

Logistics performance index-driven policy development: An application to Turkey

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ARTICLE INFO

Keywords:

Logistic performance index
Logistics
Logistics strategy development
Logistics policy suggestions
Logistics policies of countries

ABSTRACT

Logistics Performance Index (LPI), published by the World Bank, is a powerful tool for countries to benchmark and assess their performance in global logistics business. Researchers have investigated relations between LPI scores and other related statistics for developing country logistics policies; however, no studies examine the strategies of countries with high or increasing LPI scores. These countries could be used as a benchmark for improving the performance of competing countries, specifically emerging economies. The aim of this study is to develop a methodological framework for recommending logistics policies to improve the LPI score of specific countries. The study implements both qualitative and quantitative methods for developing the strategic recommendations in an uncertain business environment. The sources of the required data include logistics magazines, scientific articles, newspapers, World Bank investment reports, news and Ministry of Transport publications of the countries, as well as expert opinions. The framework consists of two main steps; (i) analyzing countries' logistics strategies and their impacts on LPI scores and (ii) providing policy recommendations for improving the LPI score of specific countries under consideration. We implemented the developed framework to provide strategic recommendations for Turkey. The developed framework is a strategic tool which can be used by countries to benchmark and implement relevant logistics policies, thus sustaining and improving their LPI scores and worldwide trade performances.

1. Introduction

Logistics is one of the key elements of trade (Martí et al., 2014), and logistics performance significantly affects the volume of bilateral trade. It increases the competitiveness not only for companies, but also for countries, who are increasingly recognizing the importance of logistics in worldwide trade (Hausman et al., 2013). This created the need to develop a specific measurement system for logistics performance, and strategies for advancing country performance.

LPI is a survey-based index prepared by the World Bank since 2007, which is extensively accepted worldwide (160 countries involved in 2018 version). LPI is a powerful tool for countries to benchmark and assess their logistics performance in a global platform, and to understand the logistics challenges as well as the areas for improvement (Gogoneata, 2008). This helps countries to understand their current position and develop strategies and policies to improve their performance in worldwide trade. Fig. 1 plots the LPI scores and the total export volume of goods and services (in logarithmic scale) of countries. There is

a positive correlation between these two indicators.

Political decisions and implemented policies have both direct and indirect effects on the attractiveness of a region or a country in terms of business location decisions and foreign direct investments (Ojala and Celebi, 2015). LPI is becoming a respected tool, increasingly used by political authorities to develop strategies (das Chagas et al., 2018). For example, in Indonesia, LPI is formally used to measure the performance of the Ministry of Commerce and is also used by the organization of Asia-Pacific Economic Cooperation to measure the impact of an initiative to improve connectivity in the supply chain. The European Commission has used LPI in its Transport Evaluation Panel, and its performance evaluation of the Customs Union (das Chagas et al., 2018). In that respect, various international transport associations and institutions support the World Bank in preparing and implementing the survey (Çemberci et al., 2015). It is therefore recognized that countries' increased LPI scores mean greater trade volumes in the globalized world (Hausman et al., 2013; Martí et al., 2014; Çemberci et al., 2015; Ekici et al., 2016).

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However, there is still limited knowledge of how LPI scores can be used to develop logistics strategies for improving country trade; the literature focuses mostly on the relation or impact of LPI and other indexes, their comparison or complementary use (e.g. Gogoneata, 2008; Hausman et al., 2013; Martí et al., 2014; Pupavac; Golubović, 2015; Rashidi and Cullinane, 2019; Kabak et al., 2019). To the best of our knowledge, there is no study that investigates the relationship between a country's LPI score and reforms (such as actions, policies, strategies, and investments) implemented, and that analyses these reforms to produce benchmarks for developing alternative policies to improve the LPI ranking of other countries.

Addressing this theoretical motivation, the aim of this study is to develop a methodological framework that (i) improves the understanding of the actions, policies, strategies, and investments behind LPI scores of the countries with recently increased rankings, or have been consistently leading performers for the last ten years, and (ii) enables other countries, particularly, the emerging economies, to benchmark their performance and build strategies or policies to improve their worldwide logistics performance under given budget constraints. From a practical perspective, this study makes a significant contribution to the logistics development of countries. The methodological framework followed in this study proposes LPI as a means for policy makers to take a broader perspective in the analysis of the competitiveness and benchmarking factors of logistics systems for improving country's logistics performance.

More specifically, this methodological framework should be able to; (1) identify the strategies that determine and improve the countries' LPI scores, (2) outline the strategies a country can implement to improve its LPI ranking, (3) determine an optimal combination of strategies that contribute to formalizing country policies for improving its LPI ranking under budget constraints. This method may lead the way for improved trade, not only for Turkey, but also for other countries, and can be used to develop policy recommendations.

This study employs a multi-method approach. First, secondary data is collected from various online sources, reports and news, and content analysis is used to code the logistics actions implemented by the best-scored or progressive countries. Then, regression analysis is applied to calculate the effect of each coded action on each LPI criteria. This is followed by a survey implementation to estimate the costs of these actions, and the development of a mathematical model that maximizes the LPI score by selecting a subset of actions for a given budget. This methodological framework is implemented in Turkey, to develop effective logistics policies for improving its competitiveness in world trade.

The outline of the study is as follows; after a literature review in

Section 2, Section 3 presents the methodological framework. Section 4 discusses the implementation of the developed framework to Turkey and the last section concludes the study.

2. Literature review

The recent wave of global change consists of complex interactions between people, firms, and organizations. Supply chains encompass nations and regions, and trade has become a 24/7 commercial enterprise. Performance in trade requires connectivity not only through road, rail and sea routes, but also in telecommunications, monetary markets and information-processing (Ojala et al., 2014). Inefficient systems of transportation, logistics and trade-related infrastructure can severely obstruct a country's potential to compete on an international scale, while a competitive advantage in terms of logistics performance increases its international trade, allows expansion towards new markets and encourages businesses (Ekici et al., 2016).

The above-mentioned evolution introduces LPI as a critical tool for countries to observe their performance over time, assess their relative position with respect to other countries, and outline areas for improvement to achieve higher levels of logistics performance in worldwide trade. An understanding of logistics performance needs starting from the national level will allow better evaluation of the existing position, and more precise targeting of trade and transport policies to be implemented across countries.

2.1. The importance of logistics on country trade

Trade is an important means for countries' economic development, especially for emerging economies. Countries depend on international trade to increase sales of their domestic products in global markets. Naturally, the volume of trade between two countries depends on the attractiveness of the exporting country and the needs of the importing country. When an importing country has several potential supply sources, the important determinants of bilateral trade volume are distance and the associated costs of crossing borders, costs of transporting goods, and customs and duties (Hausman et al., 2013).

Studies show a strong relationship between logistics and economic growth. Chu (2012) and Navickas et al. (2011) show investing in logistics is important for fostering economic growth, especially for undeveloped and developing countries. According to Navickas et al. (2011), the main factors of logistics systems impact on country's economic growth could be embodied through development levels of logistics systems and infrastructure, the impact of business environment, the mobility and effective use of resources, logistic flexibility and receptivity

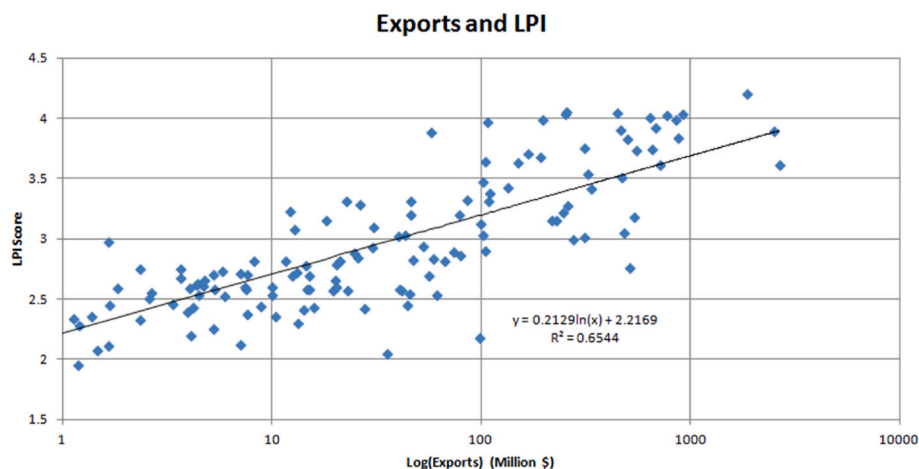


Fig. 1. Export volumes and LPI scoresSource World Development Indicators, Databank, World Bank, latest available data is used for both indicators.

to innovations. Due to the strong relationship between logistics and economic development, regional logistics activities play an increasingly crucial role in the development of national competitiveness in modern knowledge-based economies. This is especially relevant for developing countries such as Turkey, which need investment to improve its position in international trade (Özceylan et al., 2016).

As the channel of international trade, logistics encompasses activities such as freight transportation, warehousing, customs clearance, and payment systems, performed mainly by private service providers for traders and owners of goods; however, it is also critical for public policies of national governments and regional and international organizations (Arvis et al., 2012). Ekici et al. (2016) pointed out that, due to the complexity of global supply chains, the efficiency of logistics depends on government services, investment and policies, amongst other factors which influence the competitiveness of the nation as a whole.

Transport system efficiency and industry profitability are closely related. For this reason, transportation systems are considered as a production factor and as one of the key determinants of facility location decisions. Political decisions and implemented policies have both direct and indirect effects on the attractiveness of a region or a country in terms of business location decisions and/or foreign direct investment (Ojala and Çelebi, 2015). Logistics is therefore one of the key elements of trade, as competitiveness is increasingly fostered by a country's logistics performances. Hausman et al. (2013) and Martí et al. (2014) discuss the concept of LPI influenced inter-country trade, highlighting the need to consider LPI in policy decisions, and implement performance enhancement studies to increase countries' trade volumes. LPI analyses differences in countries' logistics performances, offering a customized image of customs procedures, logistics charges and the infrastructure that is vital for facilitating overland and maritime transport. At the same time, it provides a baseline for benchmarking with exemplary cases, such as the European Union (EU), to show how the implemented policies and reforms can enhance logistics performance and thus, trade performance (Martí et al., 2014).

The logistical performance between two nations can be a true indicator of the total price of procurement and have a significant effect on the decision of procurement and the trade volume between countries. Many studies have demonstrated a strong link between logistics performance and trade volume for countries (Hausman et al., 2013; Caruthers et al., 2003; Dee et al., 2006). In almost all cases, however, the metrics used for logistics performance are either indicators derived from surveys or from more comprehensive concepts.

2.2. Logistics performance index (LPI)

LPI is a worldwide survey evaluating the logistics performances of trading countries in six logistics areas; customs, infrastructure, ease of arranging shipments, quality of logistics services, timeliness, tracking and tracing. First implemented in 2007, the second assessment was introduced after 3 years, and is currently published every two years. LPI measurements support assessment of countries' logistics performances in terms of improvements and challenges, and benchmark across countries to develop more effective logistics policies. This multidimensional performance indicator allows not only comparisons between countries, but cross-sectional statistical investigations (Gogoneata, 2008). Various international transport associations and institutions supported the World Bank in preparing and implementing this 34-item questionnaire (Çemberci et al., 2015). The scores for each performance area are generated for each country. The items are classified according to LPI indicators, and each item refers to one or more indicators, and the total LPI score is computed as the average of the scores on each criterion.

Areas, where the government plays a key role, are building infrastructure, developing regulatory regimes for transport services, and designing and implementing efficient customs clearance procedures (Ekici et al., 2016). LPI rankings serve as a benchmark for policy-makers

and other interested parties in assessing the relative competitive performance of their country within a global context. The logistics strategy is a set of guiding principles, driving forces and ingrained attitudes that help to coordinate goals, plans and policies, reinforced by conscious and subconscious behavior within and between partners throughout the network (Hayes and Wheelwright, 1984).

There are a wide range of studies investigating aspects of LPI. van Roekel (2017) focuses on the weights of LPI indicators and shows that all criteria cannot be assumed to have the same effect on the total score, i.e. there are probable differences in the effects of individual LPI criteria on the overall LPI score. Hausman et al. (2013) and Martí et al. (2014) show that LPI influences inter-country trade. Pupavac and Golubovič (2015), Çemberci et al. (2015) and Ekici et al. (2016) discuss the relationship between Global Competitiveness Index (GCI) and LPI. Gogoneata (2008) uses standard econometric techniques and LPI to evaluate the impact of several key macroeconomic variables on the quality of the logistics sector, whereas das Chagas et al. (2018) aim to identify critical barriers to Brazilian competitiveness using LPI. Other studies focus particularly on the comparison or complementary use of LPI and other indexes (e.g. Gogoneata, 2008; Hausman et al., 2013; Martí et al., 2014; Pupavac and Golubovič, 2015).

2.3. Policy development in logistics

Policy making is a dynamic process shaped by interactions within the transport sector (Meersman and Voorde, 2019). There are several studies related to policy development in particular logistics operations, such as port activities and hinterland congestion in relation to vertical integration (Borger and Bruyne, 2011), the effects of value-added port decisions on the development of regional economy (Deng et al., 2013), logistics and transportation systems and their impact on foreign direct investment performance (Halaszovich and Kinra, 2018). Port governance is another important topic attracting academic interest (Zhang et al., 2018). Yang and Chen (2016) introduces global logistics hub port assessment criteria and compares the policies of port development in three mega hub ports.

Furthermore, Lean et al. (2014) suggest that improving the transport network infrastructure contributes to economic development. They also emphasize the importance of coordination among the authorities managing different modes of transport for facilitating the implementation of multi-modal transport systems. They point out the need for further research in different country settings. The importance of developing policies for improving the transport infrastructure and logistics for comparative advantage is also emphasized by Park (2020). Rezaei et al. (2018) highlights the relative importance of infrastructure for effective policy development by assigning weights to six components of LPI and implementing Best Worst Method.

Studies focusing on the policy implications in relation to logistics performance and economic growth provide an insight to policy makers to benchmark their own country policies, especially for developing countries (Lean et al., 2014). The relation between logistics performance and competitiveness of countries is investigated for providing insight to policymakers (Ekici et al., 2016, 2019; Kabak et al., 2019). The implications of GCI on improving the logistics performance of a country is studied by proposing a methodology that outlines the factors effecting the competitiveness of countries and presents a roadmap for policymakers to introduce effective country strategies (Kabak et al., 2019; Ekici et al., 2019). Sustainable operational LPI, introduced by Rashidi and Cullinane (2019), also provides policymakers a benchmarking mechanism to assess their logistics industry in terms of sustainability-based indices, and develop policies for improving the national logistics performance, and thus, their national economies. EU transport policy is reviewed by Ponti et al. (2013), and policy actions focusing on infrastructure, competition and regulation (in relation to trucking industry, local public transport, air transport, railways, ports) and environmental and safety principles are indicated as being

important issues for further development. Stojanović and Ivetić (2020) recommend Incoterms as an additional LPI indicator in benchmarking and assessment, helping policy makers to improve transport and logistics flows.

Remedial work in this area shows that GCI may increase the LPI ranking, or that any increase in LPI criteria may increase competitive power (Pupavac and Golubović, 2015; Çemberci et al., 2015; Ekici et al., 2016). However, there is limited understanding of how LPI scores can be used as a benchmark to develop logistics strategies and country policies, and thus, improve trade.

3. The methodological framework

Countries perform actions based on several motivations, including increasing exports, gaining competitive advantage, creating new jobs and improving the education system. Their actions have implications on several indicators monitored by different international indices, such as LPI, GCI, Environmental Performance Index (EPI) and Corruption Perception Index (CPI). As described in the previous section, there are studies analyzing the relations between LPI and other indices (e.g. Gogoneata, 2008; Hausman et al., 2013; Martí et al., 2014; Pupavac; Golubović, 2015; Rashidi and Cullinane, 2019; Kabak et al., 2019). Once a relation is detected between LPI and another index, one further step is necessary to recommend actions that may influence the indicators of the analyzed index, i.e., the detection of the relation between the actions of the countries, and their implications on country LPI scores; where the aim of this study is focused.

Multi-method or hybrid methodological approaches are applied in logistics policy development studies, especially when the aim is to propose a decision-making tool or methodological approach (Ekici et al., 2016, 2019; Kabak et al., 2019). Modelling techniques (Brooks et al., 2017; Lean et al., 2014; Rezaei et al., 2018; Rashidi and Cullinane, 2019), and statistical analysis (Deng et al., 2013; Ekici et al., 2019; Halaszovich and Kinra, 2018; Stojanović and Ivetić, 2020) are also used in logistics policy decision-making studies. Complementary to other techniques, scenario analysis is applied; e.g. to identify interactions between variables, rather than cause and effect relationships (Ekici et al. ap 2016). The indicators or dataset of studies are mainly obtained from sources such as relevant reports (e.g. WEF global competitiveness reports; White Paper) or the literature (Deng et al., 2013; Ponti et al., 2013; Ekici et al., 2016). Qualitative methods (such as expert opinions) are also used as complementary to quantitative methods in the methodological phases, in cases where knowledge and expertise in transportation and logistics activities are necessary to explore particular relationships or dynamics (Ekici et al., 2016). Importantly, Meersman and Voorde (2019) state that existing models in logistics policy studies are inadequate considering the structural shifts in the area; particularly in their inability to account for the underlying behavioral patterns of various agents and dynamics of the industry in specific country settings.

Following these multi-approaches in logistics policy-making studies, this study employs a multi-method approach, and proposes a methodological framework for policy makers to assess and benchmark the competitiveness of their country's logistics systems for improving performance. Fig. 2 presents the stepwise description of the proposed framework.

The first step is to *determine the sample countries*. The sample for content analysis consists of countries with significantly increased LPI scores or those that are consistent leaders in LPI lists in recent years. In the *data collection* step, various sources are searched to identify the logistics-related actions and strategies implemented in the sample countries in the last decade. *Content analysis* is applied to the collected data and strategic actions are coded under distinct categories (Mayring, 2000; Krippendorff, 2004).

The data generated in the content analysis is translated into a matrix, and *regression analysis* is used to calculate the effect of each coded action on each LPI criteria. Regression analysis is used to identify the actions

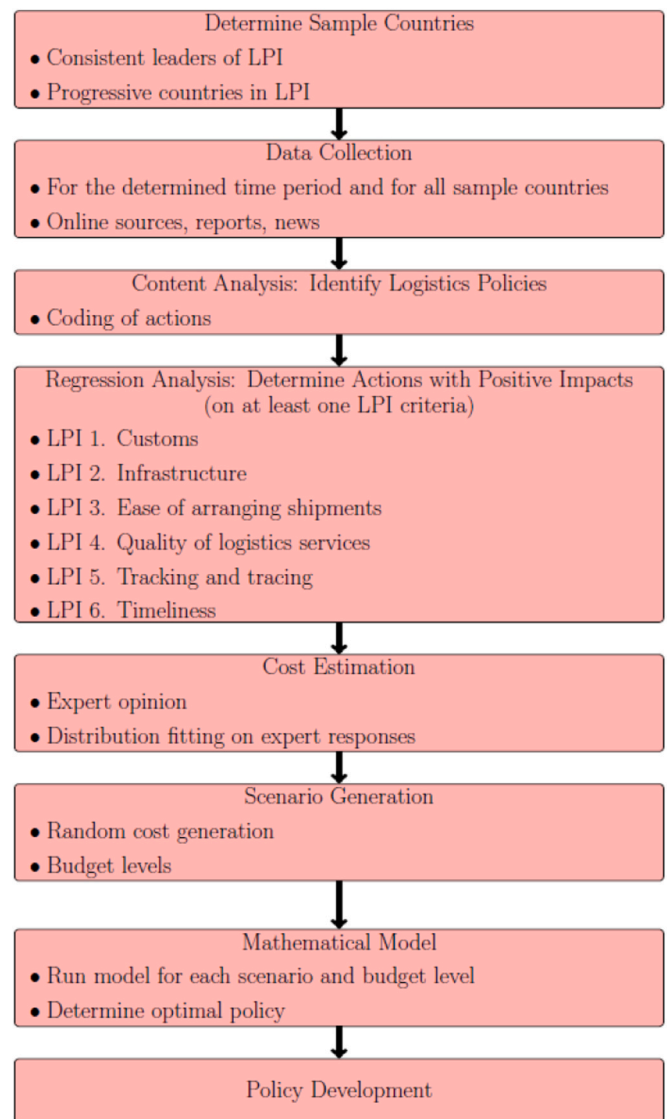


Fig. 2. Steps of the proposed framework.

with meaningful effects, which are then used to recommend strategies and policies for the improvement of LPI score for the country under consideration. The analysis shows some actions have significant effects on LPI.

Since a budget is required to implement the strategic recommendations, a questionnaire, designed for *cost estimation* of these actions, is conducted; logistics experts in Turkey are asked to estimate the relative cost of each action on a scale from 1 to 100. Rather than using the average estimates for action costs and dealing with a single instance of the problem, we fit random distributions to expert opinions. In *scenario generation* step, several scenarios with different actions costs are generated, based on these random distributions. Then, a *mathematical model* is created to maximize the LPI scores after selecting a subset of actions for a given budget. A computational test for each instance produces solutions for different budget levels. Computational experiments on randomly generated samples allow us to determine how action choices are affected in different budget combinations. In the *policy development* step, the results of the mathematical model are analyzed and reported for 20 different budget levels for 100 scenarios.

3.1. Determine sample countries

The sample countries are identified through purposeful sampling (Flick, 2014). In the selection process, average LPI scores are assessed considering all years for which LPI ranking is available, and upper-lower bound limit analysis is conducted. In the ranking, cases in which the lower limit of the following year is higher than the upper limit of the previous year are analyzed to determine whether the reforms implemented by the countries lead to a specific advantage. Because the effects of a remediation work can be long-term, this ranking assessment should not be limited to the following year but extended along the continuum of years. Following this procedure, in this study, the countries with highest LPI scores, and best progress scores within the last ten years are identified as representative cases of successful assessment and implementation of logistics policies to improve or sustain LPI scores. Generally, countries with consistently higher scores are from among the high-income countries, according to the OECD (2005) report, and the actions of these countries potentially provide important recommendations for those with lower or non-progressive LPI-scores. Nevertheless, the list of countries can be updated by considering the characteristics of the case country, such as industry dynamics, competition, and geographical properties.

3.2. Data collection

Countries' strategies and policies to improve logistics performances are outlined using content analysis to interpret the textual data (Miles and Huberman, 1994; Mayring, 2000; Krippendorff, 2004), which is gathered from various online sources, including logistics magazines, articles, newspapers, investment reports of the World Bank, Ministry of Transport publications and news. Data covers the years between 2007, when LPI was first published, and 2018. The main categories and sub-coding are explored by making inferences from detailed reading of data inductively (Mayring, 2000).

3.3. Content analysis: identifying logistics policies

In qualitative content analysis, data is categorized by making inferences after a detailed reading of the themes of the text (i.e., inductively), following the qualitative data analysis procedures (Mayring, 2000).

In content analysis, an iterative process is used to analyze and code the logistics policies of the sample countries, which are then grouped under distinct categories. Categories with emerging data are constantly compared, as further sources of secondary data are added in the analysis process (Miles and Huberman, 1994; Krippendorff, 2004). The reliability of the coding process is investigated by two independent researchers. In case of disagreement, the assessment of a third researcher is asked to resolve the dispute (Mayring, 2000).

The list of actions may vary when the framework is implemented for different countries or the framework is implemented for the same country in different years. The lists of benchmark countries may change for different analyses; either for two different case countries or for the same case country in two different years. Moreover, after the last content analysis, benchmark countries may implement new actions that may require an update in the action list.

3.4. Regression analysis: determine actions with positive impacts

After completing the coding process, regression analysis is utilized to determine the relation between these actions and their impact on LPI area scores. We use the following notation:

3.4.1. Sets

- T : set of years at which LPI scores are announced, $t \in T = \{2007, 2010, 2012, 2014, 2016, 2018\}$,
- J : set of LPI areas, $j \in J = \{\text{Customs, Infrastructure, Ease of arranging shipments, Quality of logistics services, Tracking and tracing, Timeliness}\}$,
- C : set of countries analyzed, $c \in C$
- A : set of actions determined by content analysis, $a \in A$,

3.4.2. Parameters

- N_{cat} : number of type a actions taken by country c at year t ,
- LPI_{cjt} : score of country c on LPI area j at year t
- α_{aj} : impact of action a on LPI area j

Note that, actions in A set and the number of actions taken by a country at a year (N_{cat} values) are the outputs of the content analysis. In order to analyze the relation between these actions and the LPI scores, we conduct regression analysis. An action taken by a country may improve the LPI score on one area but deteriorate it on another. To capture such effects of the actions, we conduct the regression analysis on each LPI area separately and each regression model includes all actions. Regression analysis predicts the best α_a values using the following equation:

$$LPI_j = \alpha_{0j} + \sum_{a \in A} \alpha_{aj} N_a + e_j \quad j \in J$$

where e_j is the error term of the regression model.

LPI_j values are represented as a column vector of LPI_{cjt} parameters with $|C| \times |T|$ rows and N_a values are represented by a matrix of N_{cat} parameters with $|A|$ columns and $|C| \times |T|$ rows.

Some actions may have an immediate impact and may affect the first announced LPI score immediately after implementation, whereas for others, there may be a time lag to create a significant impact. The length of the lag may also differ according to countries and also to LPI areas. In our study, we assume that the impacts of the actions are observed in the latest announced LPI score.

As expected, not all actions have a significant impact on each area. In order to find the most suitable regression model for each area, we employ a backward elimination method with a suitable threshold value.

If an action negatively affects all six LPI areas, if selected, it will reduce the average LPI score. On the other hand, an action may positively affect one area but negatively affect others. In such cases, that action's positive effect can compensate for the negative effect of the other areas and increase the overall LPI score. Since the aim in the study is to outline the actions that would increase the LPI score, the mathematical model will choose the actions with at least one positive effect on an LPI area and ignore those with negative impacts on all 6 areas.

3.5. Cost estimation

After determining the set of actions and their impact on each LPI area, we need to estimate the actions' relative costs. For this purpose, we prepare a questionnaire for a target group, composed of logistics experts.

An online survey is deployed to increase the interactivity and provide flexibility to all participants, who can respond only once. We ask participants to estimate the relative costs of actions by assigning a score between 1 and 100 for each action. Recall that α_{aj} value represents the contribution of action a on the score of LPI area j . All actions with at least one LPI area j with a positive α_{aj} value are included.

Let E be the set of experts, $e \in E$, and r_{ea} be the response of expert e for action a . We normalize the response of each expert as follows:

$$r'_{ea} = 100 \frac{r_{ea}}{\sum_{a \in A} r_{ea}}$$

So that the total budget estimates of experts are equal to 100 units.

We consider each action separately and treat the normalized survey results as samples from random distributions of action costs. For each action, we fit a random distribution to the normalized expert responses using an input analyzer.

3.6. Scenario generation

Let $D(a)$ be the suggested distribution for the cost of action a determined in cost estimation step. Using these random distributions, we generate the action costs of an instance k . Let c_{ka} be the cost of action a in instance k and let B_k be total cost of actions in instance k , $B_k = \sum_{a \in A} c_{ka}$.

We use K as the set of all instances.

For a given instance k , we define 20 different budget values such that $b = 5\%, 10\%, 15\%, \dots, 95\%, 100\%$ of B_k value. Hence, we obtain scenarios with several budget levels and with different action costs.

3.7. Mathematical model

We develop a mathematical programming model that aims to maximize the LPI score by selecting a subset of actions under a given budget constraint. We define the actions based on content analysis, estimate the impacts of these actions on each LPI criteria by regression analysis, and generate the costs of taking these actions based on survey results.

Below, we provide the details of the mathematical model, including the decision variables, objective function and the constraints, and additional sets and parameters required.

The World Bank takes LPI weights as equal while calculating average LPI scores of countries. Rezaei et al. (2018) conduct an extensive survey with logistics experts from six continents for assigning weights to different LPI areas. Based on the survey results, infrastructure has the highest weight and tracking and tracing, the lowest. Moreover, experts' weight distributions vary according to their country of origin. Marti et al. (2017) propose a data envelopment analysis-based logistics performance index (DEA-LPI) where each country picks the most favorable weight set. In the mathematical model, we add w_j parameters to provide flexibility to the model where the country under consideration can use different weights according to the needs and policies of the country.

3.7.1. Additional parameters

- w_j : weight of LPI area j
- LPI_{0j} : Current LPI area j score of country under consideration.
- b : available budget

3.7.2. Decision variables

- x_a : 1 if action a is selected and 0 otherwise
- LPI_{0j}^* : Modified LPI area j score of country under consideration,
- LPI_0^* : Modified LPI score of country under consideration.

The objective function (1) aims to maximize the final LPI score, defined as the weighted sum of the modified LPI scores of each LPI area. Constraint sets (2) and (3) define upper bounds on the modified area scores. Constraint set (2) imposes that for each LPI area, the modified area score cannot exceed the sum of current LPI score and the total impact of taken actions. Constraint set (3) defines the upper bound for each LPI area. Constraint (4) ensures that the total cost of taken actions do not exceed the budget. Constraint sets (5) and (6) define decision variables.

$$\text{Maximize } LPI_0^* = \sum_{j \in J} w_j LPI_{0j}^* \tag{1}$$

s.t.

$$LPI_{0j}^* \leq LPI_{0j} + \sum_{a \in A} \alpha_{aj} x_a \quad j \in J \tag{2}$$

$$LPI_{0j}^* \leq 5 \quad j \in J \tag{3}$$

$$\sum_{a \in A} c_{ka} x_a \leq b \tag{4}$$

$$LPI_{0j}^* \geq 0 \quad j \in J \tag{5}$$

$$x_a \in \{0, 1\} \quad a \in A \tag{6}$$

3.8. Policy development

We analyze the trade-offs between the available budget and the final LPI score. For each budget value b , we analyze the final LPI score and the selected actions for the given budget. We repeat the trade-off analysis on 100 randomly generated instances. Hence, the mathematical model is solved 2000 times for different instances. We record the optimal solution of each instance and report the percent of instances for which each action is selected, and the minimum, mean and maximum LPI scores for each budget value. For each action, we discuss in detail the actions taken by sample countries and provide recommendation for the country under consideration.

4. Implementation of the methodological framework: A case of Turkey

The methodological approach explained in the previous section was implemented in Turkey, an emerging country, which is positioned between east and west, ranked 18th in the world economic size, with \$771 B Gross Domestic Product (GDP), with \$223 B imports, \$168 B exports, and over 10 million Twenty-foot Equivalent Unit (TEU) logistics capacity (WITS World Integrated Trade Solution, 2018).

4.1. Strategy identification

4.1.1. Consistent leaders and progressive countries in LPI score

In order to provide suggestions to improve Turkey's LPI ranking, first, sample countries were selected among the countries with significantly increased LPI scores and consistent leaders in LPI ranking by following the procedure explained in Section 3.1. Table 1 shows top 10 and progressive countries according to the LPI score analysis.

4.1.2. Data collection process

When these countries' LPI scores were reviewed over time, variability in scores was observed every year. In order to explore the actions causing this fluctuation, and outline the effective strategies and policies implemented by sample countries, qualitative content analysis was employed (Mayring, 2000). Data was collected among special interest sources directed at specific interest groups, for example: trade magazines, logistics magazines, articles related to LPI and logistic development, national press, World Bank investment reports, Ministry of Transport publications and logistics news related to sample countries. The strategies and actions implemented by sample countries between

Table 1
Top 10 countries and Progressive countries.

Top 10 Countries		Progressive Countries	
Germany	Luxembourg	United Arab Emirates	Lithuania
Sweden	Netherlands	Qatar	India
Singapore	Belgium	Kenya	Botswana
United Kingdom	Hong Kong SAR, China	Rwanda	Tanzania
United States	Austria	Namibia	

2007 and 2018, the dates of the earliest and most recent LPI reports, respectively, were identified via Google search “logistics magazines 2007 ... 2018” with “logistics improvement” and “logistics development” as keywords in English language news. The reliability of the logistics magazines was intuitively determined by examining their contents and confirmed by consulting the ranking site www.alexacom. The search continued until the topics regarding the activities of the countries started to be repeated; that is, content searching ended when the discovery rate of new topics became very low.

4.1.3. Identifying logistics policy implementations of sample countries

The coding of actions was derived from the related secondary sources through inductive approach and grouped under distinctive categories. Categories and data were compared constantly through an iterative process of category building, testing and revising (Miles and Huberman, 1994; Mayring, 2000; Krippendorff, 2004). After content analysis, the logistics actions of high-scored and progressive countries were classified under 234 codes, with 158 sub-groups. Since the sub-code of 158 themes was not completely unique, and can involve overlaps, further categorization was made which resulted in 16 distinct actions (Table 2).

The reliability of the coding process was confirmed by two independent researchers (Mayring, 2000). Detailed coding of content is presented in Appendix A.

4.2. Strategy valuation

4.2.1. Outlining the actions with significant impact on LPI criteria

In order to identify actions with an impact on countries’ LPI scores, and the more effective actions, the coding table is adapted to regression analysis as 58*24 matrix. The table for regression analysis was prepared based on the frequency of actions taken by counties in related years. For this problem, LPI scores are assigned as y variables, and the taken actions as x variables.

In order to outline the actions having significant impact on all six areas, separate regression analysis was conducted for each area considering these 16 actions. Each analysis is implemented via backward elimination method, and the actions with p values less than 0.1 are considered as having significant effects. Actions having positive effect on at least one LPI area are discussed in detail, while others with only zero or negative effects in any of the LPI areas are omitted. Table 3 presents regression analysis data results.

According to the results of the regression analysis, six out of 16 actions have positive affect in at least one LPI area. The actions with negative effects on LPI (infrastructure development; labor reform; technological improvement; monitoring, analyzing and reporting of the system; provide safety in logistics) are removed from further analyses. Table 4 presents the actions affecting the LPI areas. For instance, if the efficiency studies action is selected, it has a positive impact of 0.823 units on the Infrastructure LPI area.

Actions which have positive impact on LPI scores, are explained based on the detailed coding of content (Appendix A). Cooperation action category refers to cooperative initiatives between 2 or more countries (i. e. ports), policy makers and the private sector related to customs

Table 2
Action list.

Action List	
Change in management system	Marketing
Cooperation	Monitoring, analyzing and reporting of the system
Create alternative energy source	Provide safety in logistics
Efficiency studies	Technological improvement
Environmentalism mindset	Training and education
Fee/Tax regulation	Use different modes of port
Infrastructure development	Use of different modes of transportation
Labor reform	Work on competition

operations, economic or logistics activities. Efficiency Studies action category refers to efficiency related activities of countries, such as removing unnecessary administrative barriers, investing in bottlenecks, and maximizing container efficiencies. Environmentalism Mindset action category refers to the strategies or reforms associated with the country’s environmental activities, such as waste management, emission reduction, and environmental protection. Marketing action category refers mainly to the private sector’s customer-oriented strategies, advertising, and promotion activities. Use of Different Modes of Ports action category refers to activities related to initiatives and investments to design transport center models or the use of the host model. Use of Different Modes of Transportation action category refers to activities related to combining different types of transport modes (multi-modal transportation) and establishing a corridor model.

It appears that these actions were implemented successfully by the developed countries. For example, Germany improved working and living conditions in the freight transport and logistics sector in 2010 (labor reform), Belgium develop a cargo community system in 2013 (technological improvement), USA established an advisory group for continuous reporting and monitoring of port performance in 2015 (monitoring analyzing and reporting of the system) and United Kingdom took the decision to expand ports’ container capacity (infrastructure development). However, these actions likely negatively affected emerging or less developed countries, which had difficulty in adapting to the new developments.

4.2.2. Estimating the cost of taking actions

The survey, focused on estimating the costs of the selected six actions, was completed by a group of 27 logistics experts, with an average of 12 years’ sector experience. We normalized the expert responses as described in Section 3 and fitted random distributions for the cost of each action using Arena Input Analyzer. Table 5 shows statistics generated from the expert responses and the suggested random distribution.

4.3. Strategy selection

4.3.1. Scenarios with different actions and budget levels

Using the suggested random distributions, we generated 100 different instances. Note that, in each instance, the set of actions and impacts of these actions on each LPI are common. However, the costs of the actions were randomly generated. For each instance, we compute the budget required to implement all actions (the total cost of all actions), before solving the developed mathematical model for 20 different budget levels, from 5% to 100% of the total budget.

4.3.2. Identifying optimal actions under budget constraint

We develop the mathematical model and conduct the experiment on GAMS. We solve a total of 2000 mathematical models in a total run time of less than 5 min.

Table 6 shows the number of instances of each action selected for different budget levels. Even for small budget levels adopting an environmentalism mindset has the highest selection rate, due to the combination of their high impact on several LPI areas, and their reasonable cost requirements.

The table also shows that the mathematical model prefers the action of environmentalism mindset, even when the budget is 15% of the total action costs. After the budget exceeded 25% of the total action cost, the environmentalism mindset is the most significant return on the action and is selected in all instances. Moreover, efficiency studies and cooperation actions are always selected, even at lower budgets. Use of different modes of port action also contributes to the LPI score, but the mathematical model avoids taking this action nearly in all instances, unless the budget level is 100%. Based on the experiments, the order of actions to be taken are as follows: (1) Adopting an Environmentalism Mindset, (2) Efficiency Studies, (3) Cooperation, (4) Marketing, (5) Use Different

Table 3
Regression analysis data results.

	Customs	Infra-structure	Ease of arranging shipments	Quality of logistics services	Timeliness	Tracking and tracing
Adjusted R ²	40.50	41.01	34.20	39.72	40.31	42.18
Significant F	10.7	8.93	6.93	13.52	13.83	14.86
Actions						
<i>P</i> values						
Regression	0.000	0.000	0.000	0.000	0.000	0.000
Cooperation	0.030		0.074	0.009	0.011	0.017
Efficiency Studies		0.002				
Environmental Mindset	0.000		0.050	0.000	0.000	0.000
Marketing			0.031			
Use Different Modes of Port	0.065					
Use Different Modes of Transportation		0.006				

Table 4
Impact of actions on LPI areas.

Actions	Customs	Infrastructure	Ease of arranging shipments	Quality of logistics services	Timeliness	Tracking and tracing
Cooperation	0.1104		0.0836	0.1368	0.1231	0.116
Efficiency Studies		0.823				
Environmental Mindset	0.509		0.389	0.513	0.454	0.495
Marketing			0.504			
Use Different Modes of Port	0.384					
Use Different Modes of Transportation		0.42				

Table 5
Expert responses and fitted distributions.

Actions	Mean	Standard Deviation	Distribution
Cooperation	14.78	5.45	Normal (14.8, 5.35)
Efficiency Studies	15.67	4.77	Normal (15.7, 4.68)
Environmental Mindset	18.14	4.57	Normal (18.1, 4.49)
Marketing	18.40	5.29	Triangular (10, 15.2, 30)
Use Different Modes of Port	18.93	3.88	Triangular (12, 16.8, 28)
Use Different Modes of Transportation	14.09	5.15	Normal (14.1, 5.06)

Modes of Port, (6) Use Different Modes of Transportation.

Fig. 3 reports the mean, minimum and maximum LPI scores for different budget levels. The LPI score increases 0.84 units, from 3.15, Turkey’s current LPI score, to 3.99, the best possible LPI score when all actions are taken. By using 20% of the budget required, the mean LPI score reaches 3.53, approximately half of the possible range, whereas the maximum LPI score reaches 3.68, about two thirds of the possible range.

4.3.3. Policy recommendations to improve LPI score of Turkey

We discuss in detail these six actions to provide policy recommendations for improving Turkey’s LPI scores. The first three actions in particular are highly recommended in case of limited budget.

- **Environmental Mindset:** Sustainable environmental thinking is an emerging field as a market driver (Rao and Holt, 2005; van Roekel, 2017; Arvis et al., 2010; Rashidi and Cullinane, 2019). This action addresses the countries involved in environmental business activities, such as waste management, emission reduction, environmental protection. Sustainability of operational logistics performance makes an important contribution to a country’s logistics performance by helping to manage the sources of inefficiency (Rashidi and Cullinane, 2019). As outlined in this study, reduction and control of the CO2 emission rates is the most important of all environmental activities. Two actions that indicate environmental concern are government encouragement for the use of environmentally friendly vehicles and equipment, and the development and strict supervision of waste

disposal facilities. Policies can be implemented to provide incentives to motivate stakeholders towards environmental activities; an example is the Singapore government’s provision of 50% of the investment cost of the implementation of Green Technology for green logistics (Xiao and Lam, 2017), and granting of 15% discount in port dues to ocean-going vessels using approved abatement/scrubber technologies or clean fuels during port stays of 5 or fewer days. Furthermore, CO2 emission reduction studies can be carried out, as Germany is doing to protect the environment (Federal Ministry of Transport and Development, 2010).

- **Efficiency Studies:** Improving the logistics efficiency of a country enhances its global competitiveness (Ekici et al., 2016). This category includes countries’ decisions and strategies related to improving efficiency in operations. The key action in productivity studies is building a measurement system for continuous detection and management of efficiency bottlenecks as well as making investments to remove bottlenecks. Actions will be needed to eliminate bottlenecks, which vary according to the downturn periods in which they occur, therefore it is important to identify their specific causes. For example, Canada uses performance indicators to measure efficiency in ports and supply chains (Arvis et al., 2010), to identify opportunities to remove inefficient activities. Another example is the use of loading and unloading ramps to save time and improve efficiency; also, larger transport units can decrease the number of journeys needed (Federal Ministry of Transport and Development, 2010).
- **Cooperation:** Coordination among different authorities is a critical element for economic development (Lean et al., 2014). Since the first introduction of LPI scores, rather than relying on individual company actions, countries’ public agencies and private stakeholders are increasingly cooperating to implement well-grounded programs to address the weakest links and stimulate cooperation along the macro supply chain (Arvis et al., 2010). This is also important for generating an atmosphere of trust for collaborative management of industrial issues. For example, countries including Kenya, Uganda and Burundi have encouraged regional integration by establishing a trade corridor. Increased LPI scores provide evidence of the impact of this action on these countries (Arvis et al., 2016). One of the most important aspects of building a corridor is the reduction of trade bureaucracy, which, importantly, shortens the delivery lead times. However, in some periods, the benefits are reduced by ineffective management of the process by stakeholders. In addition, cooperation

Table 6
Percentage of selected action for selected Budget.

Budget	Environmental Mindset	Efficiency Studies	Cooperation	Marketing	Use Different modes of Port	Use of Different modes of Transportation
5	1	3	2	0	0	0
10	9	22	10	3	0	0
15	43	35	16	4	1	0
20	90	14	8	2	0	0
25	100	24	10	2	1	0
30	100	58	23	2	3	0
35	100	86	19	4	0	0
40	100	94	34	4	6	0
45	100	86	69	19	14	0
50	100	95	91	9	9	0
55	100	100	97	13	11	1
60	100	94	91	43	36	5
65	100	97	97	77	26	0
70	100	100	100	94	7	0
75	100	100	99	96	13	5
80	100	100	96	81	84	23
85	100	100	100	99	100	1
90	100	100	100	100	100	0
95	100	100	100	100	100	0
100	100	100	100	100	100	100
Total number of selections in all scenarios	1743	1508	1262	852	611	135
Percentage of selection in all scenarios	87.15%	75.40%	63.10%	42.60%	30.55%	6.75%

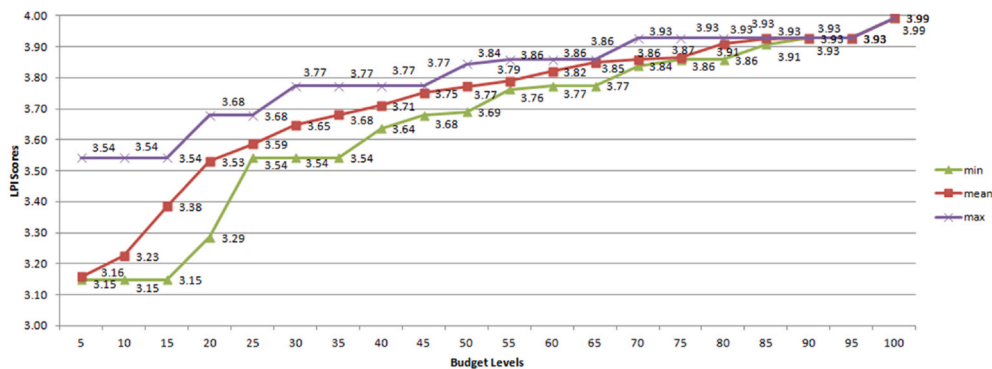


Fig. 3. LPI scores versus Budget levels.

always increases confidence between the parties, as providing for sharing of experiences and know-how, increasing trust and fostering trade (Notteboom et al., 2017; Brooks et al., 2017; Arvis et al., 2010; Federal Ministry of Transport and Development, 2010).

- **Marketing:** Marketing is also a key element in trade (Brooks et al., 2017). Developing a customer-oriented approach and increasing marketing activities to promote the quality and variety of services are also critical to logistics performance. To increase the volume of ports, for example, countries should implement marketing strategies to attract the interest of foreign shippers (Parola et al., 2018; Mandják et al., 2019), such as improving customer orientation in port management to increase competitiveness in worldwide trade (Parola et al., 2018; De Langen and van der Lugt, 2006).
- **Use Different Modes of Port:** Decisions related to port management have value-added effects on overall operations that contribute to the development of regional economy (Deng et al., 2013). Actions developed to redesign port business models are found to benefit operational activities and management of trade, and thus, improve a

country's LPI scores; these include designing a transfer center, for example, a combination and distribution point in a transport network, and implementing the host model such as Landlord model, which is a model involving state-owned port land, but where all operations are carried out by private companies. The initiatives related to this category eliminates unnecessary intensity and complexity in transport centers and facilitates operational management in ports.

- **Use Different Modes of Transportation:** There is an increasing need to integrate different modes of transport. This is highly important for improving a country's transport conditions and effectiveness of the transportation process, which, in turn, will contribute to economic development (Lean et al., 2014). This action category is generally implemented by countries that integrate transport networks. One objective of this strategy is to reduce traffic in the most used transportation mode, and to shorten the delivery time. For landlocked countries with limited transport options, the establishment of a regional corridor would support this action.

5. Conclusion

The novel methodological framework proposed in this study, provides countries with guidelines for assessing strategies with positive impact on LPI criteria, thus supporting their logistics performances. The framework provides a basis for policy makers to assess and improve national logistics performance by benchmarking high performers' the best practices. This benchmarking framework benefits policy makers, especially of emerging economies, which are playing an increasingly critical role on trade routes (AncorSuárez-Alemán et al., 2016). Therefore, this approach contributes to the literature by proposing LPI as a tool for benchmarking and policy making in the improvement of logistics performance.

This study has some limitations. Firstly, the content analysis could be expanded to involve a greater number of countries, and the analysis could focus on particular characteristics of the case country, such as industry dynamics, competition, or geographical properties. Another limitation is that the while regression models in the study consider the individual effect of each action on the considered LPI area score, it should also be considered that certain actions may have interactions, and when taken simultaneously, may generate synergy, or cancel out each other's impacts. A further research direction is to consider these interactions in regression and mathematical models. On the other hand, the actual costs of the actions contained in the mathematical model were unknown, therefore, it was necessary to conduct a cost assessment

questionnaire with 27 logistics experts from Turkey. However, future studies can be based on actual costs of the actions. Finally, the methodological framework developed in this study need validation, which is considered as further research direction. In that regard, the findings can be discussed with policy makers or experts from the field and advanced for better implementation of the strategies to improve the LPI score of the country.

We develop a framework that utilizes quantitative and qualitative methods. A further research direction is to improve the framework by suggesting methods for decision making such as country selection, impact and cost estimation. Also, it is possible to conduct a retrospective analysis to assess the power of the framework and calibrate the necessary components. Besides, rather than observing the impacts of the actions in the latest announced LPI scores, capturing the possible time lags for different types of actions, for different countries and for different LPI areas, is a possible future research direction.

Author statement

Aysu Göçer: Supervision, Conceptualization, Methodology, Data Curation, Formal Analysis, Validation, Writing - Review & Editing; Özgür Özpeynirci: Supervision, Conceptualization, Methodology, Formal Analysis, Validation, Writing - Review & Editing; Meltem Semiz: Investigation, Methodology, Data Curation, Formal Analysis, Writing – Original Draft

Appendix A

Grouping of Actions

Action Categories	Sub-codes	Actions
Cooperation	Integration of Ports	<ul style="list-style-type: none"> * Integrating ports into society and logistic chains * Reinforcing the competitive position of ports * Encouraging joint trade missions and exhibitions between ports * Encouraging co-operation between inland waterways
	Common Strategy	<ul style="list-style-type: none"> * Encouraging economic, commercial, logistics, and policy cooperation * Developing common operational tools and a common approach
	Cooperation between all stakeholders of the logistics network	<ul style="list-style-type: none"> * Realigning communication between companies and trade associations * Optimizing communication between policymakers and transport stakeholders * Encouraging cooperation between carriers
	Exchange of Experience and Cooperation Programs Make Regional Integration	<ul style="list-style-type: none"> * Exchanging ideas and experience * Exchanging port and logistics know-how * Establishing a transportation corridor in a regional base * Establishing pipeline corridors
Efficiency Studies	Measure Efficiency in Ports and Supply Chain Transport	<ul style="list-style-type: none"> * Developing indicators to capture the complexities of port operations * Using performance indicators to measure efficiency in ports and supply chain transport * Discovering efficient freight moves through the country * Making long-distance transport operations more efficient
	Invest to Remove Operational Bottlenecks	<ul style="list-style-type: none"> * Reducing pathing conflicts between regional passenger rail and rail freight services * Taking targeted action to remove bottlenecks on railway lines and roads * Investing to transport infrastructure * Improving loading and unloading operations at ramps * Planning to upgrade rail networks with particular attention to the needs of rail freight * Widening busy sections of motorways to more lanes * Paying particular attention to different needs of passenger and freight transport in transport infrastructure planning
	Larger transport units in the shape of longer trains/vehicle/ships	<ul style="list-style-type: none"> * Larger transport units to decrease traffic volume, and combine loads to remove unnecessary projects
Environmentalist Mindset	Promote Green Practices in Operations	<ul style="list-style-type: none"> * Improving supply and disposal facilities including the shore line power supply * Investing to implement green technology for green logistics * Improving the environmental compatibility of logistics activities * Promoting movement to protect environment and tackle climate change * Implementing uniform worldwide environmental standards * Using heavy vehicles that are environmentally friendly * Improving inland waterway vessels * Using environmentally-friendly port equipment and practices
	Emission control	<ul style="list-style-type: none"> * Developing uniform standards to calculate CO2 emissions from logistics services and contribute to green logistics

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Action Categories	Sub-codes	Actions
Marketing	Invest to increase interest to port	* Setting up standards to allow small and medium- sized enterprises to calculate their own emissions
		* Identifying measures to avoid the distortions of competition by calculating CO2 emissions in a standardised manner
		* Investing to port superstructure and terminal equipment to increase attractiveness for shipping lines
Use Different Modes of Transportation	Attracting the interest of foreign shippers with international trade fairs	* Investing to port facility for trucks to access the terminals
	Marketing initiatives, customer-centric approach to port operations	* Investing to port facility by developing a logistics support area to provide services to all cargo types
	Promote Multimodal Transportation	* Investing to new information technology and tools to facilitate the flow of electronic documents in ports, between trading partners and service providers along the transport chain
Use Different Modes of Port	Establish Multimodal Corridor	* We are intensifying our marketing activities at international trade fairs namely in Russia, Brazil, the USA, India, and China.
	Set up Hubs as Transfer Center	* an internationally visible trademark, especially in non-European markets
	Promote Alternative Energy Sources	* Recent trends include the emergence of a customer-centric approach to port operations, the development of strategic partnerships, and the export of skills and expertise in port management and operations.
Fee/Tax Regulation	Duty Reduction Programmes	* Using inland waterways to improve multimodal platforms
	Providing Incentives for Environmentally Friendly Operations in Ports	* Helping railway operators access port terminals
	Increase Transportation Capacity	* Optimizing combined rail traffic
Infrastructure Development	Infrastructure Projects Providing Land Side Access to Sea Ports	* Shifting freight traffic to railways and waterways
	Sustainable Port City Development	* Outlining the proportion of all transport services being suitable for multimodal transport
	Ensure Labor Health and Safety	* Deepening waters at strategic container wharves in order to accommodate vessels of various sizes
Labor Reform	Encourage Career in Maritime	* Improving infrastructure to enable modal shift towards railways and waterways by developing and deploying innovative technology
	Encourage Career in Maritime	* Allocating funding for combined transport in order both to shift more traffic to rail and waterway networks
	Encourage Career in Maritime	* Multimodal corridor with road, rail, pipeline, and inland waterway transport networks
Monitoring, Analyzing and Reporting of the System	Create A Platform for Monitoring and Protecting Data	* Developing hinterland connections
	Creating an Integrated Surveillance System	* Improving domestic feeder networks
	Creating an Integrated Surveillance System	* Introducing port reforms to focus investment resources on major ports

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Action Categories	Sub-codes	Actions
Provide Safety in Logistics	Creating a Big Data Management System	<ul style="list-style-type: none"> * Setting up an exchange of information networks among national authorities to increase the interoperability of surveillance activities, improve the effectiveness of the operations at sea, and facilitate implementing relevant community legislation and policies. * Increasing Interoperability of Surveillance Activities * Developing logistics systems to collect, organize, and interpret datasets * Making big data investments that maps a country's entire set of supply chains, from shipper information to tracking data and beyond
	Establishing an Advisory Group for Reporting and Monitoring of Port Performance	<ul style="list-style-type: none"> * Creating a port performance freight statistics system to be evaluated by an advisory group of industry stakeholders and provide recommendations to improve port efficiency
	New Ship Designs and Equipment to Improve Safety	<ul style="list-style-type: none"> * Promote new forms in ships design, advanced structures, materials, clean propulsion and energy-efficient solutions to improve safety and environmental performance
	Develop a Safety Culture	<ul style="list-style-type: none"> * Promoting a shared maritime safety culture and common efforts in neighbouring countries * Ensuring that all maritime administrations deploy the economic and human resources needed to fulfil their responsibilities as flag, port and coastal states
Work on Competition	Apply Global Standards	<ul style="list-style-type: none"> * Following and implementing certification programs to comply with international standardization * Focusing on Shipping Quality * Aligning the substantive competition rules globally * Monitoring market conditions and examining the economic impact of the new antitrust approach
	Develop Business Infrastructure	<ul style="list-style-type: none"> * Strategic location and well-developed business infrastructure attracts investors * Forming transport hubs with connection to international airport to major destinations around the world * Position ports as hubs for shipping routes in the relevant region. * Enhancing port connectivity and productivity to attract more carriers and cargo, and allow more vessels to arrive at more destinations within a shorter time
	Develop Policies for Sustainable Transport	<ul style="list-style-type: none"> * Developing national and international policies to promote sustainable transport * Implementing measures in accordance with the principles of fair competition, financial transparency, non-discrimination and cost-efficiency in line with safety, security and sustainable growth requirements * Providing financial transparency for sustainable growth
	Follow and Apply Developments in the World	<ul style="list-style-type: none"> * Expanding and modernizing to enhance capacity and efficiency to keep pace with global developments, especially in containerisation. * Adopting container technology along with other innovations in ports
Technological Improvement	Protect Knowledge and Intellectual Property	<ul style="list-style-type: none"> * Maintaining competitive advantage by taking appropriate measures to protect knowledge and intellectual property
	Apply Standards to Cope with Extreme Navigation Conditions	<ul style="list-style-type: none"> * Applying appropriate ice navigation technology and construction standards to large vessel sizes * Applying ice-breakers to vessels operating in more exposed sea areas
	Implement Technology to Maritime Transport Chain Operations	<ul style="list-style-type: none"> * Technological development and advanced logistics to short sea shipping and inland waterway transport to achieve sustainable mobility * Implement e-services, e-freight, e-customs and intelligent transport systems * Single window system by interconnecting customs information technology (IT) systems * Developing information and communication technology inspection and monitoring tools * Using telecommunication systems to manage the fleet technically, including controlling vessel engine performance, structural strength, and the overall state of operation remotely * Deploying e-Maritime services that encompasses various public administrations, port communities, and shipping companies * Promoting better use of information and communication technologies to improve quality of life at sea * Foster the availability of satellite broadband communications in on-board healthcare, distance learning, and personal communications * Using information sharing platforms
	Improve Traceability of Ships and Cargoes	<ul style="list-style-type: none"> * Introducing a new information technology system to better monitor and direct port traffic * Building an integrated information management system that identifies, monitors, tracks, and reports of all vessels at sea and on inland waterways * Introducing digital cargo tracking systems
Training and Education	Upgrade Competences of Seafarers	<ul style="list-style-type: none"> * Maintaining high training standards and professional competence among crew members * Maritime training to improve and adapt seafarer competences to requirements of shipping industry
	Advanced maritime education	<ul style="list-style-type: none"> * Working in partnership with training institutions and the industry to establish 'maritime certificates of excellence'
	Improve skills and qualifications of employees	<ul style="list-style-type: none"> * Creating a network of centers of excellence for maritime training * Facilitate lifelong career prospects in the maritime clusters * Developing advanced skills and qualifications of officers to enhance their employment and have good career paths to become officers
Change in Management System	Establish Single Customs Territory	<ul style="list-style-type: none"> * Introducing Single Customs Territory clearance procedures * Making final customs clearances for free circulation at the port of entry * Reducing administrative burden and shorten the time for customs formalities * Reducing weight and other controls * Building one-stop border posts * Creating paperless cargo clearance
	Privatization	<ul style="list-style-type: none"> * Public-private partnerships * Achieving long-term stability through privatization * Amending the Ports Decree and transfer the responsibility for the execution and financing of the construction and provision of sea locks from regional authorities to a limited company

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