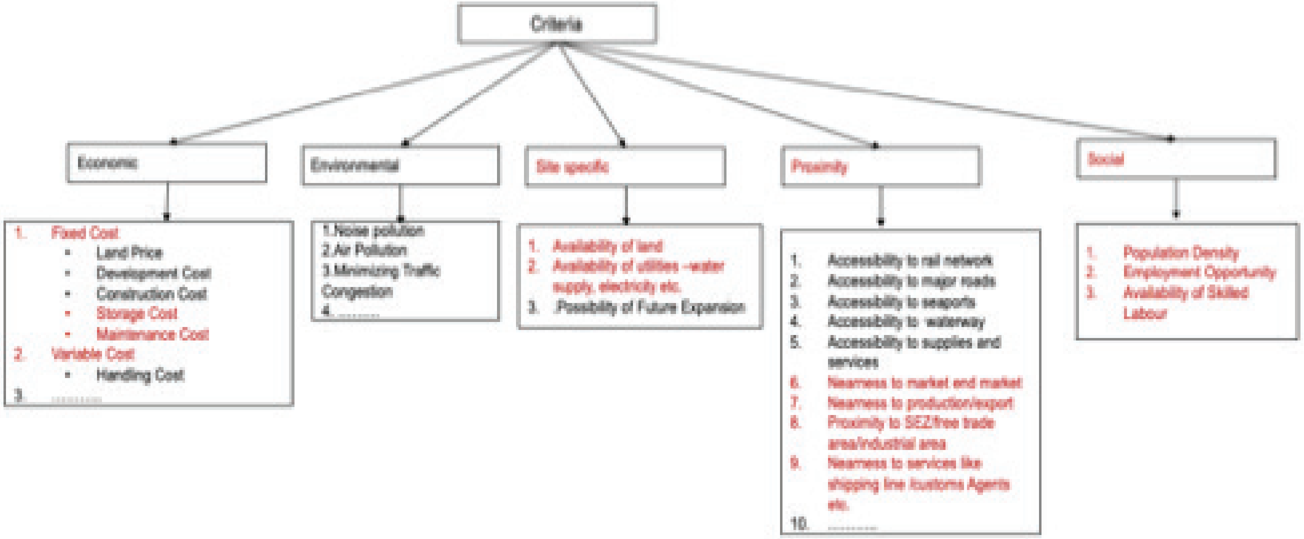

Figure 2.
List of factors for Cycle 2.

3.2.4. Delphi Cycle 3

The experts were informed about the previous response. A list was prepared to which most of the experts agreed to with five main criteria, and 24 sub-criteria were presented. The final vetted list of the criteria's chosen is given Fig 3. In the first round, questionnaires were shared with twenty-four experts, and sixteen expert opinions were recorded. In this stage, the expert was asked to rank the criteria on a linear scale without giving an equal rank option. The rank obtained were also checked for consistency using Kendall's W. The W value was low, so we decided to go for another round, including more experts.

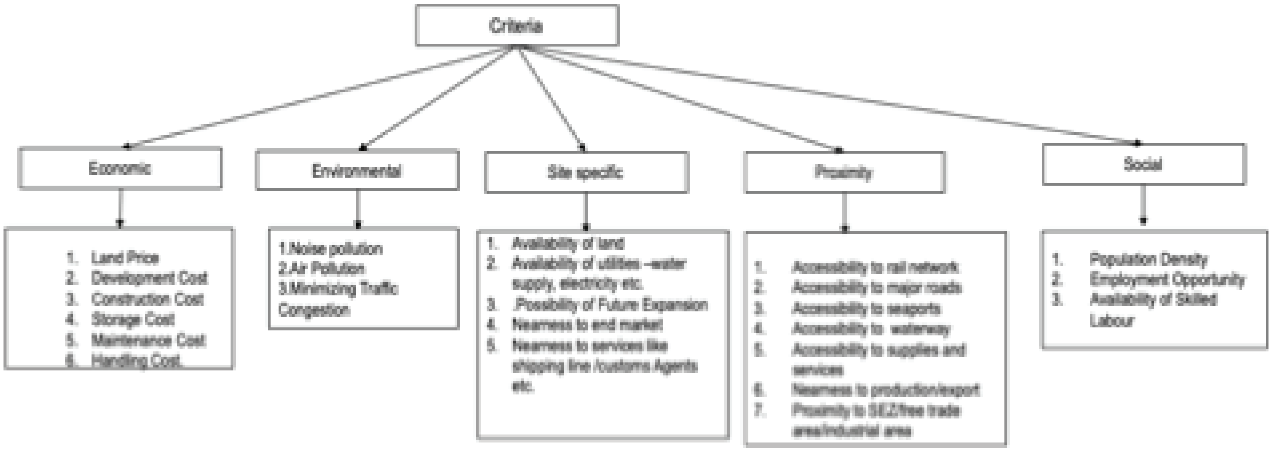

Figure 3.
Final vetted list of criteria.

3.2.5. Delphi Cycle 4

After the three survey rounds, the consistency was checked, and Kendall's W value was determined. The W value obtained for ranking criteria is given below in Table 3. The economic subfactor and the proximity subfactor have not reached the required W value, as the consistency range of Kendall's W falls between (0.70-0.99), with 0.99 meaning that almost all the experts support the factor rankings. Due to this, it was decided to find rank of the criteria by running the questionnaire for another cycle. The same experts were approached for the responses, and all the experts gave the ranking. The Kendall's W value was determined and found that all the main criteria and subsectors fell within the required range.

4. ANALYSIS OF RESULTS

A systematic way in which Delphi results can be presented is explained by Kobus et al. (Kobus and Westner, 2016). The response of the Delphi was analysed. The number of experts who participated in each survey round is given below in Fig 4.

Getting the response to the questionnaire was really tough. The port managers, industrial users, and service providers were very helpful during the process of Delphi, but most of the academicians from top-notch institutes in the transportation sector refused to answer the questionnaire, quoting their inexperience in the area of dry ports. This can be co-related because there are only very few academic publications in Scopus journals. We cannot find a single article where an Indian from an Indian university has penned.The responses were mainly from port managers who have turned to academia.

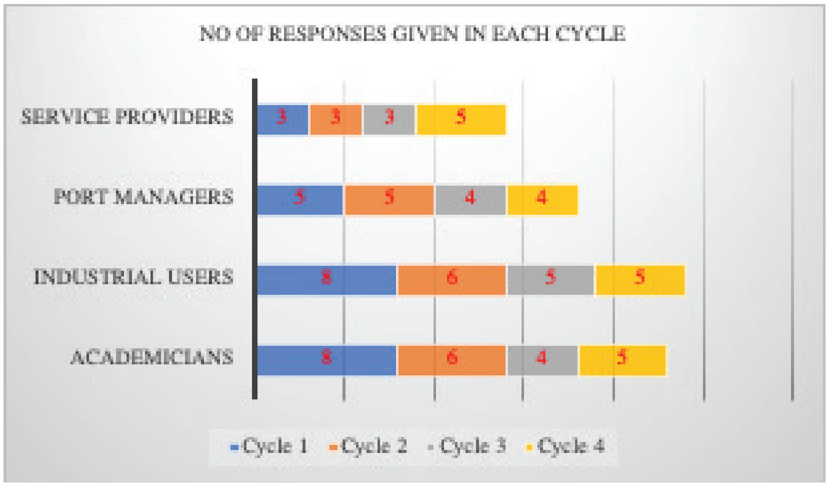

Figure 4.
Number of responses in each cycle of Delphi.

4.1. Main Criteria

The final vetted list contained five main criteria and twenty-four sub-criteria. Each of these was ranked, and the weights were determined separately. The main criteria value was ranked separately. This paper has consolidated the mean rank and found Kendall's W value to ensure consistency, as explained above. The main criteria and sub-criteria have been ranked, and the mean rank for each factor has been systematically presented. The main criteria ranking is shown in Table 4 below.

Table 4.
Delphi Result: Main criteria.

	Round 1					Round 2				
Main factors	Mean	Median	IQR	RANK	W	Mean	Median	IQR	RANK	W
ECONOMIC	2	2	2	2		1.9375	2	2	2	
PROXIMITY	1.625	2	1	1		1.75	2	1	1	
SITE SPECIFIC	4.1875	4	1	4	0.7133	4.3125	4	1	4	0.7445
SOCIAL	4.625	5	1	5		4.625	515			
ENVIRONMENTAL	2.5625	3	1.25	3		2.375	3	1.25	3	

It can be observed that the proximity criteria are ranked first, and social criteria last. It is a concern that the proximity and economic criteria have been ranked higher than the environmental and social ones. It may be because the experts in this geographical area of dry port operations have an outlook towards a more cost-effective operation than a sustainable one. This result contradicts the result obtained for Spanish dry ports, where environmental criteria were ranked first (Núñez, Cancelas and Orive, 2013). Another study on Indian Intermodal studies has ranked social criteria more relevant than environmental criteria by consulting five experts (Kumar and Anbanandam, 2019). It indicates that the expert field of expertise and the number of reliable responses influence the opinion. Since this paper has more experts and the expertise level is high in dry ports, this can be considered more reliable. Moreover, the first two cycles of Delphi were conducted to vet the criteria and the fact that no dry port studies have adopted this methodology makes this study even more robust

4.2. Sub-Criteria

The analysis and the results of all the subfactors are given in Table 5.The subfactor-wise discussion is also given below

4.2.1. Economic

One of the most critical decisions of any dry port, regardless of the region, is the economic or trade-related criteria. It includes capital, development, operating, storage, handling, and maintenance costs. The experts have revealed that an individual may lease the land and do the dry port operation, which adds to the running cost of the dry port. Most of the land is acquired on rent by the dry port operators. There are cases in which an individual owns the land and the assets, and the operations are run by other persons, making it a rental facility for operation purposes alone. Of the sub-criteria, the land cost was ranked first. It is significant, as we know, that a large amount of investment is needed to buy or lease land. The lowest-ranked factor was the maintenance cost because all dry ports have an in-house maintenance cell, as per the experts.

4.2.2. Proximity

The other criteria considered are proximity (Pekin and Macharis, 2013; Murat Saka and Cetin, 2020), accessibility(Nguyen and Notteboom, 2016), nearness or the distance function (UNESCAP, 2018), which is critical for any dry port operation. Most of the papers have taken the Euclidean distance. A few papers have also taken it as several facilities, distance to these facilities, or even as qualitative criteria, like the service quality. The criteria considered here are the accessibility road network, rail network, airports, seaports, waterways, production centres, SEZs, and other logistic platforms. Of these criteria, the accessibility to seaport was ranked first; this may be because the experts were aware that the questionnaire's purpose was to locate a dry port in a peninsular region. The second crucial rank was accessibility to the rail network; this may be due to the environmental benefits of rail over other networks. Even though it is a very sustainable model, the waterways were ranked fourth. The government allows heavy subsidies for water transportation, but the water transport network is highly inefficient. The nearness to logistic platforms were the last ranked subsectors. It may be because, without proper planning, there is no sense in opening new logistic hubs; however, they attract much investment.

4.2.3. Environmental

Environmental criteria are considered qualitative or binary variable in most literature. The criteria considered in our study include air, noise pollution, traffic congestion, which is very significant due to the trucking activities. The dry port location being a newer topic, we can see that most papers have frequently considered this factor in literature, especially studies in developed regions. The environmental parameters were given prime importance, while locating Spanish dry ports (Awad-Núñez, Soler-Flores, et al., 2016). The environmental factor has been ranked third in our study. Of the sub-criteria, the gradation of rank was air pollution>congestion>noise pollution. These criteria will permanently harm the environment.

4.2.4. Site-specific

Location criteria often seen in studies are geographical criteria, like the slope, elevation, terrain condition in developed countries (Awad-Núñez, Soler-Flores, et al., 2016). The difference could be seen in developing countries, where SEZs, marketplaces, and production centres play a significant role (Komchornrit, 2017). In this study, we have not considered the terrain condition as we are trying to find the criteria for a more considerable extent of land, and a significant geographical condition will be impossible to achieve. The subfactor possibility of future expansion has been ranked first. It may be because, with increasing trade volume and increasing price, it might not be possible to open new facilities and therefore it is always ideal to have options for future expansion. The availability of land and services is the bottom line, since these two criteria represent prerequisites for any dry port location, which may be why the experts have so far neglected them.

4.2.5. Social

The softer criteria, like socio-political ones, need to be included for more relevant results in developing countries, and there is a need to incorporate different stakeholders as port managers, service providers, industrial users (Lam Canh Nguyen et al. 2016). The socio-political situation in developing countries is very critical. The strikes and wage issues in developing countries hinder the smooth functioning of a dry port. The unstable Government and wrong policy decisions have shifted the freight flow from rail to India's roads (Gujar, Adolf K Y Ng and Notteboom, 2019). Hence social criteria also need to be considered while locating a dry port. Even though these criteria were included, social criteria had the minor rank when ranking of the criteria was done. The subsectors, like the population density>availability of skilled labour> employment opportunity, are very significant for the dry port location, as the skilled labour is required for port-related operations. If a dry port is located in a densely populated area, it might also have a negative impact.

Table 5.
Analysis of the Delphi Cycle 3 & 4.

		Round 1				Round 2			
Main factors	Sub factors	Mean	Median	IQR	W	Mean	Median	IQR	W
ECONOMIC	Land Price	2.00	1.50	2.00	0.4347	1.50	1.50	1.00	0.7119
	Construction cost	2.81	2.50	1.25		2.06	2.00	2.00	
	Development cost	2.44	2.00	1.50		3.00	3.00	1.00	
	Storage cost	4.06	4.00	1.50		4.94	5.00	2.00	
	Handling cost	4.50	5.00	3.00		4.25	4.00	2.25	
	Maintenance cost	5.06	5.00	1.25		5.38	5.00	1.00	
PROXIMITY	Accessibility to sea ports	4.31	5.00	2.50	0.5304	1.75	2.00	1.00	0.7065
	Accessibility to rail networks	2.38	3.00	1.25		2.56	3.00	1.25	
	Accessiblity to major roads	2.88	3.00	2.00		2.88	3.00	2.00	
	Accessibility to waterway	2.19	2.00	2.00		3.44	4.00	1.25	
	Neams to production centres	4.50	5.00	2.00		4.81	5.00	2.00	
	Nemess to logistic platfoms	5.50	6.00	2.00		6.25	6.50	1.25	
	Nemess to SEZ	6.25	6.50	1.00		6.31	6.00	1.00	
SITE SPECIFIC	Availability of land	4.19	4.00	1.00	0.4977	4.56	5.00	1.00	0.7727
	Availability of utilities	2.50	2.00	1.25		4.25	4.00	1.00	
	Possibility for future expansion	1.38	1.00	1.00		1.44	1.00	1.00	
	Neamers to End market	3.13	3.00	2.00		1.88	2.00	1.25	
	Nemess to services like shipping line	3.81	4.00	2.00		2.88	3.00	0.25	
SOCIAL	Population Density	3.00	3.00	0.00	0.7148	2.88	3.00	0.00	0.7656
	Employment Oppurtunity	1.63	3.00	-1.00		1.94	2.00	0.00	
	Availability of skilled labour	1.38	1.00	1.00		1.19	1.00	0.00	
ENVIRO-NMENTAL	Noise pollution	3.00	3.00	0.00	0.7240	2.94	3.00	0.00	0.7656
	Air pollution	1.38	1.00	1.00		1.31	1.00	1.00	
	Minimizing traffic congestion	1.63	2.00	1.00		1.69	2.00	0.75	

5. LIMITATIONS OF THE STUDY

This study has adopted a robust factor selection methodology; first, the criteria have been identified and given for an opinion survey for preparing an initial list. A two-round Delphi survey has been done to finalise the criteria, which helps in robust decision making on the selected criteria. However, Delphi has its shortcomings, as mentioned in every Delphi study, as in the case of choice of experts who may create a bias in the criteria chosen and the ranking. In this study, a linear ranking method has been adopted. However, it would have been better if a more precise scaling had been chosen and a robust way of analysis had been possible

6. CONCLUSION

The purpose of the study was to find the factors determining location of dry port in a peninsular region. The literature review has revealed that scholars focus more on transportation, proximity, and economic criteria. Social criteria are less studied but this is very relevant for developing economies as the government changes frequently. The social criteria have been included in the opinion survey, but when ranking of the factor was being done, social criteria were given the least priority. This type of survey can be adopted to decide on the criteria for any field of study as this Delphi methodology is more robust. The study has observed the addition of criteria specific to the peninsular region, such as "accessibility to the seaport". The criteria like rental or development costs have also been added as the land can be on lease, which represents a burden to the dry port operator by increasing the total cost. The social factor has been ranked lower than other criteria, and this needs to be addressed strongly as very few studies have so far been conducted on social criteria, as it is not easily quantifiable. This Delphi survey method for finalising the criteria in multiple rounds has not yet been attempted in the case of dry port studies. This method has given robustness to the criteria chosen. As a further extension work, these criteria can be categorised as location-based and network-based ones and can be modelled separately. As the container volume is exponentially increasing, the associated facilities like dry port need to be appropriately planned.

CONFLICT OF INTEREST:

The authors declare no conflict of Interest.

ACKNOWLEDGEMENT: The authors would like to thank the Department of Science and Technology, Women's Scientist Division for the project DST/WOS-A/ET-151/2017 dt.12.09.2017.

REFERENCES

Abbasi, M. and Pishvaee, M. S., 2018. A two-stage GIS-based optimization model for the dry port location problem : A case study of Iran, Journal of Industrial and Systems Engineering, 11(1), pp. 50–73.

Ambrosino, D. & Sciomachen, A., 2014. Location of Mid-range Dry Ports in Multimodal Logistic Networks. Procedia - Social and Behavioral Sciences, 108, pp.118–128. Available at: http://dx.doi.org/10.1016/j.sbspro.2013.12.825.

Awad-Núñez, S. et al., 2016. A Methodology for Measuring Sustainability of Dry Ports Location Based on Bayesian Networks and Multi-criteria Decision Analysis. Transportation Research Procedia, 13, pp.124–133. Available at: http://dx.doi.org/10.1016/j.trpro.2016.05.013.

Awad-Núñez, S. et al., 2016. How should the Sustainability of the Location of Dry Ports be Measured? Transportation Research Procedia, 14, pp.936–944. Available at: http://dx.doi.org/10.1016/j.trpro.2016.05.073.

Barrios, M. et al., 2021. Consensus in the delphi method: What makes a decision change? Technological Forecasting and Social Change, 163, p.120484. Available at: http://dx.doi.org/10.1016/j.techfore.2020.120484.

Binoy, B.V, Naseer, M. A. and Anil Kumar, P., 2020, A methodology for identifying critical factors influencing land value in urban areas: a case study of Kerala, India. Property Management, 38(5), pp.665–681. Available at: http://dx.doi.org/10.1108/pm-01-2020-0004.

Bossche, M.V. & Gujar, G., 2010. Competition, excess capacity and pricing of dry ports in India: some policy implications. International Journal of Shipping and Transport Logistics, 2(2), p.151. Available at: http://dx.doi.org/10.1504/ijstl.2010.030864.

Cetin, O. and Saka, M., 2019. Determination of dry port location within the hinterland of kocaeli ports by applying AHP, 20th Commemorative Annual General Assembly, AGA 2019 - Proceedings of the International Association of Maritime Universities Conference, IAMUC 2019, pp. 200–207. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85077983425&partnerID=40&md5=16abe546b8bd8523cb6878e52f33e730.

Chang, Z., Lu, J. & Qi, Z., 2011. Location Analysis for Dry Ports Based on FCM. Applied Mechanics and Materials, 97-98, pp.1022–1026. Available at: http://dx.doi.org/10.4028/www.scientific.net/amm.97-98.1022.

Chang, Z., Notteboom, T. & Lu, J., 2015. A two-phase model for dry port location with an application to the port of Dalian in China. Transportation Planning and Technology, 38(4), pp.442–464. Available at: http://dx.doi.org/10.1080/03081060.2015.1026103.

Chun-hui Wang & Jin-yu Wei, 2008. Research on the Dry Port Location of Tianjin Port Based on Analytic Network Process. 2008 International Seminar on Business and Information Management. Available at: http://dx.doi.org/10.1109/isbim.2008.74.

Özceylan, E. et al., 2016. Evaluation of freight villages: A GIS-based multi-criteria decision analysis. Computers in Industry, 76, pp.38–52. Available at: http://dx.doi.org/10.1016/j.compind.2015.12.003.

Flostrand, A., Pitt, L. & Bridson, S., 2020. The Delphi technique in forecasting– A 42-year bibliographic analysis (1975–2017). Technological Forecasting and Social Change, 150, p.119773. Available at: http://dx.doi.org/10.1016/j.techfore.2019.119773.

Gujar, G.C., Ng, A.K.Y. & Notteboom, T., 2019. The impacts of major government initiatives on the development of dry ports: A case study of the direct port delivery scheme in India. Journal of Transport Geography, 80, p.102498. Available at: http://dx.doi.org/10.1016/j.jtrangeo.2019.102498.

Hanaoka, S. & Regmi, M.B., 2011. Promoting intermodal freight transport through the development of dry ports in Asia: An environmental perspective. IATSS Research, 35(1), pp.16–23. Available at: http://dx.doi.org/10.1016/j.iatssr.2011.06.001.

Henttu, V., Hilmola, O. and Lättilä, L., 2010. Financial and environmental impacts of a dry port to support two major Finnish seaports, Lappeenranta University of Technology, Department of Industrial Management, Research Report.

Jeevan, J., Chen, S.-L. & Cahoon, S., 2017. Determining the influential factors of dry port operations: worldwide experiences and empirical evidence from Malaysia. Maritime Economics & Logistics, 20(3), pp.476–494. Available at: http://dx.doi.org/10.1057/s41278-017-0063-y.

Jovin J. Mwemezi, 2012. PInland container depot integration into logistics networks based on network flow model: The Tanzanian perspective. African Journal of Business Management, 6(24). Available at: http://dx.doi.org/10.5897/ajbm12.294.

Ka, B., 2011. Application of Fuzzy AHP and ELECTRE to China Dry Port Location Selection. The Asian Journal of Shipping and Logistics, 27(2), pp.331–353. Available at: http://dx.doi.org/10.1016/s2092-5212(11)80015-5.

Khaslavskaya, A. & Roso, V., 2020. Dry ports: research outcomes, trends, and future implications. Maritime Economics & Logistics, 22(2), pp.265–292. Available at: http://dx.doi.org/10.1057/s41278-020-00152-9.

Kobus, J. and Westner, M., 2016. Ranking-type Delphi studies in is research: Step-by-step guide and analytical extension, Proceedings of the 9th IADIS International Conference Information Systems 2016, IS 2016, pp. 28–38.

Komchornrit, K., 2017. The Selection of Dry Port Location by a Hybrid CFA-MACBETH-PROMETHEE Method: A Case Study of Southern Thailand. The Asian Journal of Shipping and Logistics, 33(3), pp.141–153. Available at: http://dx.doi.org/10.1016/j.ajsl.2017.09.004.

Komchornrit, K. & Weerawat, W., 2018. Modeling Framework of Hybrid Method for Site Selection of Dry Port: A Case Study in Southern Region of Thailand. KMUTNB International Journal of Applied Science and Technology, 13(3). Available at: http://dx.doi.org/10.14416/j.ijast.2018.11.004.

Kumar, A. & Anbanandam, R., 2019. Location selection of multimodal freight terminal under STEEP sustainability. Research in Transportation Business & Management, 33, p.100434. Available at: http://dx.doi.org/10.1016/j.rtbm.2020.100434.

Lamii, N. et al., 2020. Systematic Review of Literature on Dry Port Concept Evolution. Transactions on Maritime Science, 9(2). Available at: http://dx.doi.org/10.7225/toms.v09.n02.009.

Lättilä, L., Henttu, V. & Hilmola, O.-P., 2013. Hinterland operations of sea ports do matter: Dry port usage effects on transportation costs and CO2 emissions. Transportation Research Part E: Logistics and Transportation Review, 55, pp.23–42. Available at: http://dx.doi.org/10.1016/j.tre.2013.03.007.

Li, F., Shi, X. and Hu, H., 2011. Location Selection of Dry Port based on AP Clustering - The Case of SouthWest Location, Journal of Systems and Management Sciences, 1(10), pp. 79–88.

MacCarthy, B.L. & Atthirawong, W., 2003. Factors affecting location decisions in international operations – a Delphi study. International Journal of Operations & Production Management, 23(7), pp.794–818. Available at: http://dx.doi.org/10.1108/01443570310481568.

Madan B. Regmi, Hanaoka, S., 2012. Application of analytic hierarchy process for location analysis of logistics centers in Laos, 91th Annual Transportation Research Board meeting. Available at: http://t2r2.star.titech.ac.jp/cgibin/publicationinfo.cgi?q_publication_content_number=CTT100633376 %5Cnhttp://docs.trb.org/prp/12-0471.pdf.

Miraj, P. et al., 2020. Research trend of dry port studies: a two-decade systematic review. Maritime Policy & Management, 48(4), pp.563–582. Available at: http://dx.doi.org/10.1080/03088839.2020.1798031.

Nazemzadeh, M. & Vanelslander, T., 2015. The container transport system: Selection criteria and business attractiveness for North-European ports. Maritime Economics & Logistics, 17(2), pp.221–245. Available at: http://dx.doi.org/10.1057/mel.2015.1.

Ng, A.K.Y. & Cetin, I.B., 2012. Locational Characteristics of Dry Ports in Developing Economies: Some Lessons from Northern India. Regional Studies, 46(6), pp.757–773. Available at: http://dx.doi.org/10.1080/00343404.2010.532117.

Nguyen, L.C. & Notteboom, T., 2016. A Multi-Criteria Approach to Dry Port Location in Developing Economies with Application to Vietnam. The Asian Journal of Shipping and Logistics, 32(1), pp.23–32. Available at: http://dx.doi.org/10.1016/j.ajsl.2016.03.003.

NITI Aayog and RMI, 2018. Goods on the Move: Efficiency and Sustainability in Indian Logistics, MOVE: Global Mobility Summit. Available at: https://niti.gov.in/writereaddata/files/document_publication/Freight_report.pdf.

Núñez, S. A., 2013 Setting of weighting factors influencing the determination of the location of Dry Ports using a DELPHI methodology', Proceedings of ScieConf 2013, pp. 505–510. Available at: https://dx.doi.org/10.13140/2.1.4545.3763.

Pekin, E. & Macharis, C., 2013. A GIS-based analysis of the potential for freight villages in Turkey. World Review of Intermodal Transportation Research, 4(2/3), p.157. Available at: http://dx.doi.org/10.1504/writr.2013.058980.

Pham, H.T. & Lee, H., 2019. Developing a Green Route Model for Dry Port Selection in Vietnam. The Asian Journal of Shipping and Logistics, 35(2), pp.96–107. Available at: http://dx.doi.org/10.1016/j.ajsl.2019.06.002.

Pham, T.Y., Ma, H.M. & Yeo, G.T., 2017. Application of Fuzzy Delphi TOPSIS to Locate Logistics Centers in Vietnam: The Logisticians' Perspective. The Asian Journal of Shipping and Logistics, 33(4), pp.211–219. Available at: http://dx.doi.org/10.1016/j.ajsl.2017.12.004.

Rahmato, W. P., 2016. Kandangan dry port project: An option of solution for congestion: Case of Lamong Bay Terminal (Surabaya, Indonesia). Available at: http://commons.wmu.se/all_dissertations/528.

Roso, V., 2008. Factors influencing implementation of a dry port G. Kovacs, ed. International Journal of Physical Distribution & Logistics Management, 38(10), pp.782–798. Available at: http://dx.doi.org/10.1108/09600030810926493.

Saka, M. & Cetin, O., 2020. Comparing two judgment scales of AHP with a case study: reaching a decision on a dry port location. WMU Journal of Maritime Affairs, 19(4), pp.427–461. Available at: http://dx.doi.org/10.1007/s13437-020-00218-8.

J. Skulmoski, G., T. Hartman, F. & Krahn, J., 2007. The Delphi Method for Graduate Research. Journal of Information Technology Education: Research, 6, pp.001–021. Available at: http://dx.doi.org/10.28945/199.

Tadić, S. et al., 2020. Dry Port Terminal Location Selection by Applying the Hybrid Grey MCDM Model. Sustainability, 12(17), p.6983. Available at: http://dx.doi.org/10.3390/su12176983.

Tadić, S., Krstić, M. & Kovač, M., 2021. Implementation of the dry port concept in central and Southeastern Europe logistics network. World Review of Intermodal Transportation Research, 10(2), p.131. Available at: http://dx.doi.org/10.1504/writr.2021.115414.

UNESCAP, 2018. Development and operation of dry ports of international importance, Connecting to Compete 2018: Trade Logistics in the Global Economy – The Logistics Performance Index and Its Indicators.

United Nations, 2012. Introduction to the development of dry ports in Asia, Economic and Social Commission for Asia and the Pacific.

Varese, E., Marigo, D. & Lombardi, M., 2020. Dry Port: A Review on Concept, Classification, Functionalities and Technological Processes. Logistics, 4(4), p.29. Available at: http://dx.doi.org/10.3390/logistics4040029.

Wang, C., Chen, Q. & Huang, R., 2017. Locating dry ports on a network: a case study on Tianjin Port. Maritime Policy & Management, 45(1), pp.71–88. Available at: http://dx.doi.org/10.1080/03088839.2017.1330558.

Wei, J., Sun, A. & Zhuang, J., 2010. The Selection of Dry Port Location with the Method of Fuzzy-ANP. Advances in Wireless Networks and Information Systems, pp.265–273. Available at: http://dx.doi.org/10.1007/978-3-642-14350-2_33.

Yildirim, BF and Emrah, Ö., 2014. Evaluating Potential Freight Villages in Istanbul Using Multi Criteria Decision Making Techniques, Journal of Logistics Management, 3(1), pp. 1–10. Available at: http://dx.doi.org/10.5923/j.logistics.20140301.01.

Żak, J. & Węgliński, S., 2014. The Selection of the Logistics Center Location Based on MCDM/A Methodology. Transportation Research Procedia, 3, pp.555–564. Available at: http://dx.doi.org/10.1016/j.trpro.2014.10.034.