Article

Developing a Measurement Framework for Ethiopian Dry Port Sustainability: An Empirical Study

Zellalem Tadesse Beyene [1,*], Simon Peter Nadeem [2] and Matiwos Ensermu Jaleta [1]

1   School of Commerce, Addis Ababa University, Addis Ababa P.O. Box 1176, Ethiopia;
    matiwos.ensermu@aau.edu.et
2   Centre for Supply Chain Improvement, University of Derby, Derby DE221GB, UK; s.nadeem@derby.ac.uk
*   Correspondence: zellalem.tadesse@aau.edu.et

Abstract: In the context of a dry port, sustainable operations involve developing and implementing policies and procedures that reduce adverse effects on the environment, advance economic viability, and strengthen social responsibility. Several factors contribute to achieving environmental, economic, and social sustainability, making it critical to identify the factors influencing the sustainability of dry port operations. This research aims to identify decisive factors associated with economic, social, and environmental sustainability, and to develop a framework for measuring sustainability in dry port operations. The research utilises exploratory factor analysis (EFA) and the analytical hierarchical process (AHP) to develop a measurement framework for assessing the sustainability of Ethiopian dry ports. EFA is an effective method with which to identify factors that contribute to sustainable dry port operations. To provide a frame for the critical sustainability performance metrics for dry ports, the AHP approach was used. Data were collected from 300 stakeholders using surveys to identify key factors, and 20 senior experts were involved in validating and rating the most influential factors determining dry port sustainability. This research asserts the most pertinent factors guiding dry port sustainability operations, resource allocation, and decision-making. From an environmental sustainability perspective, critical factors include minimising business-partner impacts, reducing waste, addressing climate change, providing environmental planning education to teams, and implementing measures to protect the national environment. From a social perspective, the factors identified include a resettlement policy, employment opportunities for the community, workplace safety, stakeholder consultation, and top-management guidance. From an economic standpoint, critical factors include value-added services, reduced transportation costs, decreased time, enhanced productivity in the trade supply chain, and profit orientation. The research provides valuable insights with which to guide the development of practices and policies aimed at ensuring sustainable dry port operations, a critical domain of the trade supply chain.

Keywords: dry port; sustainability; measurement framework; empirical study

1. Introduction

Dry ports are typically thought of as logistics hubs with large capacities and regular transport services that connect to gateway seaports and centres of production. In the context of a trade supply chain, dry ports may function as inland hubs or as seaport expansions to ease the flow of cargo between seaports and the production and consumption base [1]. The trade supply chain has been under growing pressure to meet sustainability standard regulations and public demands. By combining dry port operations with a production base and the inland interface of a seaport, these pressures can be reduced [2]. Tadic et al. [3] argue that the primary benefits and driving forces behind building a dry port are to mitigate the adverse environmental consequences caused by transportation flows, enhance logistics operations' efficiencies, and support regional economic growth. In urban and regional settings, dry ports could be modelled as logistical centres to study the environmental effects

of trade supply chains and transportation-related sectors. Dry ports typically oversee the operations of logistics chains and transportation networks [4]. Hui et al. [5] highlighted that dry ports can contribute to the sustainability efforts of trade supply networks, even if their operations require considerable changes to the current trade logistics chain.

It is indispensable to have a framework that takes into account a variety of factors when measuring dry port sustainability in developing nations from the viewpoints of multiple stakeholders [1,6] Given the multitude of crucial considerations that need to be made, including stakeholder involvement, legal rules and compliance, and other aspects, it may be challenging to stress sustainability without these. The choice to ensure the dry port's sustainability necessitates an examination of the entire trade logistics chain, intending to shift as much cargo as possible from the road to less environmentally damaging and more energy-efficient modes of transportation, such as rail [7]. There has been a lot of research conducted recently on the effects that transport has on the environment and how these effects can be mitigated using various logistics principles [8]. The dry port idea is among several that have attracted a lot of interest. The topic has garnered global attention from practitioners and researchers due to its environmental perspective [9]. Ports throughout the globe have been struggling to grow sustainably in recent years due to a variety of factors, including growing environmental consciousness, social responsibility pressure, and an on-going search for sustainable economic operations [10]. Delai and Takahashi argued that [11] there is no consensus on what to actually measure or how to measure sustainability performance. There are differences in the applications of criteria among the group of stakeholders; organisations should take into account these disparities to evaluate sustainability performance. Macneil, et al. [12] indicated that there are no port-specific indicator frameworks available. Spangenberg [13] argued that there are three components to sustainability: social, environmental, and economic. Nevertheless, no comprehensive framework exists that comprises a small number of carefully chosen indicators based on transparent, standardised, and methodologically sound foundations, allowing for the meaningful clustering of indicators with which to suggest policy priorities and precisely defined targets across each pillar of sustainability at the industry level.

Furthermore, there is a lack of clarity and empirical evidence about measurement frameworks for dry port sustainable operations from the social, economic, and environmental domains. The primary goal of this paper is to develop a measurement framework for assessing the sustainability of dry ports and integrate sustainability metrics that dry ports can use with the current performance measurement system, which will enable them to foster a sustainable culture. This will help port stakeholders and decision-makers to create sustainable policies and set targets to ensure uniformity in operations in dry ports. The study will also help port stakeholders and decision-makers to create sustainable policies and realistic sustainability targets, in addition to providing uniformity in operations at each dry port. In light of this, the present research attempts to build a framework for dry port sustainable operations to support practitioners and direct future scholarly investigations in this area. Therefore, the objective of this research is to use EFA and the AHP to build a measurement framework for Ethiopian dry port sustainability. Factor analysis is employed to identify dimensions directly related to sustainability, and the AHP is used to verify the framework by quantifying selected criteria.

This report is organised into five sections: Section 1 provides an introduction to the study; Section 2 presents a literature review on the dry port sustainability factors; Section 3 states the process of the EFA and AHP; Section 4 presents the results and discussions; and finally, Section 5 provides conclusions and future research directions.

2. Literature Review

This part explains the notion of sustainable supply-chain management and the metrics that make up the measurement framework.

2.1. Notions of Sustainable Supply Chain Management

The three main dimensions of sustainability—economic, social, and environmental—form the foundation of the triple bottom line idea. An organisation's endeavours to give back to the community are its social element; its ability to turn a profit is its economic part. After all, the environmental component has to do with how a business operates concerning its environmental objectives. A business is deemed sustainable when it meets all three of these criteria simultaneously [14]. The triple bottom line is a theoretical framework that enables a company to fully comprehend its responsibilities not just to its shareholders but also to other stakeholders, including the community, the environment, and other facets of society [15].

Stakeholder theory helps managers to comprehend the interactions between businesses and their stakeholders and outline performance outcomes [16]. Many stakeholders' interests have grown as a result of the absence of a holistic perspective on sustainability measurement. Stakeholders play a role in the creation, use, and evaluation of measurements; they may contribute to the development of sustainable performance measurements [17]. Stakeholder theory provides stakeholder constructs that demonstrate a theoretical foundation from which to examine influences on sustainability [18]. In order to promote sustainable supply-chain management, stakeholders need to suggest social, environmental, and economic factors [19]. Stakeholders have the power to influence company decisions in ways that ultimately impact sustainability. The authors advise organisations to make decisions with the sustainability of their supply chain in mind and to comprehend the choices made by their stakeholders [20]. Sustainable supply-chain management is still underexplored from the viewpoints of stakeholders and is becoming a growing concern for environmental, social, and economic performance [14]. Implementing sustainable supply-chain management methods in an organisation's supply chain is greatly dependent on stakeholders' exposure [21]. It is necessary to alter corporate culture, the organisational behaviour of all supply-chain participants, and their mutual interactions to include sustainability thinking in trade supply-chain activities [22].

The concept of sustainability is riddled with ambiguities and complexities. Different factors are introduced to reduce this complexity as a prerequisite for management and planning actions [23]. To ensure sustainable trade supply-chain management, ports should integrate sustainability into their operations [24]. The Global Reporting Initiatives (GRI) Standards provide a strong framework for reporting sustainability performance and making improvements to it. They are also related to the goals and targets of sustainable development [12]. Ports need to develop strategies and policies to reinforce procedures targeted at creating sustainability that accommodates social, economic, and environmental factors in an integrated approach [25]. For ports creating green ports, a lack of appropriate variables will always be a source of confusion because they will not know where to start. Moreover, utilising erroneous indicators will yield insignificant results. Some ports identified six topics, as follows: liquid-pollution management, air-pollution management, marine biology preservation, low carbon and energy saving, organisation and management, and noise control. Lucid environmental management factors help to ensure sustainable development at ports [26].

Seaport systems' inland elements, such as dry ports, play a vital role in determining how well seaports perform and compete [27]. Although the context and setting of dry ports are receiving more attention, the role these nodes play within their different hinterlands differs greatly in terms of governance, stakeholders, and the commercial relationships they facilitate [12,13]. Similar to any major transportation hub, an inland port needs a suitable location with easy access to the rail terminal and space for expansion [28]. The amount of export and import transactions managed by the dry ports depend on access to a sizable population base [29]. Studies on the optimisation of dry port operations from various angles have been carried out. Certain authorities have identified the main elements that affect the performance of dry ports, such as information sharing, the availability of value-added services, customs clearance, facility capacity, location, and railway connectivity [30].

Rules, land use, infrastructure, and the environment are the main factors that prevent the deployment of dry ports. Consequently, these lower the effectiveness of goods movements on land access routes leading to and from seaports [31]. Sustainable climate adaptation is crucial, as is looking for maximum optimisation while keeping the balance between the social, environmental, and economic spheres in mind [7].

2.2. Measurement Factors

Research on sustainability measurement has expanded rapidly and examined a wide range of topics, including the application of sustainability metrics, the diffusion of environmental standards, and sustainability disclosure and measurement in sustainable supply chains [17]. Fostering sustainability at ports is made possible by offering a framework for measuring sustainability using indicators. The framework, which organises the metrics based on the three pillars of sustainability, must contain the best-performing factors [32].

The factors in Appendix A are extracted from Table 1 and used for the survey to gather data on environmental, social, and economic dimensions to uncover and frame the factors of dry port sustainability.

Table 1. Sustainability dimensions.

Aspects	Indicators	References
	Minimises emissions	[33]
	Minimise waste	[34]
	Reduces corporate footprint	[35,36]
	Reduces the impact of business partners on the natural environment	[37]
	Contribute to curbing climate change	[36]
	Environmental efficiency efforts	[38]
	Reduce traffic accident	[39]
	Reduces industrial accidents	[40]
	Reduces lubricant pollution	[41]
	Improves air quality	[42]
	Reduces noise pollution	[43]
	Propose a plan to protect natural systems	[44,45]
Environmental	Helps to form Indigenous resource managers	[45]
	Educate the team in environmental planning	[45]
	Survey the landscape's natural attributes	[45]
	Identify natural opportunities and constraints	[45]
	Apply eco-principles	[45]
	Adapt environmental laws from other countries	[45]
	Draft a nature-friendly development plan	[45]
	Recommend land development sustainability	[45]
	Recommend land conservation sustainability	[45]
	Establish nature reserves and protected areas	[45]
	Environmental protection council	[45]
	Community participation committee to protect the environment	[45]
	Local citizens affect dry port development	[45]

Table 1. *Cont.*

Aspects	Indicators	References
Social	Creates employment for the surrounding community	[46]
	Follows resettlement policy about local community	[45]
	Care about employment safety	[47]
	Ensures stakeholder consultation	[22]
	Practices need top management guidance	[48]
	Corporate leadership support	[49]
	Social practices take a long time to implement	[50]
	Social practice takes a lot of corporate efforts	[51]
	Social practices reflect the corporate culture of the company	[52]
	Cultivate the lushness of the settlement area	[45]
	Establish a deliberative decision process on social sustainability	[45]
	Value surrounding community	[45]
	Creates education opportunities for the surrounding community	[45]
	Addresses disparities in economic attainment in the surrounding community	[45]
	Make all citizens economic stakeholders	[45]
	Subsidise food, health care, and education	[45]
	Work deliberately to use resources efficiently	[45]
	Address the 'wellness needs' of the population	[45]
	Wellness needs' on an all-for-one basis	[45]
Economic	Maximise value-added services	[53]
	Reduce transport costs in the trade supply	[54]
	Reduce time in the trade supply chain	[55]
	Ensures productivity in the trade supply chain	[56]
	Creates accessibility to railway	[2]
	Provides reliability service	[2]
	Dry ports are profit-oriented	[2]
	Make money for all stakeholders	[57]
	Improve the competitive position trade supply chain	[58]
	Create a competitive advantage for the trade supply chain	[58]
	Enhance the overall trade supply-chain performance	[59]
	Add to the financial performance of the company	[2]
	Dry port services quality has improved	[60]
	Economic development in the surrounding area	[61]
	Expand green zones to safeguard open space	[45]

3. Research Design

This research adopts an integrative research approach. This section provides an overview of the research methodology and data collection process adopted in this research. Following a review of the body of knowledge, a survey questionnaire was developed. We received assistance from senior experts on dry ports to further pre-test the questionnaire. Based on the experts' recommendations, we further modified the statements in our questionnaire to improve their validity and reliability. We surveyed stakeholders in our study, including senior staff members, clearing agents, and dry port employees. Then, the questionnaire was distributed to 372 stakeholders who operate within or in conjunction with dry ports; 300 of the questionnaires were returned with no response bias in their entirety. In two months, we were able to collect 300 valid responses (80.6% of the total 372 responses). Thereafter, exploratory factor analysis and an analytical hierarchy process [62] were utilised to create a measurement framework for dry port operations.

3.1. Exploratory Factor Analysis (EFA)

EFA is a technique that allows for the exploration of a set of observable variables' potential underlying factor structure without imposing a predetermined framework on the results [63]. We selected ten crucial economic, social, and environmental elements using factor analysis to determine essential factors with high factor loadings. With the aid of EFA, the gathered data were methodically examined using SPSS (Statistical Package for the Social Sciences—Version 29). Using the Kaiser–Meyer–Olkin Measure of Sampling Adequacy Test, sample adequacy was determined. Cronbach's Alpha test, an SPSS built-in tool, was used to assess the dataset's reliability. The following steps (see Figure 1) in the factor analysis sustainability research were adapted as suggested by Knežević, and Stefańska [64].
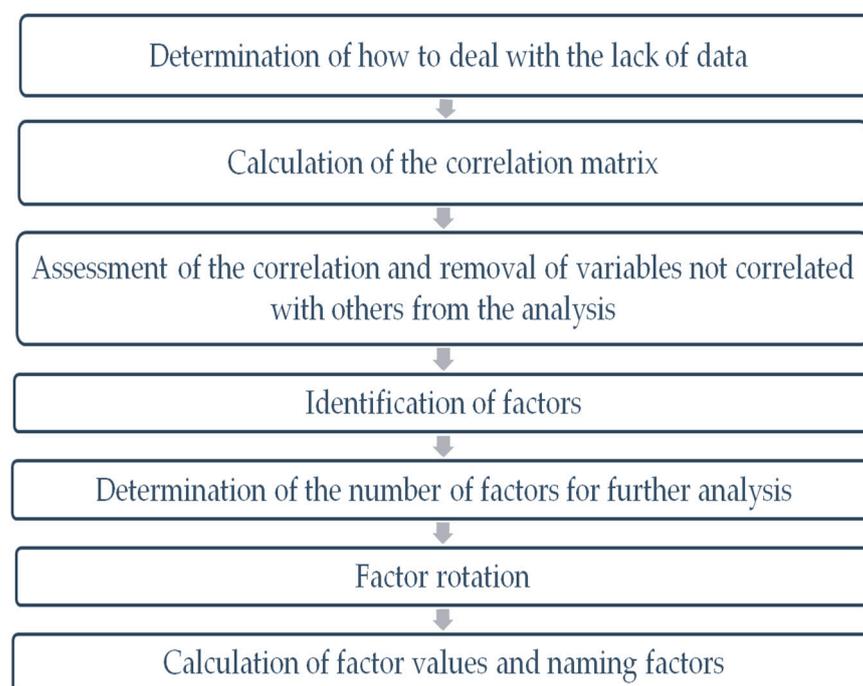
Figure 1. The methodological flow chart for EFA.

3.2. Analytical Hierarchy Process (AHP)

Before applying the AHP, a group of observable variables (survey questions) were first subjected to EFA to identify the underlying components. An AHP was employed to rank the weights with the greatest potential to impact the sustainability of dry ports. The following steps (See Figure 2) were set to employ AHP [65] along with the template recommended by Goepel [66] to generate outputs of AHP.

Figure 2. The methodological flow chart for AHP.

4. Results and Discussions

The questionnaire was developed from the literature, and the study relied on the data gathered from a survey among dry port stakeholders. This study used both EFA and the AHP to evaluate the factors influential to sustainable dry port operations to identify and analyse which of the sustainability aspects fall under each triple bottom line, which is the economic, social, and environmental aspects. The goal is to develop a sustainability framework balancing economic, social, and environmental aspects for the sustainable operations of dry ports.

4.1. Exploratory Factor Analysis

The Kaiser–Meyer–Olkin test (KMO) makes it possible to choose variables and evaluate their applicability for factor analysis. This test assesses how well our data are prepared for factor analysis. For this test, 0.8 and above is the optimum scenario to accept the factors for further analysis [64]. Table 2 below shows the KMO test statistics, which in our case is 0.962. This is a promising outcome that affirms our data's reliability for conducting factor analysis and other statistical analyses. It will also be a useful resource for identifying the factor structure. Bartlett's test further demonstrates the potential value of factor analysis as a research methodology in this particular case.

Table 2. Kaiser–Meyer–Olkin and Bartlett's Tes.

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.962
Bartlett's Test of Sphericity	Approx. Chi-Square	24,270.134
	df	1770
	Sig.	<0.001

The first table in Appendix B is specifically connected to the goal of factor analysis—that is, locating the underlying structure. There are sixty components (i.e., the number of initial factors considered) on the left side of the table. We wish to lower this value since it is difficult to characterise dry port sustainability using so many variables, which makes the current situation unfavourable. Furthermore, we will acquire 70.14% of the explained variance when separating 3 components while assessing the cumulative percentage (percentage of the variation explained by separate factors; see Appendix B). This indicates that we can account for around 70.14% of the variations in dry port sustainability using three distinct dimensions (a 60-element factor structure would allow us to account for 100% of the data). Next, with a loading factor of 0.60 or higher, the researchers discovered crucial components that were trustworthy [67] for the AHP (see Appendix C). Tables 3–5 depict the factors with the highest loading under environmental, social, and economic sustainability.

Table 3. Environmental factors.

No.	Factors	Factor Loading
1.	Adapt environmental laws	0.89
2.	Contribute to curbing climate change	0.885
3.	Plan to protect the national environment	0.885
4.	Minimise waste	0.884
5.	Reduce business partner impact	0.883
6.	Educate team in environmental planning	0.883
7.	Minimise emissions	0.882
8.	Reduce corporate footprints	0.881
9.	Efficiency environment efforts	0.879
10.	Minimise waste	0.876

Table 4. Social factors.

No.	Factors	Factor Loading
1.	Employment opportunities for the community	0.889
2.	Follow resettlement policy	0.888
3.	Employment safety	0.884
4.	Stakeholder consultation	0.871
5.	Top management guidance	0.843
6.	Corporate leadership	0.838
7.	Social practice	0.837
8.	Corporate culture	0.836
9.	Lushness of settlement areas	0.824
10.	Value surrounding community	0.724

Table 5. Economic factors.

No	Factors	Factor Loading
1.	Value added services	0.783
2.	Reduce transportation cost	0.744
3.	Reduce time	0.731
4.	Productivity in trade supply chain	0.714
5.	Profit oriented	0.713
6.	Money for all stakeholders	0.69
7.	Competitive position in trade supply chain	0.672
8.	Enhance trade supply-chain performance	0.626
9.	Accessibility to railway	0.622
10.	Service quality	0.605

The three variables with the largest factor loading are: adapting environmental laws; contributing to curbing climate change; and planning to protect the national environment. The link between each variable and the underlying factor is represented by the highest factor loadings, which identify variables that are most strongly associated with the environmental dimension in this context.

Employment opportunities for the community, following resettlement policy and employment safety are factors in the social dimension of sustainability with the highest loading factor.

Value-added services, transportation costs and reduced time are the factors in the economic dimensions of sustainability with the highest loading factors.

4.2. Analytical Hierarchy Process

4.2.1. Environmental Factors

Table 6 and Appendix D indicate that reducing business-partner impact, reducing the corporate footprint, and contributing to curbing climate change are the most important factors in the environmental dimension, as ranked by the senior experts in the area of dry port environmental sustainability. The consistency ratio shows excellent consistency when it is near 0; however, inconsistent judgments may be indicated by values much above 0.1. The reliability of each pair of items in the comparison is compared to determine the maximum relative error (MRE), which quantifies the maximum relative inconsistency in pairwise comparisons. In this regard, as it is depicted in the tables, there is no issue regarding the consistency of rating the factors among the experts.

Table 6. Environmental factors.

No.	Factors	Weights	Ranking
Factor-1	Reduce business partner impact	20.5%	1
Factor-2	Minimise waste	6.5%	9
Factor-3	Contribute to curbing climate change	9.9%	3
Factor-4	Educate team in environmental planning	8.4%	6
Factor-5	Plan to protect the national environment	9.2%	5
Factor-6	Reduce corporate footprints	10.6%	2
Factor-7	Adapt environmental laws	9.7%	4
Factor-8	Minimise emissions	7.6%	8
Factor-9	Efficiency environment efforts	8.8%	7
Factor-10	Minimise wastes	8.8%	7
Lambda: 11.388			
Consistency Ratio: 0.07			
MRE: 8.9%			

4.2.2. Social Factors

Corporate leadership, social participation, and employment opportunities for the community are ranked as the criteria with the highest weight in Table 7 and Appendix E. High weights given to criteria or alternatives in the AHP denote their increased significance or priority in reaching the decision-making process's overarching aim or purpose. These elements are seen to be crucial in the social dimensions of dry port sustainability.

4.2.3. Economic Factors

Value-added services, railway accessibility, and competitiveness in the trade supply chain are among the key aspects in the context of economic sustainability, as depicted in Table 8 and Appendix F. Their substantial significance in attaining dry port economic sustainability is evidenced by their high weights in the AHP analysis.

Table 7. Social factor.

No.	Factors	Weights	Ranking
Factor-1	Employment opportunities for the community	26.1%	1
Factor-2	Follow resettlement policy	5.7%	9
Factor-3	Employment safety	8.8%	4
Factor-4	Stakeholder consultation	7.5%	7
Factor-5	Top management guidance	8.9%	4
Factor-6	Corporate leadership	10.4%	2
Factor-7	Social practice	9.2%	3
Factor-8	Corporate culture	6.9%	8
Factor-9	Lushness of settlement areas	8.3%	6
Factor-10	Value surrounding community	8.3%	6
Lambda: 12.087			
Consistency Ratio: 0.06			
MRE: 7.3%			

Table 8. Economic factors.

No.	Factors	Weights	Ranking
Factor-1	Value added services	25.5%	1
Factor-2	Reduce transportation cost	5.8%	9
Factor-3	Reduce time	8.9%	4
Factor-4	Productivity in trade supply chain	7.6%	8
Factor-5	Profit oriented	8.9%	5
Factor-6	Accessibility to railway	10.4%	2
Factor-7	Competitive position in trade supply chain	9.3%	3
Factor-8	Enhance trade supply-chain performance	7.0%	7
Factor-9	Money for all stakeholders	8.3%	6
Factor-10	Service quality	8.3%	6
Lambda: 12.01			
Consistency Ratio: 0.03			
MRE: 6.1%MRE			

4.2.4. Measurement Framework

The meaning of sustainability varies among individuals based on the context in which they find themselves. The environmental and sustainable development literature frequently discusses two schools of thought on sustainability. First, by employing specific standards and indicators, sustainability can be defined and assessed as an "achievement". The past few decades have seen significant advancements in this area in terms of defining and evaluating sustainability. Assuming that sustainability is aspirational rather than a state, the second school of thought defines sustainability as merely a route towards a goal, without the need for an absolute measurement. It is interesting to note that both philosophical traditions have an integrative conceptual definition of sustainability that takes social, economic, and environmental factors into account [68].

A sustainable supply-chain framework comprises various factors, such as financial and non-financial, materials, energy, natural resources, health and safety, human capa-

bilities, and ethics [69]. The most-studied environmental indicators are noise pollution, air pollution, water pollution, energy usage, and resource usage. Port activities may be considered significant environmental indicators when evaluating their impact on the sustainability of the environment. Experts agree that attaining sustainability goals requires improving air quality through port operations [33–35]. Researchers identified the following eight indicators of social sustainability: social image, public relations, quality of living environment, social involvement, job training, health and safety, job creation and security, and gender equality. Employee health and safety are identified as the most critical factors for researchers. The most commonly found economic indicator is foreign direct investment, which is regarded as one of the critical factors of economic performance. Sustainable port operations have a positive influence on the national economy and prosperity by driving job creation, encouraging exports, and increasing income and employment [70]. Wooldridge, and Darbra [71] stated that a comprehensive inventory of all environmental performance factors in use in the port sector has been identified and filtered based on predetermined criteria, reviewed, and appraised by stakeholders. This allows for the monitoring of the sustainable performance of operational conditions such as dust, noise, dredging, and waste; managerial conditions such as certification, compliance, and complaints; and environmental conditions such as air, water, sediments, and ecosystems.

According to Global Environmental Management, [72] many components are already in operation. These comprise environmental condition indicators, which gauge the immediate impact of an activity on the environment, leading indicators, which are in-process performance metrics, and lagging indicators, which gauge outputs such as pounds of pollutants emitted. Most organisations employ a combination of indicators because each has unique stakeholders, strengths, and drawbacks. To support policy and decision-making in a broad environmental, economic, and social context, sustainability assessments are carried out. By addressing important decision-making factors, domain specialists go beyond a simple technical or scientific review [73].

The sustainability framework helps managers and policymakers to decide which actions they should take in an attempt to make operations more sustainable [24,25]. This sustainability measurement framework (see Figure 3) provides a structured approach to assessing and tracking the environmental, social, and economic impacts of dry port operations. A sustainable dry port framework encompasses various policy and strategy inputs aimed at ensuring the efficient and environmentally responsible operation of dry ports.
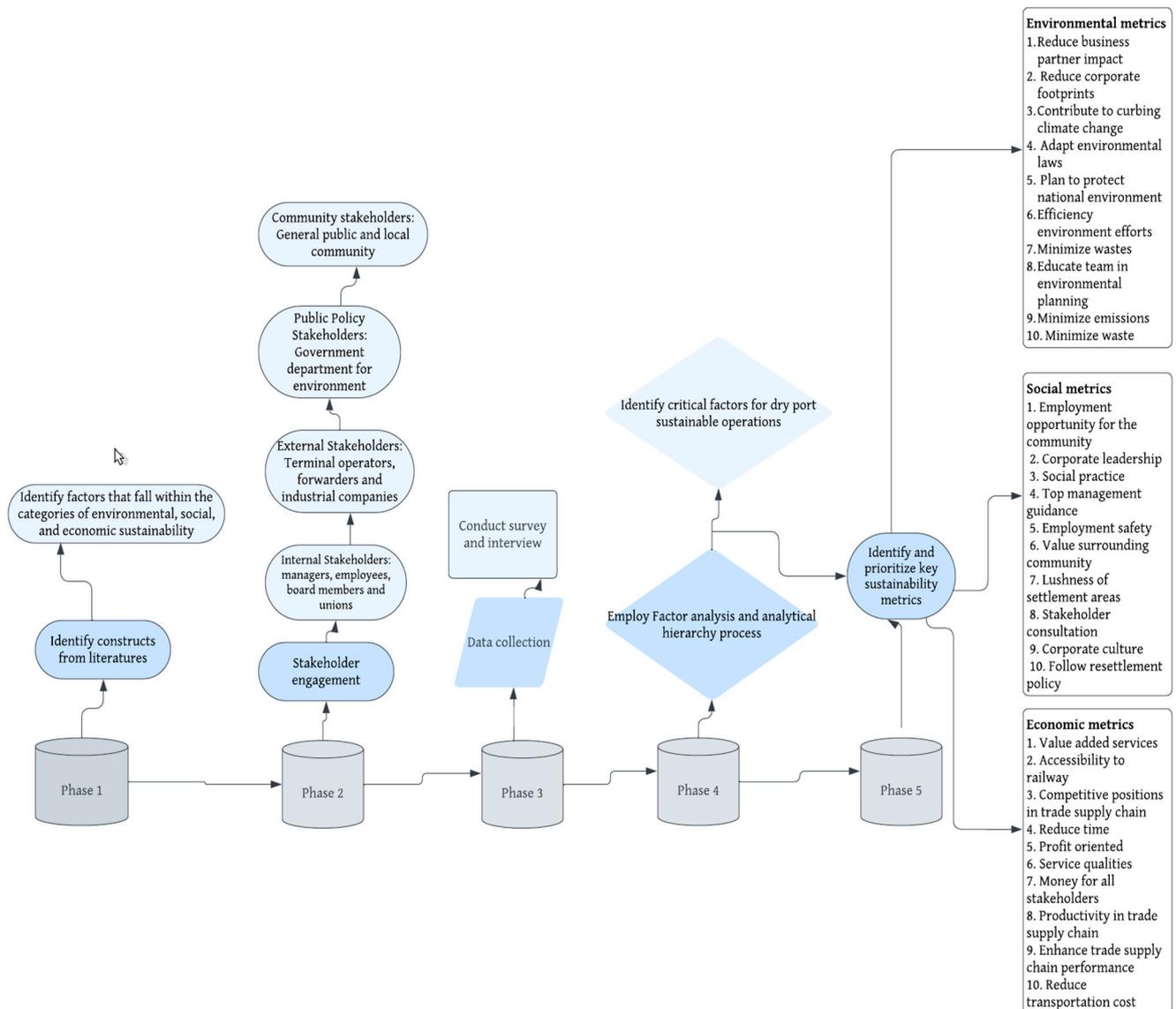
Figure 3. Dry port sustainability measurement framework.

5. Conclusions and Future Research Directions

This study suggested contributing factors for sustainable dry port operations based on stakeholder involvement in the trade supply chain. Critical factors that support the development of a sustainable framework for dry ports were identified by the research, which will contribute towards a theory and advance practices with respect to dry ports.

It is reaffirmed that the most important factors for policymakers and experts to consider when addressing environmental sustainability in dry port operations are reducing business partner impact, minimising waste, preventing climate change, educating the team about environmental planning, and creating a plan to protect the environment. In addition, the study indicated that to realise social sustainability in dry port operations, it is critical to increase employment opportunities for the community, adhere to resettlement policies, ensure workplace safety, have frequent interactions with stakeholders, and provide top-management guidance. Value-added services, time and cost savings, increased productivity in the trade supply chain, and a focus on profit are all regarded as foundational factors for the sustainability of dry ports in the economic dimension.

Through the integration of factors validated by experts into a comprehensive framework for sustainable dry ports, stakeholders can strive towards the development and operation of dry ports that not only support trade supply chains and economic growth

but also, in the long run, contribute to environmental conservation and social well-being. We framed economic, social, and environmental protection-related factors, as these are the most crucial for attaining dry port sustainability; thus, maintaining the sustainability of dry ports necessitates a high degree of port sustainability and sustainability in the natural environment.

The study has limitations as it focused on dry port stakeholders (terminal operators, freight forwarders, and regulatory bodies) and omitted several links in the trade supply chain, especially those at the seaport, such as stevedoring, shippers, and inland waterways. The study did not examine seaports and seaport stakeholders in great detail. Future research may examine the dynamics of all port supply-chain stakeholders through port sustainability research, including seaports and dry ports, even though it appears that actions and measures beyond the implementation schemes are regarded as appropriate for additional supply-chain members. The United Nations Sustainable Development Goals were not contextualised in the study's extraction of factors to develop the measurement framework.

Future research endeavours may draw upon the UN Sustainable Development Goals (SDGs) to construct a framework, examine, and assess the role of dry port sustainability, and explore the influence of environmental, social, and economic factors of the triple bottom line on the results of trade supply chains. Furthermore, to assess improvements in ensuring port sustainability through empirical findings, case studies need to be used to obtain detailed empirical findings from policymakers and port stakeholders. Researchers also need to conduct longitudinal studies to realise the improvements towards sustainability over time. In the end, the authors call for future researchers to investigate the factors that support African Agenda 2063 and Sustainable Development Goal Agenda 2030 to contribute to the achievement of equitable and sustainable socioeconomic development across a range of operations in trade supply-chain management.

Appendix A

Environment performance (ENP)

- ENP 1. Dry ports minimise emissions;
- ENP 2. Dry ports minimise waste;
- ENP 3. Dry ports reduce the corporate footprint on the natural environment;
- ENP 4. Dry ports take the impact of business partners on the natural environment into account;
- ENP 5. Dry ports reduce their business partners' impacts on the natural environment;
- ENP 6. Dry ports contribute to curbing climate change;
- ENP 7. Dry ports are part of environmental efficiency efforts;
- ENP 8. Dry ports focus on how the natural environment can be managed;
- ENP 9. I perceive that traffic accidents in dry port areas have been significantly reduced;
- ENP 10. I perceive that industrial accidents in port areas have been significantly reduced;

- ENP 11. I perceive that lubricant pollution in dry port areas has been significantly reduced;
- ENP 12. I perceive that air quality in port areas has significantly improved;
- ENP 13. I perceive that noise in the dry port areas has been significantly reduced;
- ENP 14. Dry ports propose a plan to protect natural systems;
- ENP 15. Dry port form team of indigenous resource managers;
- ENP 16. Dry ports educate the team in environmental planning;
- ENP 17. Dry ports survey the landscape's natural attributes;
- ENP 18. Dry ports identify natural opportunities and constraints;
- ENP 19. Dry ports apply eco-principles;
- ENP 20. Dry ports adopt environmental laws from other countries;
- ENP 21. Dry ports draft a nature-friendly development plan;
- ENP 22. Dry ports support land-development sustainability;
- ENP 23. Dry ports support land-conservation sustainability;
- ENP 24. Dry ports establish nature reserves and protected areas;
- ENP 25. Dry ports establish environmental protection council;
- ENP 26. Dry ports establish community participation committees to protect the environment;
- ENP 27. I heard about local citizens affected by dry port development.

Social Performance (SOP)

- SOP 1. Dry port creates employment for the surrounding community;
- SOP 2. Dry ports follow resettlement policy about local community;
- SOP 3. Dry ports care about employment safety;
- SOP 4. Dry port ensures stakeholder consultation;
- SOP 5. Dry port sustainability practices need top management guidance;
- SOP 6. Organizational support is insignificant without corporate leadership support;
- SOP 7. I feel that social practices take a long time to implement;
- SOP 8. I feel that social practice takes a lot of corporate efforts;
- SOP 9. Social practices reflect the corporate culture of the company;
- SOP 10 Dry ports cultivate the lushness of the settlement area;
- SOP 11. Dry ports establish deliberative decision processes on social sustainability;
- SOP 12. Dry ports value the surrounding community;
- SOP 13. Dry ports create educational opportunities for the surrounding community;
- SOP 14. Dry ports address disparities in economic attainment in the surrounding community;
- SOP 15. Dry ports make all citizens economic stakeholders;
- SOP 16. Dry ports subsidise food, health care, and education;
- SOP 17. Dry ports work deliberately to use resources efficiently;
- SOP 18. Dry ports address 'wellness needs' of the population;
- SOP 19. Dry ports meet 'wellness needs' on an all-for-one basis.

Economic Performance (ECP)

- ECP 1. Dry port works on maximizing value-added services;
- ECP 2. Dry ports play a role in reducing transport costs in the trade supply chain;
- ECP 3. Dry ports play a role in reducing time in the trade supply chain;
- ECP 4. Dry ports ensure productivity in the trade supply chain;
- ECP 5. Dry ports are accessible by railway;
- ECP 6. Dry port provides a reliable service;
- ECP 7. Dry ports are profit-oriented;
- ECP 8. Dry ports make money for all stakeholders involved;
- ECP 9. Dry ports improve the competitive position trade supply chain;
- ECP 10. Dry ports create a competitive advantage for the trade supply chain;
- ECP 11. Dry ports enhance overall trade supply-chain performance;
- ECP 12. Dry ports add to the financial performance of the company;

- ECP 13. I perceive that dry port service quality has improved;
- ECP 14. I perceive that the economic development of the area surrounding the dry port is improving;
- ECP 15. Dry ports expand green zones to safeguard open spaces.

Appendix B

	Total Variance Explained								
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1.	31.431	52.385	52.385	31.431	52.385	52.385	23.666	39.443	39.443
2.	8.477	14.129	66.514	8.477	14.129	66.514	10.813	18.022	57.464
3.	2.180	3.633	70.147	2.180	3.633	70.147	7.609	12.682	70.147
4.	1.682	2.804	72.950						
5.	1.140	1.900	74.850						
6.	1.038	1.731	76.581						
7.	0.942	1.570	78.152						
8.	0.836	1.393	79.544						
9.	0.783	1.305	80.850						
10.	0.770	1.284	82.133						
11.	0.661	1.102	83.236						
12.	0.582	0.969	84.205						
13.	0.566	0.944	85.149						
14.	0.542	0.903	86.052						
15.	0.505	0.842	86.894						
16.	0.469	0.782	87.676						
17.	0.461	0.769	88.445						
18.	0.411	0.685	89.130						
19.	0.410	0.683	89.812						
20.	0.378	0.630	90.442						
21.	0.360	0.600	91.042						
22.	0.336	0.560	91.602						
23.	0.318	0.529	92.132						
24.	0.305	0.508	92.640						
25.	0.288	0.481	93.121						
26.	0.271	0.451	93.572						
27.	0.241	0.402	93.974						
28.	0.235	0.391	94.365						
29.	0.217	0.362	94.728						
30.	0.209	0.349	95.076						
31.	0.199	0.332	95.409						
32.	0.189	0.314	95.723						
33.	0.176	0.294	96.017						
34.	0.166	0.276	96.293						
35.	0.161	0.269	96.562						
36.	0.153	0.255	96.817						
37.	0.150	0.250	97.067						

Total Variance Explained									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
38.	0.135	0.225	97.292						
39.	0.130	0.217	97.509						
40.	0.124	0.207	97.716						
41.	0.112	0.187	97.903						
42.	0.108	0.180	98.083						
43.	0.102	0.170	98.253						
44.	0.094	0.157	98.409						
45.	0.087	0.145	98.554						
46.	0.087	0.144	98.699						
47.	0.082	0.136	98.834						
48.	0.078	0.129	98.964						
49.	0.071	0.119	99.082						
50.	0.070	0.117	99.200						
51.	0.065	0.108	99.308						
52.	0.063	0.105	99.413						
53.	0.059	0.098	99.511						
54.	0.053	0.089	99.600						
55.	0.049	0.081	99.681						
56.	0.047	0.079	99.759						
57.	0.040	0.066	99.825						
58.	0.039	0.065	99.890						
59.	0.034	0.057	99.948						
60.	0.031	0.052	100.000						

Extraction Method: Principal Component Analysis.

Appendix C

Rotated Component Matrix [a]			
	1	2	3
ENP8	0.876		
ENP7	0.879		
ENP6	0.885		
ENP5	0.883		
ENP3	0.881		
ENP24	0.89		
ENP22	0.875		
ENP21	0.872		
ENP20	0.883		
ENP2	0.884		
ENP18	0.885		
ENP14	0.87		
ENP13	0.864		
ENP12	0.857		
ENP11	0.863		

	Rotated Component Matrix [a]		
	1	**2**	**3**
ENP10	0.83		
ENP1	0.882		
SOP1		0.889	
SOP2		0.888	
SOP3		0.884	
SOP4		0.871	
SOP5		0.843	
SOP6		0.838	
SOP7		0.837	
SOP9		0.836	
SOP10		0.824	
SOP11		0.724	
SOP12		0.658	
SOP13		0.644	
SOP15		0.615	
SOP16		0.603	
ECP1			0.783
ECP2			0.744
ECP3			0.731
ECP4			0.714
ECP7			0.713
ECP8			0.69
ECP10			0.672
ECP11			0.626
ECP12			0.622
ECP13			0.605

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. [a]. Rotation converged in 5 iterations.

Appendix D

					Pairwise Matrix (Environment Factors)						
Matrix	Factor-1	Factor-2	Factor-3	Factor-4	Factor-5	Factor-6	Factor-7	Factor-8	Factor-9	Factor-10	Normalised Principal Eigenvector
Factor-1	1	11 1/7	4 3/7	5 2/7	3/4	1/2	4/5	1 7/8	1	1	20.51%
Factor-2	0	1	5/7	1	1	1	4/5	4/5	1	1	6.54%
Factor-3	2/9	1 3/7	1	1 3/5	3 1/5	1	1 1/4	2/3	1	1	9.87%
Factor-4	1/5	1	5/8	1	2 1/9	1 1/4	1 3/7	3/4	1	1	8.36%
Factor-5	1 3/8	1	1/3	1/2	1	1	1 2/5	1 3/8	1	1	9.17%
Factor-6	1 5/6	1	1	4/5	1	1	1 1/5	1 5/7	1	1	10.64%
Factor-7	1 1/4	1 1/4	4/5	2/3	5/7	5/6	1	2 3/5	1	1	9.69%
Factor-8	1/2	1 1/4	1 5/9	1 1/3	3/4	4/7	3/8	1	1	1	7.65%
Factor-9	1	1	1	1	1	1	1	1	1	1	8.78%
Factor-10	1	1	1	1	1	1	1	1	1	1	8.78%

Appendix E

Pairwise Matrix (Social)

Matrix	Factor-1	Factor-2	Factor-3	Factor-4	Factor-5	Factor-6	Factor-7	Factor-8	Factor-9	Factor-10	Normalised Principal Eigenvector
Factor-1	1	1	27 7/9	4 5/7	5 5/9	3/4	1/2	4/5	1 7/8	1	26.13%
Factor-2	2	0	1	5/7	1	1	1	4/5	4/5	1	5.67%
Factor-3	3	1/5	1 3/7	1	1 3/5	3 1/5	1	1 1/4	2/3	1	8.79%
Factor-4	4	1/6	1	5/8	1	2 1/9	1 1/4	1 3/7	3/4	1	7.48%
Factor-5	5	1 3/8	1	1/3	1/2	1	1	1 2/5	1 3/8	1	8.86%
Factor-6	6	1 5/6	1	1	4/5	1	1	1 1/5	1 5/7	1	10.39%
Factor-7	7	1 1/4	1 1/4	4/5	2/3	5/7	5/6	1	2 3/5	1	9.19%
Factor-8	8	1/2	1 1/4	1 5/9	1 1/3	3/4	4/7	3/8	1	1	6.94%
Factor-9	9	1	1	1	1	1	1	1	1	1	8.27%
Factor-10	10	1	1	1	1	1	1	1	1	1	8.27%

Appendix F

Pairwise Matrix (Economic)

Matrix	Factor-1	Factor-2	Factor-3	Factor-4	Factor-5	Factor-6	Factor-7	Factor-8	Factor-9	Factor-10	Normalised Principal Eigenvector
Factor-1	1	25 5/8	4 5/7	5 5/9	0.75.	0.5.	0.8	1 7/8	1	1	0.2551
Factor-2	0	1	5/7	1	1	1	4/5	4/5	1	1	0.0576
Factor-3	1/5	1 3/7	1	1 3/5	3 1/5	1	1 1/4	2/3	1	1	0.089
Factor-4	1/6	1	5/8	1	2 1/9	1 1/4	1 3/7	3/4	1	1	0.0757
Factor-5	1 3/8	1	1/3	1/2	1	1	1 2/5	1 3/8	1	1	0.089
Factor-6	1 5/6	1	1	4/5	1	1	1 1/5	1 7/9	1	1	0.1045
Factor-7	1 1/4	1 1/4	4/5	2/3	5/7	5/6	1	2 2/3	1	1	0.0929
Factor-8	1/2	1 1/4	1 5/9	1 1/3	3/4	4/7	3/8	1	1	1	0.0699
Factor-9	1	1	1	1	1	1	1	1	1	1	0.0832
Factor-10	1	1	1	1	1	1	1	1	1	1	0.0832

References

1. Nguyen, L.C.; Notteboom, T. A Multi-Criteria Approach to Dry Port Location in Developing Economies with Application to Vietnam. *Asian J. Shipp. Logist.* **2016**, *32*, 23–32. [CrossRef]
2. Khaslavskaya, A.; Roso, V. Outcome-Driven Supply Chain Perspectives on Dry Ports. *Sustainability* **2019**, *11*, 1492. [CrossRef]
3. Tadic, S.; Krstic, M.; Roso, V.; Brnjac, N. Dry port terminal location selection by applying the hybrid grey MCDM model. *Sustainability* **2020**, *12*, 6983. [CrossRef]
4. Montwiłł, A.; Pietrzak, O.; Pietrzak, K. The role of Integrated Logistics Centers (ILCs) in modelling the flows of goods in urban areas based on the example of Italy. *Sustain. Cities Soc.* **2021**, *69*, 102851. [CrossRef]
5. Hui, F.K.P.; Aye, L.; Duffield, C.F. Engaging employees with good sustainability: Key performance indicators for dry ports. *Sustainability* **2019**, *11*, 2967. [CrossRef]
6. Varese, E.; Bux, C.; Amicarelli, V.; Lombardi, M. Assessing Dry Ports' Environmental Sustainability. *Environments* **2022**, *9*, 117. [CrossRef]
7. Awad-Núñez, S.; González-Cancelas, N.; Soler-Flores, F.; Camarero-Orive, A. A Methodology for Measuring Sustainability of Dry Ports Location Based on Bayesian Networks and Multi-criteria Decision Analysis. *Transp. Res. Procedia* **2016**, *13*, 124–133. [CrossRef]
8. Roso, V.; Andersson, D. Dry Ports and Logistics Platforms. *Encycl. Marit. Offshore Eng.* **2022**, *25*, 364–383. [CrossRef]
9. de Almeida Rodrigues, T.; Maria de Miranda Mota, C.; Manuele dos Santos, I. Determining dry port criteria that support decision making. *Res. Transp. Econ.* **2021**, *88*, 100994. [CrossRef]
10. Roh, S.; Thai, V.V.; Jang, H.; Yeo, G.T. The best practices of port sustainable development: A case study in Korea. *Marit. Policy Manag.* **2023**, *50*, 254–280. [CrossRef]

11. Delai, I.; Takahashi, S. Sustainability measurement system: A reference model proposal. *Soc. Responsib. J.* **2011**, *7*, 438–471. [CrossRef]

12. Macneil, J.L.; Adams, M.; Walker, T.R. Development of framework for improved sustainability in the Canadian port sector. *Sustainability* **2021**, *13*, 11980. [CrossRef]

13. Spangenberg, J.H. Environmental space and the prism of sustainability: Frameworks for indicators measuring sustainable development. *Ecol. Indic.* **2002**, *2*, 295–309. [CrossRef]

14. Tseng, M.; Ha, H.M.; Lim, M.K.; Wu, K. Sustainable supply chain management in stakeholders: Supporting from sustainable supply and process management in the healthcare industry in Vietnam supporting from sustainable supply and process management in. *Int. J. Logist. Res. Appl.* **2022**, *25*, 364–383. [CrossRef]

15. Tseng, M.L.; Chang, C.H.; Lin, C.W.R.; Wu, K.J.; Chen, Q.; Xia, L.; Xue, B. Future trends and guidance for the triple bottom line and sustainability: A data driven bibliometric analysis. *Environ. Sci. Pollut. Res.* **2020**, *27*, 33543–33567. [CrossRef] [PubMed]

16. Jones, T.M.; Harrison, J.S.; Fleps, W. How Applying Instrumental Stakeholder Theory Can Provide Sustainable Competitive Advantage Academy of Management Review. *Acad. Manag. Rev.* **2016**, *43*, 2–53. [CrossRef]

17. Mura, M.; Longo, M.; Micheli, P.; Bolzani, D. The Evolution of Sustainability Measurement Research. *Int. J. Manag. Rev.* **2018**, *20*, 661–695. [CrossRef]

18. Herold, D.M. Demystifying the link between institutional theory and stakeholder theory in sustainability reporting. *Econ. Manag. Sustain.* **2018**, *3*, 6–19. [CrossRef]

19. Rebs, T.; Brandenburg, M.; Seuring, S.; Stohler, M. Stakeholder influences and risks in sustainable supply chain management: A comparison of qualitative and quantitative studies. *Bus. Res.* **2018**, *11*, 197–237. [CrossRef]

20. Qazi, A.A.; Appolloni, A. Does the stakeholder's relationship affect supply chain resilience and organizational performance ? Empirical evidence from the supply chain community of Pakistan. *Int. J. Emerg. Mark.* **2022**; *ahead-of-print*. [CrossRef]

21. Ombati, O.T. Stakeholder Exposure and Sustainable Supply Chain Management Practices in Safaricom, Kenya. *Am. J. Ind. Bus. Manag.* **2018**, *8*, 1139–1156. [CrossRef]

22. Siems, E.; Seuring, S. Stakeholder management in sustainable supply chains: A case study of the bioenergy industry. *Bus. Strategy Environ.* **2021**, *30*, 3105–3119. [CrossRef]

23. Munda, G. "Measuring sustainability": A multi-criterion framework. *Environ. Dev. Sustain.* **2005**, *7*, 117–134. [CrossRef]

24. Alamoush, A.S.; Ballini, F.; Dalaklis, D. Port sustainable supply chain management framework: Contributing to the United Nations' sustainable development goals. *Marit. Technol. Res.* **2021**, *3*, 137–161. [CrossRef]

25. Schipper, C.A.; Vreugdenhil, H.; de Jong, M.P.C. A sustainability assessment of ports and port-city plans: Comparing ambitions with achievements. *Transp. Res. Part D Transp. Environ.* **2017**, *57*, 84–111. [CrossRef]

26. Hua, C.; Chen, J.; Wan, Z.; Xu, L.; Bai, Y.; Zheng, T.; Fei, Y. Evaluation and governance of green development practice of port: A sea port case of China. *J. Clean. Prod.* **2020**, *249*, 119434. [CrossRef]

27. Jeevan, J.; Chen, S.L.; Cahoon, S. The impact of dry port operations on container seaports competitiveness. *Marit. Policy Manag.* **2019**, *46*, 4–23. [CrossRef]

28. Jeevan, J.; Chen, S.L.; Cahoon, S. Determining the influential factors of dry port operations: Worldwide experiences and empirical evidence from Malaysia. *Marit. Econ. Logist.* **2018**, *20*, 476–494. [CrossRef]

29. Rodrigue, J.P.; Notteboom, T. Dry ports in European and North American intermodal rail systems: Two of a kind? *Res. Transp. Bus. Manag.* **2012**, *5*, 4–15. [CrossRef]

30. Khaslavskaya, A.; Roso, V. Dry ports: Research outcomes, trends, and future implications. *Marit. Econ. Logist.* **2020**, *22*, 265–292. [CrossRef]

31. Roso, V. Factors influencing implementation of a dry port. *Int. J. Phys. Distrib. Logist. Manag.* **2008**, *38*, 782–798. [CrossRef]

32. Ignaccolo, M.; Inturri, G.; Giuffrida, N.; Torrisi, V. A sustainable framework for the analysis of port systems. *Eur. Transp.* **2020**, *78*, 1–19. [CrossRef]

33. Winebrake, J.J.; Corbett, J.J.; Falzarano, A.; Hawker, J.S.; Korfmacher, K.; Ketha, S.; Zilora, S. Assessing energy, environmental, and economic tradeoffs in intermodal freight transportation. *J. Air Waste Manag. Assoc.* **2008**, *58*, 1004–1013. [CrossRef] [PubMed]

34. Farida, N.; Handayani, N.U.; Wibowo, M.A. Developing Indicators of Green Construction of Green Supply Chain Management in Construction Industry: A Literature Review. *IOP Conf. Ser. Mater. Sci. Eng.* **2019**, *598*, 012021. [CrossRef]

35. Van den Berg, R.; De Langen, P.W. Environmental sustainability in container transport: The attitudes of shippers and forwarders. *Int. J. Logist. Res. Appl.* **2017**, *20*, 146–162. [CrossRef]

36. Lăzăroiu, G.; Ionescu, L.; Uţă, C.; Hurloiu, I.; Andronie, M.; Dijmarescu, I. Environmentally responsible behavior and sustainability policy adoption in green public procurement. *Sustainability* **2020**, *12*, 2110. [CrossRef]

37. Andalib Ardakani, D.; Soltanmohammadi, A.; Seuring, S. The impact of customer and supplier collaboration on green supply chain performance. *Benchmarking* **2023**, *30*, 2248–2274. [CrossRef]

38. Wehner, J.; Taghavi Nejad Deilami, N.; Altuntas Vural, C.; Halldórsson, Á. Logistics service providers' energy efficiency initiatives for environmental sustainability. *Int. J. Logist. Manag.* **2021**, *33*, 1–26. [CrossRef]

39. Wilmsmeier, G.; Monios, J. Dry Ports. In *International Encyclopedia of Transportation*; Elsevier: Amsterdam, The Netherlands, 2021; pp. 344–348. [CrossRef]

40. Pant, R.; Barker, K.; Ramirez-Marquez, J.E.; Rocco, C.M. Stochastic measures of resilience and their application to container terminals. *Comput. Ind. Eng.* **2014**, *70*, 183–194. [CrossRef]

41. Chenikwi, C.K.; Wang, X. Possible Sustainability of Intermodal Transportation in Africa. *Open J. Appl. Sci.* **2019**, *9*, 139–158. [CrossRef]

42. Alamoush, A.S.; Ballini, F.; Ölçer, A.I. Revisiting port sustainability as a foundation for the implementation of the United Nations Sustainable Development Goals (UN SDGs). *J. Shipp. Trade* **2021**, *6*, 19. [CrossRef]

43. Muravev, D.; Rakhmangulov, A.; Hu, H.; Zhou, H. The introduction to system dynamics approach to operational effciency and sustainability of dry port's main parameters. *Sustainability* **2019**, *11*, 2413. [CrossRef]

44. Mensah, J. Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent Soc. Sci.* **2019**, *5*, 1653531. [CrossRef]

45. Basiago, A.D. Economic, social, and environmental sustainability in development theory and urban planning practice. *Environmentalist* **1998**, *19*, 145–161. [CrossRef]

46. Lam, J.S.L.; Ng, A.K.Y.; Fu, X. Stakeholder management for establishing sustainable regional port governance. *Res. Transp. Bus. Manag.* **2013**, *8*, 30–38. [CrossRef]

47. Antão, P.; Calderón, M.; Puig, M.; Michail, A.; Wooldridge, C.; Darbra, R.M. Identification of Occupational Health, Safety, Security (OHSS) and Environmental Performance Indicators in port areas. *Saf. Sci.* **2016**, *85*, 266–275. [CrossRef]

48. Colwell, S.R.; Joshi, A.W. Corporate Ecological Responsiveness: Antecedent Effects of Institutional Pressure and Top Management Commitment and Their Impact on Organizational Performance. *Bus. Strateg. Environ.* **2013**, *22*, 73–91. [CrossRef]

49. Chen, T.; Wu, Z. How to facilitate employees' green behavior? The joint role of green human resource management practice and green transformational leadership. *Front. Psychol.* **2022**, *13*, 906869. [CrossRef] [PubMed]

50. Cataldo, I.; Banaitis, A.; Samadhiya, A.; Banaitienė, N.; Kumar, A.; Luthra, S. Sustainable Supply Chain Management in Construction: An Exploratory Review for Future Research. *J. Civ. Eng. Manag.* **2022**, *28*, 536–553. [CrossRef]

51. Lu, C.S.; Shang, K.C.; Lin, C.C. Identifying crucial sustainability assessment criteria for container seaports. *Marit. Bus. Rev.* **2016**, *1*, 90–106. [CrossRef]

52. Habidin, N.F.; Norazlan, A.N.; Fuzi, N.M. Sustainable Supply Chain Management: Factor Analysis. *Int. J. Supply Chain Manag.* **2019**, *8*, 600–604.

53. Khaslavskaya, A.; Roso, V.; Sanchez-Diaz, I.; Vural, C.A. Value-added services at dry ports: Balancing the perspectives of different stakeholders. *Transp. J.* **2021**, *60*, 406–438. [CrossRef]

54. Mohan, V.G.; Naseer, M.A. Prioritisation of Dry Port Locations Using MCDM Methods: A Case of Cochin Port. *J. Inst. Eng. Ser. A* **2022**, *103*, 841–856. [CrossRef]

55. Zain, R.M.; Salleh, N.H.M.; Zaideen, I.M.M.; Menhat, M.N.S.; Jeevan, J. Dry ports: Redefining the concept of seaport-city integrations. *Transp. Eng.* **2022**, *8*, 100112. [CrossRef]

56. Munters, A.S. Evaluating Sustainable Dry Port Expansion in Africa. Available online: http://resolver.tudelft.nl/uuid:b956aaaa-252b-448e-887a-4b7bfaafb5a8 (accessed on 27 August 2021).

57. Chang, R.D.; Zuo, J.; Zhao, Z.Y.; Zillante, G.; Gan, X.L.; Soebarto, V. Evolving theories of sustainability and firms: History, future directions and implications for renewable energy research. *Renew. Sustain. Energy Rev.* **2017**, *72*, 48–56. [CrossRef]

58. Vrakas, G.; Chan, C.; Thai, V.V. The effects of evolving port technology and process optimisation on operational performance: The case study of an Australian container terminal operator. *Asian J. Shipp. Logist.* **2021**, *37*, 281–290. [CrossRef]

59. Chen, L.; Notteboom, T. Determinants For Assigning Value-added Logistics Services To Logistics Centers Within A Supply Chain Configuration. *J. Int. Logist. Trade* **2012**, *10*, 3–41. [CrossRef]

60. Chen, Z. The Maritime Commons: Digital Repository of the World Maritime the Research on Site Selection of Dry Port Cluster of Shanghai Port the Research on Site Selection of Dry Port Cluster of Shanghai Port By. 2010. Available online: https://commons.wmu.se/all_dissertations/1868 (accessed on 15 May 2023).

61. Rodrigue, J.P.; Debrie, J.; Fremont, A.; Gouvernal, E. Functions and actors of inland ports: European and North American dynamics. *J. Transp. Geogr.* **2010**, *18*, 519–529. [CrossRef]

62. Subbaiah, V.; Prasad, D. Integrating factor analysis and analytic hierarchy process for library service quality. *J. Qual. Res.* **2011**, *5*, 205–212. Available online: http://scindeks.nb.rs/article.aspx?artid=1800-64501103205S (accessed on 24 February 2024).

63. Faller, H.; Kohlmann, T.; Zwingmann, C.; Maurischat, C. Exploratory and confirmatory factor analysis. *Rehabilitation* **2006**, *45*, 243–248. [CrossRef]

64. Olejnik, I.; Knežević, B.; Stefańska, M. Factor analysis in sustainable development research. In *Qualitative and Quantitative Methods in Sustainable Development*; PUEB Press: Poznań, Poland, 2021. [CrossRef]

65. Velmurugan, R.; Selvamuthukumar, S.; Manavalan, R. Multi criteria decision making to select the suitable method for the preparation of nanoparticles using an analytical hierarchy process. *Pharmazie* **2011**, *66*, 836–842. [CrossRef]

66. Goepel, K. Implementation of an Online software tool for the Analytic Hierarchy Process (AHP-OS). *Int. J. Anal. Hierarchy Process* **2018**, *10*, 469–487. [CrossRef]

67. Reio, T.G.; Shuck, B. Exploratory Factor Analysis: Implications for Theory, Research, and Practice. *Adv. Dev. Hum. Resour.* **2015**, *17*, 12–25. [CrossRef]

68. Baral, H.; Holmgren, P. *A Framework for Measuring Sustainability Outcomes for Landscape Investments*; CIFOR: Bogor, Indonesia, 2015; Volume 22, Working paper 195. [CrossRef]

69. Santiteerakul, S.; Sekhari, A.; Bouras, A.; Sopadang, A. Sustainability performance measurement framework for supply chain management. *Int. J. Prod. Dev.* **2015**, *20*, 221–238. [CrossRef]

70. Lim, S.; Pettit, S.; Abouarghoub, W.; Beresford, A. Port sustainability and performance: A systematic literature review. *Transp. Res. Part D Transp. Environ.* **2019**, *72*, 47–64. [CrossRef]
71. Puig, M.; Wooldridge, C.; Darbra, R.M. Identification and selection of Environmental Performance Indicators for sustainable port development. *Mar. Pollut. Bull.* **2014**, *81*, 124–130. [CrossRef]
72. Global Environmental Management Initiative. *Measuring Environmental Performance: A Primer and Survey of Metrics in Use*; Global Environmental Management Initiative: Washington, DC, USA, 1998; pp. 1–21.
73. Sala, S.; Ciuffo, B.; Nijkamp, P. A systemic framework for sustainability assessment. *Ecol. Econ.* **2015**, *119*, 314–325. [CrossRef]