International Logistics Performance Feature Extraction Insights and Portugal's Global Positioning

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ABSTRACT

The critical role of logistical performance in fostering engineering innovation is universally acknowledged, encompassing the rationalization of supply chains, optimization of inventory management, and facilitating or impeding global collaboration. Efficient logistics integration with innovative technologies is crucial for the prompt delivery of materials and components, enhancing the speed and efficacy of engineering innovation processes. This study examines the robust correlation structure among the Logistics Performance Index (LPI) Indicators over multiple years. The LPI assesses global logistics performance by measuring factors such as the quality of trade and transport infrastructure, the ease of customs procedures, and the efficiency of customs clearance, among other aspects influencing the transnational flow of goods. Our findings confirm the LPI's conceptualization as a latent variable, characterized by its indicators, which demonstrate outstanding internal consistency. This consistency substantiates the LPI's reliability for global logistics performance evaluation. Recognized as a valuable measure of logistical efficiency, the LPI serves as a practical tool in engineering, guiding strategic decision-making and enhancing operational cost-effectiveness and competitiveness.

CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics; • **Networks** → Network reliability.

KEYWORDS

Logistics Performance, LPI, Logistics Decision-Making in Engineering, Feature Aggregation, Exploratory Factor Analysis

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1 INTRODUCTION

Global logistics efficiency is crucial for companies considering international expansion. To assist with this, the World Bank has developed the Logistics Performance Index (LPI), which evaluates countries based on the quality of their trade infrastructure, ease of customs procedures, and efficiency of goods clearance across borders.

The LPI is derived from surveys conducted with global freight forwarders and logistics professionals, capturing various facets of a country's logistics environment. It measures logistics performance through six key dimensions:

Customs Clearance Process: Evaluates the efficiency of customs and border clearance. Infrastructure Quality: Assesses the quality of trade and transport infrastructure like ports and roads. Ease of Arranging Shipments: Looks at the ease of organizing competitively priced shipments. Competence and Quality of Logistics Services: Rates the skill and quality of logistics providers. Tracking and Tracing: Measures the ability to track and trace consignments. Timeliness of Shipments: Checks the regularity with which shipments meet delivery schedules. Scores range from 1 to 5, with higher scores indicating superior logistics capabilities. This makes the LPI an invaluable tool for governments, businesses, and researchers to compare logistics performance internationally, spot improvement opportunities, and inform policy decisions.

The 2023 LPI edition introduced new Key Performance Indicators (KPIs) based on big data, which include real-time tracking of shipping containers, air cargo, and parcels, providing a broader perspective on global trade dynamics. These new KPIs complement traditional survey data, offering a fuller picture of logistics performance.

Proposals to enhance the LPI suggest various strategic improvements to better measure and optimize logistics conditions, especially important in scenarios where data collection might be compromised, such as during global disruptions.

The LPI thus not only aids businesses in making informed decisions about international operations but also helps countries in developing policies that foster an efficient logistics framework.

The 2023 edition of the International Logistics Performance Index (LPI) enables comparisons across 139 countries, revealing an overall improvement in global logistics performance over the past decade. Notably, the LPI score increased, with a secondary peak emerging around 3.5 between 2018 and 2023, indicating stronger performance

among more countries. However, the reduction in sample size from 160 countries in 2018 to 139 in 2023 complicates direct comparisons, especially at the lower score ranges.

The LPI consistently evaluates a broad spectrum of economies, though the specific countries assessed can vary in each edition due to data availability and varying participation levels. For instance, the 2014 edition did not include data for Portugal.

In 2023, the highest LPI scores were predominantly from high-income economies, with Singapore maintaining its top ranking from previous years with a score of 4.3. Eight of the top twelve scorers were European countries. Conversely, the lowest scores generally came from countries with low to lower-middle incomes facing economic challenges from conflicts, natural disasters, or geographic and economic constraints, affecting their integration into global supply chains.

This paper aims to validate the LPI as a reliable measure of logistical performance by analyzing key characteristics and relationships among its indicators. Recognizing the LPI as a robust metric allows it to inform strategic decision-making in engineering and other sectors, improving operational cost-effectiveness and competitiveness. Additionally, the paper tracks Portugal's LPI performance from 2007 to 2023, focusing on its changes and implications for logistics strategy.

2 TEMPLATE OVERVIEW

Some examples. A paginated journal article [1].

3 ACKNOWLEDGMENTS

Identification of funding sources and other support, and thanks to individuals and groups that assisted in the research and the preparation of the work should be included in an acknowledgment section, which is placed just before the reference section in your document.

This section has a special environment:

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so that the information contained therein can be more easily collected during the article metadata extraction phase, and to ensure consistency in the spelling of the section heading.

Authors should not prepare this section as a numbered or unnumbered `\section`; please use the "`acks`" environment.

4 APPENDICES

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Start the appendix with the "`appendix`" command:

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Papers may be written in languages other than English or include titles, subtitles, keywords and abstracts in different languages (as a rule, a paper in a language other than English should include an English title and an English abstract). Use `language=...` for every language used in the paper. The last language indicated is the main language of the paper. For example, a French paper with additional titles and abstracts in English and German may start with the following command

```
\documentclass[sigconf, language=english, language=german,
               language=french]{acmart}
```

The title, subtitle, keywords and abstract will be typeset in the main language of the paper. The commands `\translatedXXX`, `XXX` begin title, subtitle and keywords, can be used to set these elements in the other languages. The environment `translatedabstract` is used to set the translation of the abstract. These commands and environment have a mandatory first argument: the language of the second argument. See `sample-sigconf-i13n.tex` file for examples of their usage.

6 SIGCHI EXTENDED ABSTRACTS

The "`sigchi-a`" template style (available only in LaTeX and not in Word) produces a landscape-orientation formatted article, with a wide left margin. Three environments are available for use with the "`sigchi-a`" template style, and produce formatted output in the margin:

`sidebar`: Place formatted text in the margin.
`marginfigure`: Place a figure in the margin.
`margintable`: Place a table in the margin.

ACKNOWLEDGMENTS

To Robert, for the bagels and explaining CMYK and color spaces.

REFERENCES

[1] Jean-François Arvis, Lauri Ojala, Ben Shepherd, Dina Ulybina, and Christina Wiederer. 2023. *Connecting to Compete 2023: Trade Logistics in the Global Economy – The Logistics Performance Index and Its Indicators.* World Bank Group, Washington, DC.

A RESEARCH METHODS

A.1 Part One

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B ONLINE RESOURCES

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