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Measuring Competitiveness Potential at Sectoral Level: An Empirical Application to the Logistics Sector in Uruguay[1]

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Medición del potencial de competitividad a nivel sectorial: una aplicación empírica al sector logístico en Uruguay
Medindo o potencial de competitividade no nível setorial: uma aplicação empírica ao setor logístico no Uruguai.

This article proposes an innovative approach to measure sectoral competitiveness. Focusing on logistics activity in Uruguay, the creation of a composite index to assess its competitiveness potential is proposed (Competitiveness Potential Index, CPI). The construction of the CPI follows a systematic methodology and is based on a specific definition of the concept of competitive potential to be measured, together with a theoretical model that encompasses the concept in six dimensions. Data from primary and secondary sources are used and different multivariate analyses are carried out to verify the relevance and analytical robustness. It is considered that an important step has been taken in improving the competitiveness of the logistics sector in Uruguay, providing new key information for analysis and decision-making, both in the public and private sectors.

En este artículo se desarrolla un enfoque innovador para medir la competitividad sectorial. Centrándose en la actividad logística en Uruguay, se propone la creación de un índice compuesto para evaluar su potencial competitivo (Índice de Potencial Competitivo, IPC). La construcción del IPC sigue una metodología sistemática y se basa en una definición específica del concepto de potencial competitivo a medir, junto con un modelo teórico que engloba el concepto en seis dimensiones. Se utilizan datos de fuentes primarias y secundarias y se realizan diferentes análisis multivariados para verificar la pertinencia y robustez analítica. Se considera que se ha dado un paso importante en la mejora de la competitividad del sector logístico en Uruguay, aportando nueva información clave para el análisis y la toma de decisiones, tanto en el sector público como en el privado.

Este artigo propõe uma abordagem inovadora para medir a competitividade setorial. Com foco na atividade logística no Uruguai, propõe-se a criação de um índice composto para avaliar seu potencial de competitividade (Índice de Potencial de Competitividade, IPC). A construção do IPC segue uma metodologia sistemática e se baseia em uma definição específica do conceito de potencial competitivo a ser medido, juntamente com um modelo teórico que abrange o conceito em seis dimensões. São utilizados dados de fontes primárias e secundárias e são realizadas diferentes análises multivariadas para verificar a relevância e robustez analítica. Considera-se que um passo importante foi dado na melhoria da competitividade do setor logístico no Uruguai, fornecendo novas informações-chave para análise e tomada de decisão, tanto no setor público quanto no privado.

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1. Introduction

The competitiveness potential of a territory (nation, city or region) can be defined as the set of resources and capabilities that it has - or is capable of building - to achieve previously established wellbeing and sustainable development goals (Camacho, 2020). Following an analogous approach, this definition can be applied to sectors of economic activity. Thus, the competitiveness potential of a sector may be conceptualized as the set of resources and capabilities that companies within a sector collectively have and use to improve their performance and, therefore, to improve their competitiveness and the overall competitiveness of the sector.

Given this approach, achieving measures of a sector's competitiveness potential becomes a crucial element for assessing its competitive evolution. In this sense, the generation of indicators of competitive potential at the sector level is essential to provide a solid and objective basis for decision-making for both public and private actors. These measures allow for systematic and quantitative assessment and monitoring of the resources and capabilities of a sector, providing a comprehensive view of its status and evolution, as well as for the early detection of priority areas for improvement. In what comes to public actors, having accurate and up-to-date indicators on competitiveness potential of different sectors facilitates the designing and implementation of more effective and targeted public policies. Likewise, in what comes to private actors, especially small and medium-sized enterprises (SMEs), these indicators are valuable tools for strategic planning and operational decision-making. SMEs often lack the resources to carry out in-depth analyses on their own, thus they can greatly benefit from the information provided by sectoral indicators, enabling them to identify opportunities for improvement, adapt to market trends and optimize their internal processes to increase their competitiveness.

According to the given definition of competitiveness potential, we are approaching a multidimensional concept. This is because the resources and capacities that make up the competitiveness potential are of a diverse nature, hence the factors that affect each of them come from different dimensions.

In this sense, composite indicators are particularly useful for measuring competitiveness potential, as they allow multifactorial concepts to be summarized in one aggregated and understandable measure. A composite indicator integrates various dimensions and variables, providing a holistic view of the sector, which facilitates the interpretation of complex data and the communication of results to a broader audience, including both experts and non-experts in the field.

Within this context, this article proposes a procedure for constructing composite indicators to measure sectoral competitiveness potential, with a specific focus on the logistics sector. The decision to apply the exercise to a specific sector is twofold. First of all, carrying out an empirical application allows us to exemplify the diverse considerations we made throughout the process, which ultimately lets us provide greater clarity to the exposition. Secondly, given the recognized importance of the logistics sector both for Uruguay and for other small countries, any progress towards the competitiveness construction of the sector might be a relevant contribution not only at an academic level but also for private sector development and public policy definition.

Keywords
Competitiveness potential, Composite indicator, Logistics sector, Uruguay.

Palabras clave
Potencial competitivo, Indicador compuesto, Sector logístico, Uruguay

Palavras-chave
Potencial de competitividade, Indicador composto, Setor logístico, Uruguai.

JEL Code
C43, L80, O12

The specific objective of this research is, thus, to give proof that it is possible to construct a composite index able to measure the competitiveness potential of a sector. Furthermore, this paper focuses on identifying key methodological aspects to guide future research aimed at attaining robust measures of other sectoral competitiveness potentials, modifying sector or territory.

To achieve its goal, this paper elaborates mainly from two main previous lines of research. On one hand, we continue to explore the methodology for constructing composite indexes systematized and summarized by Horta, Camacho, Silveira and Ferreira (2023). In particular we apply this methodology to a new object of study, improving findings and extending proof of the usefulness of the proposed method. On the other hand, in order to be able to perform the empirical application we guide our research on the analysis of the logistics sector in Uruguay performed by Horta, Camacho and Silveira (2022). The findings of this study allow us to propose a theoretical framework for reference, granting a solid theoretical base for the construction of the model as suggested by the followed methodology, allowing us to focus this specific paper on the application. Integrating these two lines of research allows us to elaborate the foundations for this specific investigation. In other words, the main contribution of this paper is the linkage between two apparent distant lines of research.

The rest of the document is structured as follows. The next section briefly develops the theoretical framework that supports the research, including a subsection on composite indicators, a second subsection on the conceptualization of competitiveness potential (object to be measured) and a third subsection on the logistic activity in Uruguay to provide a grounding context for the reader. The third section describes the construction of the compound index (CPI), focusing on key methodological aspects. In the fourth section, the results attained with the index are presented along with a brief explanation of how they could be used for policy and decision making. Finally, in the last section we conclude.

2. Theoretical Framework

The theoretical framework is divided into three parts. First, a brief description of the characteristics, advantages and main methodological aspects related to the construction of composite indices is presented. Second, based on the relevant literature related to the conceptualization of competitiveness, a theoretical model of the competitive construction process is proposed, in which the concept of competitive potential is embedded. Finally, the economic context of the logistics sector in Uruguay is summarized, in which the competitiveness potential is measured

2.1. Composite Indicators

Composite indicators or indexes synthesize the information contained in a selected set of indicators and variables into a single measure (Nardo & Saisana, 2009; Saisana, M., & Tarantola, S., 2002; Jiménez-Fernández, E. & Ruiz-Martos, M., 2020). This way, researchers and analysts are able to incorporate the evolution of different dimensions into a single measurement, which ultimately could help to study

complex phenomena. Therefore, composite indicators are used to measure multidimensional concepts that cannot be captured by a single indicator (OECD, 2008).

For instance, these types of indicators are widely known tools used to evaluate and classify countries, regions or sectors in terms of their performance in areas such as competitiveness, innovation, environment and sustainability (Becker, Saisana, Paruolo & Vandecasteele, 2017; Kuc-Czarnecka, Lo Piano & Saltelli, 2020).

According to Curchod and Alberto (2021), composite indicators have the advantage of being easily interpretable. However, they should not be very complex to operationalize in order to reduce the subjectivity associated with their construction (Domínguez Serrano et al., 2011).

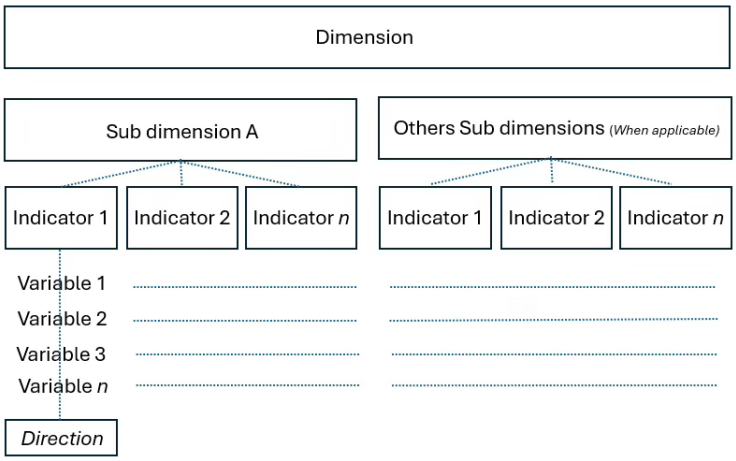
Nevertheless, it is fair to acknowledge that the usage of composite indicators is also criticized. Even more, according to Sharpe (2004) there is a division in the literature regarding indicators between those researchers who aggregate variables into a unique composite indicator, called "aggregators", and those who do not, called "non-aggregators". The "aggregators" support the construction of composite indices to describe complex phenomena, while the "non-aggregators" consider them statistically insignificant due to the arbitrariness of the weighting processes (Sharpe, 2004).

Indeed, each methodological decision has an impact on the result of the index (Greco et al., 2018). In this sense, an essential point in the construction of composite indexes is the need for absolute transparency in the methodology used (Horta et al., 2023).

Another issue to bear in mind when working with composite indexes, on top of the selected methodology, is that their quality depends on the quality of the underlying data Thus, the quality of these indicators is a multifaceted concept, and their appropriateness depends on the perspectives, needs and priorities of the users (OECD, 2008).

Methodologically, composite indicators are composed of dimensions, individual indicators, variables and objectives (Munda and Nardo, 2009; Nardo and Saisana, 2012). Dimensions are the top level of analysis and include individual indicators that measure specific aspects of the complex phenomenon. Variables are the specific measures of each indicator and finally, objectives determine the desired direction of change in the individual indicators (increase or decrease), which we can also call “target” or “direction”.

Figure. - Compound index structure



According to the OECD manual (2008), recently revisited and applied to a specific case by Horta et al. (2023), the first methodological step for constructing a composite index is designing a model able to reflect the underlying theoretical framework of the concept to be measured. In this opportunity we are approaching the measurement of the competitiveness potential of a sector, thus it is essential to correctly define this concept.

2.2. Competitiveness Potential

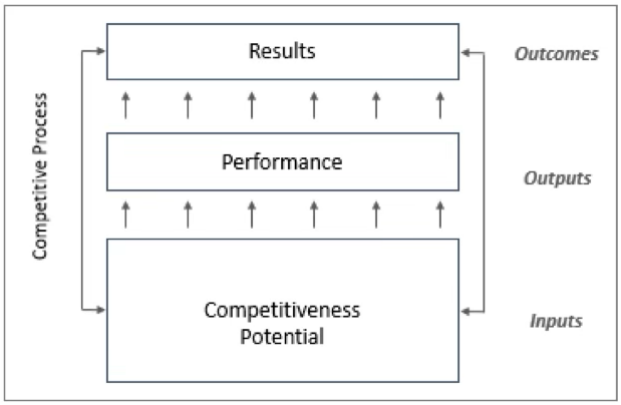
The concept of competitiveness potential is embedded in the conceptualization of competitiveness. When we approach this matter, though there is still no general agreement regarding the exact definition of competitiveness, there is some relative consensus in the literature concerning some specific issues that could aid the process (Camacho, 2020; Horta y Camacho, 2024). There are three main interrelated elements regarding the conceptualization of competitiveness that must be considered. First, the importance of wellbeing as the ultimate competitiveness goal. Second, the idea that competitiveness is a process and not a state. Third, the dynamic quality of the concept, where time is essential, and the sustainability issue is key. Given these three areas in which an agreement seems to be in place, the competitiveness concept is frequently presented in a multilevel model. In this sense, the competitive process can be approximated, considering elements of inputs, outputs and outcomes or final results (Aiginger, 2006; Aiginger and Firgo, 2015, 2017; and Huggins, Izushi and Thompson, 2013). Furthermore, and following Camacho and Horta (2022), Camacho et al. (2024) and Horta et al. (2024), we can even add a final level to the model, when the outcomes or objective wellbeing become subjective wellbeing or happiness.

In this sense when talking about regional competitiveness, and considering the consensus previously mentioned, we can say that it can be defined as the process through which, from a set of resources and capabilities which are sources of competitive advantage, a territory can achieve previously established wellbeing and sustainable development goals (Camacho, 2020). This definition considers the importance of wellbeing as the final goal, highlights competitiveness as a process and incorporates the notion of time and sustainability explicitly. At the same time, this definition approaches the conceptualization of competitiveness in levels, where resources and capabilities, are the inputs of the process and sustainable development objectives are the final outcome.

Similarly, when focusing on sectors, or on sectoral competitiveness, we can use the logic described above. A competitive sector is one that promotes the competitiveness of the companies that comprise it, based on a geographical environment, with a given macroeconomic and institutional setting and acting in a microeconomic environment that it can influence. We can say, then, that the inputs are all the resources and capabilities that a sector has that allow it to leverage the competitiveness of the companies that comprise it.

Graphically, and following Camacho (2020), we can represent the theoretical model as shown in **Figure 1**. At the bottom of the model, we can see the Competitiveness Potential, which is made up of all the inputs of the process or, in other words, the set of resources and capabilities that a sector has to achieve its objectives. This competitiveness potential is key to generate immediate results (outputs) which are, in other words, the immediate performance of the sector (for example, greater productivity). Then, these intermediate results, as part of the competitive process, must become the previously defined development objectives, generally associated with sustainable increases in well-being.

Figure 1. - Competitive construction process (Source: Camacho, 2020)



Competitiveness potential is the basis for achieving competitiveness, although it does not guarantee it on its own. The competitiveness of a sector also depends on the results that can be obtained with that potential (outputs or performance). In any case, as it is the fundamental element from which competitive construction is born, being able to approach its measurement is a key element to understand the potential of the sector, its strengths and possible weaknesses and to provide knowledge for improving the competitive process.

After defining Competitiveness Potential, given that it is a multidimensional concept, we can verify that the use of composite indexes is a useful tool for its measurement.

2.3. The economic context of the logistics sector in Uruguay)

Logistics activity is a fundamental pillar for economic development, especially since its enhancement has strong spillovers over many other sectors in the economy. Uruguay, as a small country in between two big players such as Brazil and Argentina, is particularly concerned with this situation.

Any country's ability to facilitate trade, connect markets, and improve operational efficiency benefits not only local businesses but also positions the country as a key player in international trade. Uruguay is no stranger to this situation. Thus, continuous investment in infrastructure and the adoption of modern logistics practices are essential to maximize Uruguay's potential as a Regional Distribution Center (RDC), given its strategic location.

One way to see Uruguay's strategic role as potential key regional distribution hub is to analyze and quantify origins, destinations, and categories of goods involved.

In this sense, there is a 20% increase in extra-regional transits passing through Uruguay with final destination to Mercosur (Argentina, Brazil, Uruguay and Paraguay) over the past three years (2023 vs 2021). The total value of RDC transits from eight selected extra-regional countries[3] in the period 2021-2023 amounted to 7,949 million USD. Of this total, 6,017 million USD (75.6%), was directed towards Mercosur countries. Paraguay emerged as the principal destination (47%) closely followed by Argentina (42%), while Brazil represented 11% (INALOG, 2024). The importance of these numbers can be appreciated if one considers that Uruguay's GDP in 2023 was 77,240 million USD (World Bank, 2025).

The predominant products transiting through Uruguay include pharmaceuticals, electrical devices for telecommunications, and serums, vaccines, and human blood. The values of transits originated from China and United States were particularly significant. For instance, RDC transits originated from China in 2021-2023 totaled 3,501 million USD, with Paraguay receiving 56% of these goods, followed by Argentina at 39%. In contrast, transits from United States amounted to 1,064 million USD, with Paraguay again leading as the destination at 48%, followed by Argentina at 31% and Brazil at 21% (INALOG, 2024).

On the other hand, over the 2021-2023 period, logistical dynamics reveal that most transits end at border crossings, with 86% finishing at these locations, while only 10% end at airports and 4% at ports. This distribution highlights the critical importance of land-based logistics within Uruguay's transit framework (INALOG, 2024).

Also, there has been a significant increase in RCD transits in Uruguay from Mercosur countries to external destinations. Argentina was identified as the primary source of these transits, followed by Paraguay and Brazil. RDC transits from selected Mercosur countries to destinations outside Uruguay increased by 30%, from 253 million USD in 2021 to 330 million USD in 2023.

In conclusion, this data highlights Uruguay's critical role as a distribution center within the region. The data indicates a pressing need for the national logistics sector to enhance efforts aimed at increasing its competitiveness.

3. Constructing a Competitiveness Potential Index of the Logistic Sector

As argued in the previous section, a proper approach to measure the competitiveness potential of any sector is the construction of a composite indicator. This section will address how it was done for the logistics activity in Uruguay.

The process of constructing a composite index of the competitiveness potential of logistics activity in Uruguay followed the methodology for constructing composite indexes developed by OECD (2008), revisited and applied to a specific measurement of competitiveness potential at a regional level in Horta et. al (2023). The intuition behind this approach was similar as when considering the definition of competitiveness potential, we mirrored the competitiveness analysis at the regional level with the analysis at the sectoral level.

Thus, the first step on the procedure involved the construction of a model that could coherently replicate the concept of the competitiveness potential of the logistics sector. In accordance with the theoretical framework described in the previous sector, *"the sectoral competitiveness potential can be defined as the set of resources and capabilities that a sector has (or is able to build) to achieve its objectives"*. To capture this definition into an operationalizable model previous analyses of the logistics sector were utilized. In particular, this investigation used as a frame of reference the study of the Logistic Sector from a cluster perspective performed by Horta et al. (2022), since it was developed in close cooperation with key actors in the sector and in contact with the National Institute of Logistics (INALOG).

Considering the findings of the previously mentioned study of the logistics activity regarding the most important elements for the development of the sector, as selected by the researchers and confirmed by the actors, we were able to construct a list of resources and capabilities forming the competitiveness potential. These elements were grouped into six different dimensions given their intrinsic nature.

1. Macroeconomic environment: Includes macroeconomic aspects such as price stability, public finances, reduced public debt in relation to GDP, among other factors that favor the business climate.

2. Institutional environment: Refers to the quality of both economic and political institutions, standards stability and main regulations.

3. Infrastructure: It is subdivided into physical infrastructure (ports, roads, airports), digital infrastructure (ICT) and administrative infrastructure (bureaucratic procedures).

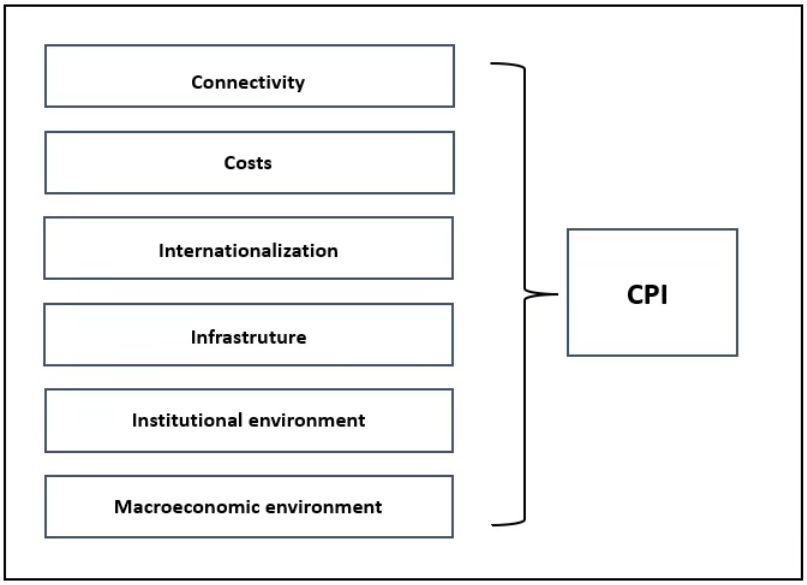
4. Internationalization: Includes, among other factors, the economy's openness and existence of trade agreements that facilitate global integration, as well as the relative price level of the economy.

5. Costs: Considers the costs of logistics services such as port fees, transportation, telecommunications, storage and customs.

7. Connectivity: Measures the quantity and quality of logistics connections, such as the number of shipping lines, cargo airlines, and operational border crossings.

Graphically, these dimensions are organized in a model presented in **Figure 2**. This model makes it easier to identify and systematize the relevant indicators that could jointly form the final synthetic index named Competitiveness Potential Index (CPI).

Figure 2. - Competitiveness Potential Index model for the logistic sector



For each of the six dimensions of the model different indicators, grouped in subdimensions when applied[4], were selected (e.g. in the Macroeconomic Environment dimension we selected the following indicators: level of activity, employment, fiscal deficit, among others; in the Infrastructure dimension, it deemed appropriate to have subdimensions: physical infrastructure, communications infrastructure, and administrative infrastructure, and we selected indicators for each of those sub-dimensions such as road network situation, port infrastructure, mobile services, etc.)[5].

Then, for each indicator we assigned a list of possible variables to be used. This is a very important methodological step, especially in developing countries, due to the lack of information. Given that some specific data may not be available, some second or third best option has to be used. Thus, it is important to have a list with different options where to choose from.

The next step was the collection of data, both from primary and secondary sources. Different public and private databases at national and international level were reviewed to create the primary quantitative database. Likewise, numerous working meetings were held with logistics actors to complete the database with additional specific information.

We aimed to prepare a complete enough dataset in order to perform the statistical analyses that would aid in selecting the best variables to use in the model.

The final step prior to the completion of the dataset was the identification and correction of potential problems such as missing values (especially in specific years) that we calculated choosing a specific method depending on the specific case (regression, average, last known data, etc.), and problems with the data series such as skewness and kurtosis, that we corrected using a linear transformation of data when encountering problems (square root, log, etc.) as suggested by OECD (2008).

Data availability, complying with the rule of having information of the highest possible quality and reliability, allowed the construction of a final database for the period 2016-2023.

We had, then, a complete data set comprised of a group of different variables (e.g. Brent crude and WTI crude, in US dollars per barrel) that could be used to measure each indicator (e.g. oil cost) in each subdimension (e.g. transport costs) of each dimension (e.g. costs) of the model. The final variables to be assigned to each indicator would be selected based on their relevance, analytical robustness, sequence in time, accessibility and fitness to the dimension, as would be calculated over the next phase.

With a whole and clean dataset, the next step we followed to prepare the data set was to assign directions for each variable. This is, each of the variables was classified as “asset” or “liability” depending on how it affects the competitiveness potential. Variables that positively affect the competitiveness potential were classified as assets (i.e., the competitiveness potential should increase when they increase). Alternatively, variables that negatively affect the competitiveness potential were classified as liabilities (i.e., the competitiveness potential should decrease when they increase).

After this classification, all variables classified as “liability” were transformed to their inverse so all the variables can be directly added when computing the final index. The transformation method used was the inverted min-max method[6].

$$I_q^t = \frac{max\left(x_q^t\right) - x_q^t}{min\left(x_q^t\right) - max\left(x_q^t\right)} * (-100)$$

With a fully prepared dataset, the next methodological step we followed was the multivariate analysis. This procedure is aimed at checking the underlying structure of the data and assessing the suitability of the different variables to each indicator. Following OECD manual, this step is fundamental to compare the statistically determined structure of the data set to the theoretical framework and discuss possible differences (OECD, 2008).

In order to conduct the multivariate analysis, we normalized the data using ZScore criterion, following the advice of the OECD handbook (2008).

Through the analysis we put special emphasis on the covariance matrix, the Kaiser-Meyer-Olkin (KMO) sample adequacy measure, and the Bartlett's sphericity test. Altogether these pieces of information shed light on the sampling adequacy of the set of variables used. Finally, Cronbach's alpha was used to evaluate the internal consistency of the set of variables. Apart from that analysis, the adequacy of each of the variables was verified based on the individual sampling adequacy measure (MSA). The results from the multivariate analysis helped to select the variables to be used for each indicator in each dimension.

Having the final model in place, comprising six dimensions (Macroeconomic environment, Institutional environment, Infrastructure, Internationalization, Costs, and Connectivity) with their own indicators, the next step was to select the aggregation and weighting procedures. Given the proposed model, we had to conduct two stages of weighting and aggregation procedures: indicators within the dimensions, and dimensions[7] within the competitiveness potential index.

For the first choice (aggregation) the linear method was used in each step, in line with the procedure followed by previous works constructing similar indicators (e.g. IMD World Digital Competitiveness Ranking, IMD 2024; Global Innovation Index, WIPO, 2024; International Competitiveness Index, IMCO 2022). For the second choice (weighting) two different procedures were selected, principal component analysis (PCA) weighting method to aggregate indicators within dimensions, and expert choice method to aggregate the dimensions into one sole index. The expert judgement method consists of assigning weightings according to, as the name of the method suggests, the judgement of one or more experts in the field.

To select the weightings for the dimensions, 32 experts or experts in logistics activity were consulted to assign points between the different dimensions. A special survey was designed and conducted for that purpose. The analysis of the responses allowed the assignment of the weightings shown in **Table 1**.

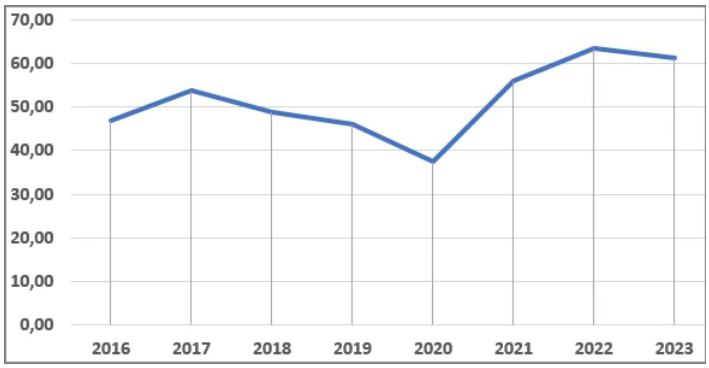
Table 1. - Weightings for the CPI

Dimension	Expert judgement
Macroeconomic environment	20,0%
Institutional environment	15,0%
Infrastruture	20,0%
Internationalization	15,0%
Costs	20,0%
Conectivity	10,0%

4. Results

The data from the aggregate index (CPI) show the evolution of the competitiveness potential of logistics activity for the period 2016-2023 in Uruguay. As shown in **Figure 3**, the competitiveness potential improves in 2017 compared to the previous year, and reaches lower levels in the following three years, experiencing a deep fall in 2020, following the Covid-19 pandemic. After that shock, the competitiveness potential shows a strong recovery both in 2021 and in 2022, reaching the highest historic level, more than 20% higher than the 2016 score, while slightly reduced in (2023).

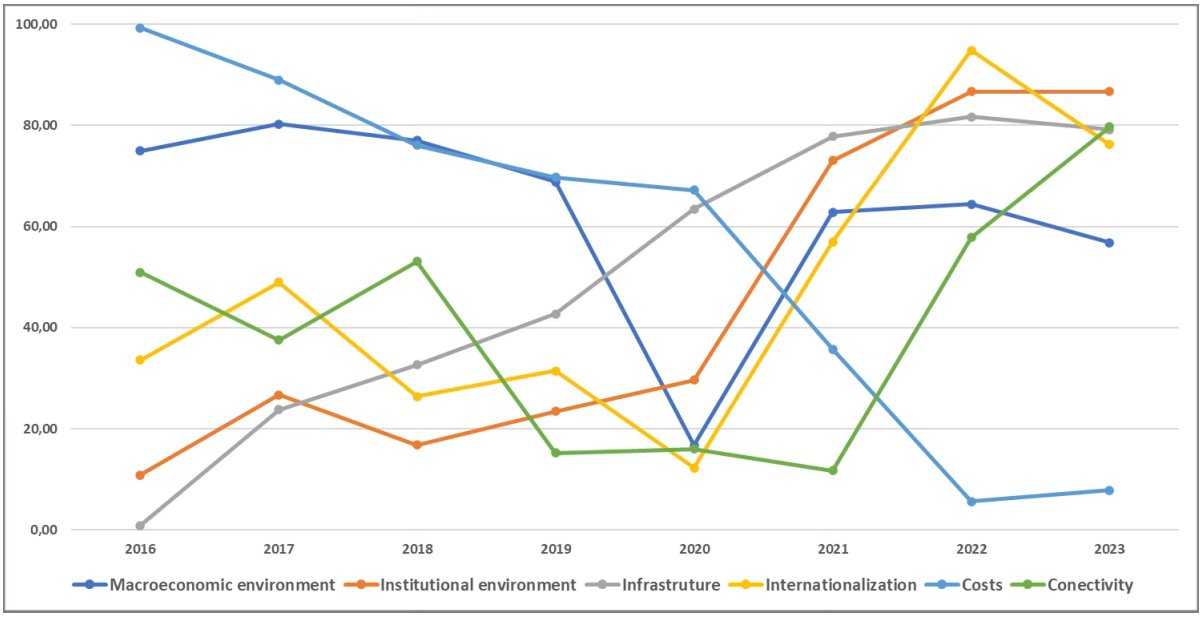
Figure 3. - Evolution of the CPI



The results obtained by each dimension (**Figure 4**) show a significant recovery in 2021 (for costs and connectivity, and 2022 (except for costs), suggesting an improvement in logistics conditions following the Covid-19 pandemic. Improvements in the dimensions linked to the macro and institutional

environment and internationalization, together with the development of supporting infrastructure, have been fundamental for the development of logistics activity.

Figure 4. - Scores for dimensions of CPI



5. Conclusions

More often than not, when analysts want to approach a measure of sectoral competitiveness, they usually evaluate the results obtained by the sector (productivity, employment, product, etc.). Though this is a valid and valuable approach, this research suggests a different, complementary and innovative approximation through the definition, modelling and measurement of the competitiveness potential of a sector. Thus, this paper intends to provide a novel contribution to literature and study of competitiveness.

More specifically, this study addresses the procedure for the construction of a composite index to measure the competitiveness potential of the logistics sector in Uruguay (logistic CPI). Following a solid theoretical framework and through rigorous methodology, it has been shown that it is possible to build a composite indicator of the competitiveness potential of a sector, which allows to obtain information on the key elements for the sector to build its competitiveness and to guide policy.

This research highlights the value of using composite indicators to synthesize complex and multidimensional information. It also puts into context how these indicators allow for a systematic and quantitative assessment of the resources and capabilities of the logistics sector, facilitating decision-making in both the public and private spheres.

Using the findings of a previous analysis of the logistic sector Horta et al. (2022), six essential dimensions were identified that influence the competitiveness potential of logistics activity: macroeconomic environment, institutional environment, infrastructure, internationalization, costs and connectivity. Each of these dimensions provides a specific perspective of the sector, allowing for the identification of areas for improvement. Furthermore, in an aggregated manner, these dimensions provide a comprehensive and holistic view of the sector, on the resources and capabilities it has at its disposal through which it can achieve the desired performance and results.

The obtained results indicate a significant recovery of competitiveness potential for the logistic sector in recent years, suggesting that logistics conditions have improved post-pandemic.

It should be noted that limitations were identified in the availability of historical data, which may affect the robustness of future analyses and call for caution when interpreting data. The quality of the composite indicators, as mentioned in the work of Greco et al. (2018), depends not only on the proposed methodology for its construction which we consider robust, but on the quality of the underlying data. In this sense, lack of information was one of the main limitations for this research.

For instance, to further improve the proposed CPI, it is necessary to advance in the definition of logistics cost indicators and improve those related to infrastructure and connectivity. In addition, conducting annual surveys to obtain perceptions of logistics service users can provide valuable information to adjust and improve the index.

Nevertheless, the findings of the study are highly relevant for public policy formulation and for the strategic planning of small and medium-sized enterprises (SMEs). Having accurate and up-to-date indicators will allow the actors involved to design more effective strategies that drive the development of the logistics sector. As Curchod and Alberto (2021) argue, composite indicators are valuable tools for decision-makers.

Despite the mentioned limitations, the calculated CPI reasonably reflects the evolution of the competitive potential of logistics activity between 2016 and 2023, an aspect that was confirmed by the main players in the sector.

All in all, the proposed logistic CPI is a valuable tool for assessing and improving the competitiveness potential of logistics activity. Continuing to refine this index will allow for a better understanding of the factors that influence logistics competitiveness and will help to design more effective policies and strategies for the development of the sector. It is considered that an important step has been taken in the construction of an index of competitiveness potential related to a specific sector of an economic activity, something new in the country and an innovative tool that can help to better understand the set of factors that influence the evolution of competitiveness.

References

Aiginger, K. (2006). Competitiveness: from a dangerous obsession to a welfare creating ability with positive externalities. Journal of Industry, Competition and Trade, 6 (2), 161-177. https://doi.org/10.1007/s10842-006-9475-6

Aiginger, K., & Firgo, M. (2015). Regional competitiveness under new perspectives. WWWforEurope Policy Paper No. 26. WIFO, number 58501. Retrieved from: https://ideas.repec.org/b/wfo/wstudy/58501.html

Aiginger, K., & Firgo, M. (2017). Regional competitiveness: connecting an old concept with new goals. In R. Huggins and P. Thompson (Eds.), Handbook of Regions and Competitiveness: Contemporary Theories and Perspectives on Economic Development (155-191). Northampton: Edward Elgar Publishing, Inc.

Becker, W., Saisana, M., Paruolo, P., & Vandecasteele, I. (2017). Weights and importance in composite indicators: Closing the gap. Ecological Indicators, 80, 12-22. ttps://doi.org/10.1016/j.ecolind.2017.03.056

Camacho, M. (2020). Competitiveness, well-being and cities. Doctoral Thesis, Pontifical Catholic University of Argentina. Buenos Aires.

Camacho, M., Horta, R., Silveira, L. & Silva, E. (2024). Impacto de las dimensiones económicas en la felicidad de las personas. Revista Venezolana de Gerencia, 29(105), 303-324. https://doi.org/10.52080/rvgluz.29.105.20

Curchod, C., & Alberto, P. (2021). The role of composite indicators in policy analysis and communication. Journal of Public Policy, 41(2), 345-361. https://doi.org/10.1007/978-94-007-0753-5_504

Domínguez Serrano, M., Blancas Peral, F., Guerrero Casas F., & González Lozano, M. (2011). Una revisión crítica para la construcción de indicadores sintéticos. Revista de Métodos cuantitativos para la economía y la empresa, 11, 41-70. https://doi.org/10.46661/revmetodoscuanteconempresa.2094

Greco, S., Ishizaka, A., Tasiou , M., & Torrisi, G. (2018). On the methodological framework of composite indices: A review of the issues of weighting, aggregation, and robustness. Social Indicators Research, 141(1), 61-94. https://doi.org/10.1007/s11205-017-1832-9

Horta, R., Camacho, M., Silveira, L. & Ferreira, L. (2023). Composite index construction methodologies: contributions from the Departmental Competitive Potential Index for Uruguay. Journal of Quantitative Methods for Economics and Business, (No.), 1-23. 10.46661/rev.metodoscuant.econ.empresa.6592

Horta. R. & Camacho, M. (2024). La importancia del bienestar subjetivo en la construcción de competitividad. Revista Boletín de Estudios Económicos, Universidad de Deusto, España. Aprobado para su publicación en etapa de edición.

Horta, R., Camacho, M. & Silveira, L. (2022). Logistics activity in Uruguay from a cluster approach. National Institute of Logistics and Catholic University of Uruguay. Retrieved from: http://www.inalog.org.uy/wp-content/uploads/2022/12/Cluster-Actividad-Log%C3%ADstica-en-Uruguay-2022-IC-UCU-oct12-VF.pdf

Huggins, R., Izushi, H., & Thompson, P. (2013). Regional competitiveness: theories and methodologies for empirical analysis. Journal of CENTRUM Cathedra: The Business and Economics Research Journal, 6 (2), 155-172. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2332832

INALOG (2024). Informe Comercio Internacional y Logística. Análisis de los tránsitos de bienes para la caracterización de Uruguay como centro de distribución para la región y el mundo 2021-2023. Instituto Nacional de Logística. Montevideo. Retrieved from: http://www.inalog.org.uy/wp-content/uploads/2024/06/informes_portadas/Tra%CC%81nsitos%20por%20Uruguay%202021-2023_versio%CC%81n%20final.pdf?_t=1721168404

Jiménez-Fernández, E. & Ruiz-Martos, M. (2020). Review of some statistical methods for constructing composite indicators. Estudios de Economía Aplicada, 38(1), 1-15. https://doi.org/10.25115/eea.v38i1.3002

Kuc-Czarnecka, M., Lo Piano, S., & Saltelli, A. (2020). Quantitative storytelling in the making of a composite indicator. Social Indicators Research, 150(3), 789-810. https://doi.org/10.1007/s11205-020-02276-0

Lall, S. (2001). Competitiveness Indices and Developing Countries: An Economic Evaluation of the Global Competitiveness Report. WorldDevelopment. 29(9), 1501-1525. https://doi.org/10.1016/S0305-750X(01)00051-1

Munda, G., & Nardo, M. (2009). Non-compensatory/non-linear composite indicators for ranking countries: A defensible setting. Applied Economics, 41(12), 1513-1523. https://doi.org/10.1080/00036840601019364

Nardo, M., & Saisana, M. (2012). OECD/JRC Handbook on constructing composite indicators. Putting theory into practice.

Nardo, M., Saisana, M., Saltelli, A., Tarantola, S., Hoffman, A., & Giovannini, E. (2005). Handbook on constructing composite indicators: Methodology and user guide. OECD Publishing. Retrieved from: https://www.oecd.org/content/dam/oecd/en/publications/reports/2005/08/handbook-on-constructing-composite-indicators_g17a16e3/533411815016.pdf

OECD (2008). Handbook on constructing composite indicators: Methodology and user guide. OECD Publishing.

Saisana, M., & Tarantola, S. (2002). State-of-the-art report on current methodologies and practices for composite indicator development. European Commission Joint Research Centre. Retrieved from: https://www.eea.europa.eu/data-and-maps/indicators/economic-water-productivity-of-irrigated/state-of-the-art-report

Sharpe, A. (2004). Literature review of frameworks for macro-indicators. Center for the Study of Living Standards. Research Report 2004-03. Retrieved from: https://www.csls.ca/reports/litrevmacro-indicators.pdf

World Bank (2025). Open access data from the World Bank. https://data.worldbank.org/

Notes

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4. The sub-dimensions were used to guide the selection of indicators but had no impact on the weighting and aggregation procedures. In other words, all the indicators in a dimension regardless of the existence of subdimensions were treated with the same approach, as an equal component of a whole set.

5. Please see Exhibit 1

6. The liability variables were thus normalized.

7. Subdimensions were not considered for the calculation of the index, they were instrumental to the selection procedure.

EXHIBIT 1

CPI: Indicators and variables by dimension

Dimension	*Indicator*	*Variables / Units*
Macroeconomic Environment	Activity level	Annual GDP variation at constant prices
	Price stability	Average annual CPI variation
	Employment	Unemployment rate (%)
	Fiscal deficit	Fiscal deficit - as % of GDP
	Public debt	Gross Debt (millions of USD)
Institutional Environment	Country risk level	Country Risk
	Level of corruption	Corruption Perception Index
	Democratic quality	Democracy Index
	Level of prosperity	Prosperity Index
Infrastructure	Road network situation	State of conservation of national routes
	Port infrastructure	Investments in MVD Port
	Productivity	Average gross productivity per container ship
	Fixed Telephony	Fixed Telephone Services
	Broadband	Broadband Services
	Export process	Agility in controls
International Flow of Goods	Foreign Trade Flow	Export/Import of merchandise (includes ZF) Mill. of US$
	Container Movement Port of MVD	By Foreign Trade (Thousands of TEUs)
	Cargo Movement Port of NP	By Foreign Trade (tons)
	Airports Movement	Total cargo movement (tons)
	Trade opening	Openness coefficient: (X+M) / GDP in %
	Exchange rate	TCN variation
Costs	Truck fuels	Diesel 50S $/liter
	Ship fuels	Oil US$/barrel
	Cost of moving containers	Average fixed costs. Exp/imp. container 20/40 TEUs dry
	Storage costs	Logistics Cost Index - CINOI, CALOG JUN2017=100
	Logistics Transport Costs	Transport Cost Index - CINOI, CALOG
	Foreign Trade Window	VUCE UI usage rate in $
Connectivity	Connectivity Level - Ports	Liner Shipping Connectivity Index (LSCI) UNCTAD. Data for Uruguay
	Connectivity Level - MVD Port	Port Liner Shipping Connectivity Index (PLSCI) UNCTAD - Port MVD
	AIC arrivals index	Index from frequency, destination and payload data
	AIC Game Index	Index from frequency, destination and payload data
	Concentration of destination markets for exports	Herfindahl and Hirschman Index Value
	Concentration of markets of origin of imports	Herfindahl and Hirschman Index Value