

Logistics Performance of the Port of Algiers and Its Impact on the Efficiency of Logistics Services: A Field Study

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الأداء اللوجستي لميناء الجزائر وتأثيره على كفاءة الخدمات اللوجستية: دراسة ميدانية

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Received: / /20xx

Accepted: / /20xx

Published: / /20xx

Summary: this study investigates the impact of logistics performance on service efficiency at the Port of Algiers, utilizing a multidimensional framework that includes infrastructure, operational speed, procedural efficiency, stakeholder coordination, and digitalization. Through a quantitative approach and a structured questionnaire, the research addresses a significant empirical gap in maritime logistics literature. Findings reveal that both performance and efficiency currently operate at a moderate level with a positive upward trend. Notably, infrastructure is the most prominent performance driver, while economic efficiency leads service indicators. Statistical analyses—including Pearson correlation and multiple linear regression—confirm a significant positive relationship, with logistics performance explaining 57.6% of the variance in service efficiency. Procedural efficiency emerged as the most critical predictor of success. The study concludes that optimizing port operations necessitates streamlining administrative procedures, enhancing digital integration, and fostering stronger stakeholder coordination to achieve competitive logistics excellence.

Keywords: Logistics performance; logistics service efficiency; ports; Port of Algiers; logistics infrastructure; logistics procedures; digitalization and technology

Jel Classification Codes : L91, R41, R42, O18, O33.

ملخص تتناول هذه الدراسة تحليل أثر الأداء اللوجستي على كفاءة الخدمات اللوجستية في ميناء الجزائر، وذلك بالاعتماد على إطار متعدد الأبعاد يشمل البنية التحتية، سرعة العمليات، كفاءة الإجراءات، التنسيق بين الفاعلين، والرقمنة. ومن خلال اعتماد منهج كمي واستخدام استبيان منظم. تسعى الدراسة إلى معالجة فجوة تجريبية مهمة في أدبيات اللوجستيات البحرية. وقد أظهرت النتائج أن كلاً من الأداء اللوجستي وكفاءة الخدمات يعملان عند مستوى متوسط مع اتجاه إيجابي تصاعدي. كما تبين أن البنية التحتية تمثل العامل الأكثر بروزاً في تفسير الأداء، في حين تنصهر الكفاءة الاقتصادية أبعاد كفاءة الخدمات. وأكدت التحليلات الإحصائية، بما في ذلك معامل ارتباط بيرسون والانحدار الخطي المتعدد، وجود علاقة إيجابية ذات دلالة إحصائية بين المتغيرين، حيث يفسر الأداء اللوجستي ما نسبته 57.6% من التباين في كفاءة الخدمات. كما برزت كفاءة الإجراءات اللوجستية كأهم عامل مؤثر في تحقيق الأداء المتميز. وتخلص الدراسة إلى أن تحسين كفاءة الخدمات اللوجستية يتطلب تحسين العمليات داخل الميناء من خلال تبسيط الإجراءات الإدارية، وتعزيز التكامل الرقمي، وتقوية التنسيق بين مختلف الفاعلين، بما يساهم في تحقيق التميز التنافسي في المجال اللوجستي.

الكلمات المفتاح : الأداء اللوجستي؛ كفاءة الخدمات اللوجستية؛ الموانئ؛ ميناء الجزائر؛ البنية التحتية اللوجستية؛ الإجراءات اللوجستية؛ الرقمنة والتكنولوجيا.

تصنيف JEL : L91, R41, R42, O18, O33.

I- Introduction :

Over the last few decades, commercial and logistics activities have changed rapidly, under the pressure of more interconnected markets, wider exchanges, and increasingly complex supply chains. This has also changed the way ports are understood within the contemporary economy. They are no longer seen merely as physical places where goods pass from one point to another. Rather, ports have become logistics nodes in which trade flows are organized, coordination among different actors is put to the test, and the efficiency of services connected to port activity becomes clear. In this context, port logistics performance has taken on growing importance. It reflects, of course, the level of direct operational activity, but it also indicates the extent to which the port system can support trade, improve efficiency, and strengthen competitiveness within a broader logistics environment (Zemri & Khetib, 2025; World Bank, 2023).

From this standpoint, logistics performance is no longer dealt with in the literature as a single, partial indicator, separated from its surroundings. It is closer to a composite structure, one in which infrastructure, procedures, institutional organization, digitalization, and operational indicators overlap and interact. Together, these elements help determine the effectiveness of the port and the quality of the services it provides. The efficiency of logistics services, therefore, does not appear outside this structure. It is formed through it. More precisely, it is the practical result of the port's ability to convert its resources, equipment, coordination patterns, procedural speed, and degree of organizational and technological integration into services that are reliable, effective, and of acceptable quality. In this sense, the relationship between logistics performance and logistics service efficiency is not just a statistical link between two variables. It expresses the connection between the internal conditions of performance and the way these conditions are translated into service outcomes within the port environment itself (Rodrigue, 2023; OECD, 2023; UNCTAD, 2023).

Yet, once this general framework is placed within the Algerian context, the matter becomes more layered. Port logistics performance is shaped by a set of constraints and uneven conditions, including limitations in some components of infrastructure, the complexity of administrative and customs procedures, weak integration with inland transport networks, delays in digital transformation, and varying levels of coordination among stakeholders. The literature dealing with this context suggests that such factors do not stop at the level of operational performance. Their effects extend further, touching the quality, cost, responsiveness, and overall effectiveness of logistics services. This makes the issue connected, at the same time, to the internal structure of port performance and to the position of the port within the national logistics system (Ben Fadel, 2025; Belhadef, 2025; Arrouche, 2024).

Within this setting, the Port of Algiers acquires particular significance. Its importance does not lie only in the role it plays in national port activity, although that role is central. It also lies in the fact that it offers a suitable field for examining, in a direct way, the relationship between logistics performance and service efficiency. Existing studies are numerous, but many of them move at a macro level, adopt comparative perspectives, or discuss operational, organizational, and digital dimensions in broad terms. What remains less examined is this relationship from inside the port institution itself, by linking logistics performance to its effect on logistics service efficiency in a specific applied context.

Accordingly, this study addresses logistics performance at the Port of Algiers through its structural, organizational, technological, and operational dimensions. At the same time, it treats logistics service efficiency as the practical extension of the effectiveness of these dimensions within the port. On this basis, the study seeks to examine the relationship in a direct field context, in order to show how it is formed and expressed within the port environment itself.

First: Methodological Framework and Previous Studies

1. Previous Literature Related to Logistics Performance of Ports at the Systemic Level

The literature dealing with the logistics performance of ports shows that the concept is no longer confined to a narrow operational reading of port activity. It is now approached as part of a wider logistics structure, tied to the efficiency of the national system of trade, transport, and supply chains. This shift reflects a broader change in perspective: the port is no longer measured merely as a technical facility, but is viewed as an institutional and operational node through which the economy's ability to organize trade flows and reinforce competitiveness can be assessed. Within this framework, studies on logistics performance, especially those operating at the macro level, have linked port performance to foreign trade indicators, economic growth, and logistics integration. The port, in this sense, becomes part of an analytical network that extends beyond its immediate operational limits (Zemri & Khetib, 2025; World Bank, 2023).

In the Algerian context, previous studies tend to agree that the evaluation of port logistics performance cannot be reduced to activity volume or cargo-handling levels. It also involves the structure of the port, the complexity of its procedures, the degree of digitalization, and the extent of its connection with inland transport networks. Such a perspective shows that the port is not assessed only within its physical boundaries. It is also evaluated through its place within the national logistics system, which often makes performance analysis broader than the direct field reality of the port itself (Ben Fadel, 2025; Belhadef, 2025; Arrouche, 2024). From this angle, the literature at this level does not treat logistics performance as a separate characteristic of the port, but as an expression of the relationship between the port facility and its wider logistics and economic environment.

Yet this level of analysis, despite its importance in revealing the economic and logistics extensions of performance, remains insufficient on its own. It does not fully explain how performance is actually formed inside the port space. When performance is examined mainly through trade, competitiveness, and macro-level indicators, the analysis becomes less able to capture the internal structure of performance, along with the operational and organizational determinants that shape service levels within the port (Arrouche, 2024; Belhadef, 2025; Zemri & Khetib, 2025). In this regard, this body of literature opens the way for a more focused level of analysis, one that moves closer to the internal conditions through which port logistics performance takes shape.

2. Previous Literature Related to Internal Determinants of Port Logistics Performance

At this level, the literature indicates that port logistics performance is produced through the interaction of several overlapping dimensions, especially infrastructure, institutional organization, coordination among actors, digital transformation, and operational performance indicators. This approach presents a more complex understanding of performance. The port is no longer seen simply as a place of equipment and facilities; it appears instead as an operational and institutional environment where material resources meet the quality of procedures, the fluidity of interaction among stakeholders, and the efficiency of information flows (Rodrigue, 2023; OECD, 2023; UNCTAD, 2023). Accordingly, understanding logistics performance from this perspective requires moving beyond a one-dimensional explanation that confines efficiency to technical or structural factors alone.

Within this context, infrastructure stands out as one of the most stable determinants used to explain differences in logistics performance. The quality of berths, warehouses, and equipment, together with the degree of connection to road, rail, and hinterland logistics networks, is closely linked to the smooth movement of goods, the reduction of bottlenecks, and the improvement of overall efficiency. The literature also gives considerable weight to the organizational and institutional dimension, particularly governance, coordination among port authorities, customs, transport operators, freight forwarders, and the pattern of interaction among the different stakeholders. In this framework, logistics service quality is not generated by material resources alone. It also depends on the degree of role integration, procedural fluidity, and the movement of

information among actors (Rodrigue, 2023; Arrouche, 2024; Belhadef, 2025; Ismail, 2016; OECD, 2023; Globe Institute, 2016).

At the same time, the literature highlights the growing importance of digital transformation as a central component affecting performance. It is not treated merely as an isolated technical element, but as part of the port's organizational and operational structure. Digitalization is associated with faster processing, more accurate information, fewer errors, and stronger coordination among stakeholders. Still, its effectiveness remains dependent on institutional and human readiness, as well as on the integration of information systems (Bougioukou, 2023). In the Algerian context in particular, delays in digital transformation and weak technological readiness frequently appear among the constraints that limit performance effectiveness. Digitalization, therefore, becomes part of a wider question related to organization, competencies, and management mechanisms within the port environment (Ben Fadel, 2025; Belhadef, 2025).

On this basis, the literature suggests that port logistics performance cannot be explained through one determinant alone. It is formed at the point where structural, organizational, digital, and human elements intersect (World Bank, 2023; Rodrigue, 2023; OECD, 2023; UNCTAD, 2023; Liu, 2010). However, although this approach comes closer to the internal conditions of performance, it often gives more attention to explaining the determinants themselves than to showing how these determinants are reflected in the efficiency of logistics services inside the port. This leads, in turn, to a third axis concerned with operational measurement and the service outputs of port performance.

3. Previous Literature Related to Measuring Logistics Performance and Its Relationship with Logistics Service Efficiency

The more specialized literature tends to examine port logistics performance through indicators that are closer to daily port activity: processing speed, waiting time, vessel or cargo dwell time, handling quality, procedural accuracy, and the reliability of services. Here, attention moves away from broad explanatory factors and toward results that can be seen in practice. Performance becomes visible in shorter delays, more reliable operations, better use of resources, and less congestion within the port (UNCTAD, 2023; Khan et al., 2019; Nguyen, 2017; Liu, 2010). In this view, logistics efficiency is not separate from service quality. Speed, accuracy, flow, quality, and reliability all meet within one practical understanding of performance.

From a knowledge perspective, the literature does not proceed along one path. Some international studies work with more detailed measurement tools, using precise operational indicators, multi-criteria models, and methods for assessing relative efficiency. Studies dealing with the Algerian context, by contrast, often move toward a broader diagnosis of performance, especially by linking it to structural, organizational, and digital constraints. This difference is not really a contradiction. It reflects a difference in the level from which the subject is being approached. International literature provides sharper tools for measuring operational performance, while local literature makes the constraints of the Algerian environment more visible (UNCTAD, 2023; Nguyen, 2017; Liu, 2010; Ben Fadel, 2025; Arrouche, 2024).

In the Algerian context, the literature appears to converge around a set of recurring weaknesses. These recurring challenges include inadequate physical infrastructure, convoluted customs and administrative routines, poor integration with inland transport networks, delayed digital adoption, and a distinct lack of coordination among stakeholders. The fallout from these bottlenecks is substantial, directly translating into inflated costs, prolonged handling times, and a tangible drop in overall service quality. Yet, while there is broad consensus on the nature of these obstacles, researchers do not necessarily view them through the same analytical lens. Certain studies evaluate performance using macro-level logistics indices, and others zero in on institutional barriers or digital readiness, while a separate strand of literature links logistics efficiency primarily to trade dynamics and economic expansion (Ben Fadel, 2025; Belhadef, 2025; Zemri & Khetib, 2025; Arrouche, 2024). Viewed collectively, it becomes evident that port logistics performance has been dissected across multiple distinct levels of analysis. It has been examined through macro

perspectives linked to trade and competitiveness, through structural and organizational determinants, and also through operational measurement and service outputs. Yet this accumulation still leaves an important question open: are these approaches enough to understand the relationship between logistics performance and logistics service efficiency at a direct field level within the Port of Algiers? It is from this point that the research gap becomes clearer.

4. Research Gap

The reviewed literature shows that port logistics performance has been approached through different analytical levels. Still, a large part of it has remained within macro or comparative perspectives, where logistics performance is connected to national logistics performance indicators, foreign trade, competitiveness, or economic growth. In such studies, the port is usually placed inside the wider logistics system, rather than being examined as an independent field unit in its own right (Arrouche, 2024; Belhadef, 2025; Zemri & Khetib, 2025; World Bank, 2023).

Other studies have addressed operational, digital, or institutional dimensions of port performance. However, they often do so in general terms, or without focusing directly on the Port of Algiers. Although these studies help in identifying the determinants of performance, they do not go far enough in building a direct field-based analysis that links logistics performance to logistics service efficiency inside the port itself.

Accordingly, the research gap lies in the limited number of studies that examine logistics performance at the Port of Algiers as a direct field subject, while also linking it to logistics service efficiency within the same institutional context.

5. Research Problem

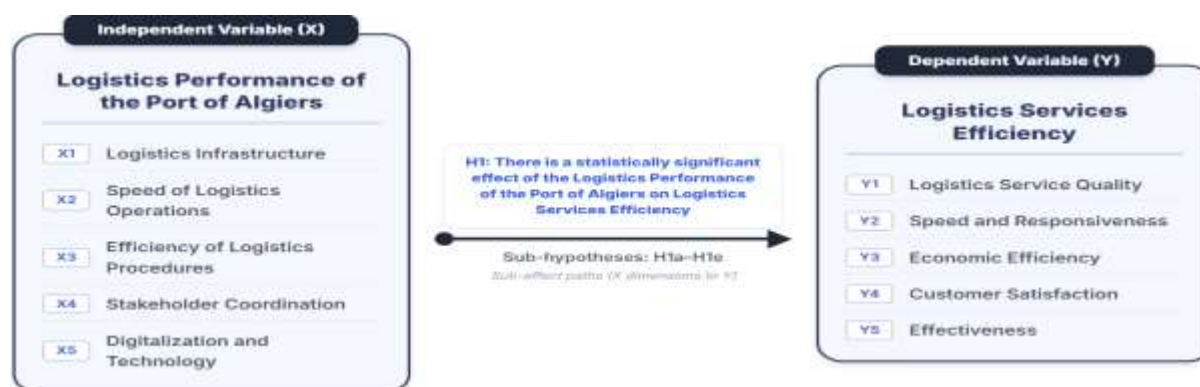
Based on the above, this study seeks to examine the logistics performance of the Port of Algiers and to explore its effect on the efficiency of the logistics services provided within it. The research question is therefore formulated as follows:

To what extent does the logistics performance of the Port of Algiers affect the efficiency of logistics services provided within it?

6. Research Hypothesis

There is a statistically significant effect relationship between the logistics performance of the Port of Algiers, represented by logistics infrastructure, speed of logistics operations, efficiency of logistics procedures, coordination among actors, and digitalization and technology, and logistics service efficiency, represented by service quality, speed and responsiveness, economic efficiency, customer satisfaction, and effectiveness

7. Study Model



II– Study Methodology and Procedures:

1. Study Methodology

This study adopted the descriptive-analytical approach, as it fits the nature of the research topic, which focuses on examining the logistics performance of the Port of Algiers and analyzing its effect on the efficiency of the logistics services provided within it. This approach makes it possible, first, to describe the phenomenon as it appears in reality, and then to analyze the relationships linking its variables on the basis of field data collected from the members of the sample. The use of this approach is also consistent with the research problem, which revolves around the extent to which logistics performance, through its different dimensions, affects the efficiency of logistics services within the port enterprise. It is likewise aligned with the general hypothesis of the study, which assumes the existence of a statistically significant effect relationship between the two variables.

2. Study Population and Sample

The study population consisted of the various actors and operators connected to port and logistics activity within the Port of Algiers. These groups were selected because they are directly exposed to logistics operations and to the services provided in the port, and are therefore in a better position to evaluate the level of logistics performance and the efficiency of logistics services from actual practice. The structure of the questionnaire indicates that the targeted categories included managers and officials in the Port of Algiers enterprise, representatives of shipping companies and shipping agents, representatives of logistics and road transport companies, in addition to other administrative bodies linked to port activity.

The study relied on purposive sampling, since the respondents were selected according to their direct relationship with the subject of the study and their practical experience in the port and logistics environment. A total of 150 paper questionnaires were distributed manually and directly to the targeted sample members. Of these, 127 questionnaires were retrieved, while 113 were considered valid for analysis after excluding incomplete or invalid forms. Thus, the retrieval rate reached approximately 84.67% of the total distributed questionnaires, whereas the rate of questionnaires valid for analysis amounted to approximately 75.33% of the total distributed.

3. Study Tool

The questionnaire was used as the main tool for collecting field data, given its suitability to the nature and objectives of the study. It allows structured quantitative data to be collected from the sample members, and makes it possible to measure their views and attitudes toward the study variables. The tool was designed in light of the theoretical framework of the study, and in response to the research gap that pointed to the need for a direct field study linking logistics performance at the Port of Algiers with the efficiency of the logistics services provided there.

4. Questionnaire Construction

The questionnaire was composed of two main parts. The first part covered general information about the respondents, including descriptive variables such as position or capacity within the institution, years of experience in the port or logistics field, nature of the relationship with the Port of Algiers, degree of daily connection to container transport, and educational level.

The second part was devoted to measuring the study variables, and was divided into two main axes. The first axis concerned logistics performance and included five dimensions: logistics infrastructure, speed of logistics operations, efficiency of logistics procedures, stakeholder coordination, and digitalization and technology. The second axis concerned the efficiency of logistics services and also included five dimensions: logistics service quality, speed and responsiveness, economic efficiency, customer satisfaction, and effectiveness. Four items were

assigned to each dimension, bringing the total number of items in the analytical part to 40. Responses were measured using a five-point Likert scale ranging from (1) Strongly Disagree to (5) Strongly Agree. This scale is appropriate for the nature of the dimensions measured and allows the data to be processed statistically in a suitable way. The construction of the questionnaire therefore reflects the study model and its general hypothesis directly.

5. Data Collection Procedures

After the questionnaire had been finalized, it was distributed in paper form to the purposive sample members, manually and directly. The scientific purpose of the study was clarified to the respondents, and the confidentiality of the information was emphasized, along with its exclusive use for scientific research. After the questionnaires were retrieved, they were reviewed and sorted to verify their completeness and suitability for analysis. Invalid forms were excluded, leaving 113 questionnaires valid for data entry and statistical processing.

6. Statistical Processing Methods

The study data were processed using SPSS software, through a set of statistical methods appropriate to the nature of the study and the structure of the questionnaire. These methods included frequencies and percentages to describe the characteristics of the sample, arithmetic means and standard deviations to determine the level of responses to the items and dimensions, item-total correlation to verify internal consistency, and Cronbach's alpha to measure the reliability of the tool. The one-sample t-test was used to compare the calculated means with the hypothesized mean of the five-point Likert scale, while Pearson's correlation coefficient was used to measure the relationship between the study variables. Multiple linear regression was also applied to test the effect of logistics performance dimensions on the efficiency of logistics services. In addition, the independent samples t-test and one-way ANOVA may be used, when needed, to identify differences in respondents' answers according to some personal and occupational variables.

III- Results and discussion :

1. Presentation of the General Characteristics of the Study Sample

The descriptive results related to the general characteristics of the study sample indicate that the sample was reasonably varied in professional, functional, and educational terms. This variation is important, given the nature of the topic, since the assessment of logistics performance and the efficiency of logistics services within the Port of Algiers requires views drawn from different positions inside the port and logistics environment.

For the variable of position or role within the institution, the results showed that executives or managers within the Port of Algiers Authority represented the largest category, with 29.2%. They were followed by other administrative entities operating inside the port, at 26.5%, then representatives of logistics companies or land transport operators, at 25.7%. Representatives of shipping companies or maritime agents came in the last position, with 18.6%. This distribution gives the sample a relatively broad character, as it includes several actors involved in port and logistics activity. It also reflects, to some extent, the complexity of the logistics system within the port itself.

With regard to years of experience in the port or logistics field, the category of 20 years or more came first, with 28.3%. The category of 5 to less than 10 years followed, at 26.5%, then the category of 10 to less than 20 years, at 23.9%, while respondents with less than 5 years of experience represented 21.2%. These figures show that the sample does not lean toward one single experience level. Rather, it brings together respondents with varying professional backgrounds, including a noticeable proportion of individuals with long field experience. This gives the responses a stronger connection to actual practice and not merely to formal or external observation.

As for the nature of the institution's relationship with the Port of Algiers, the highest percentage was recorded by the category of permanent presence within the port, whether through a headquarters or an office, at 38.9%. Regular interaction with the port, several times per month, came next, with 31.0%, followed by occasional interaction, a few times per year, at 30.1%. This distribution suggests that a significant part of the sample has a direct and fairly stable relationship with the port. Such proximity is useful, because it allows respondents to evaluate logistics performance and the services provided on the basis of repeated contact with the port environment.

Concerning the extent to which daily activity is linked to container transport, the results showed a clear convergence among the categories. The categories "not directly related" and "moderately related" each recorded 25.7%, followed by "highly related" at 24.8%, and finally "weakly related" at 23.9%. This closeness between percentages indicates that the sample includes actors with different degrees of involvement in container transport operations. In turn, this gives the study a more balanced view of logistics activity, since it does not rely only on respondents who are directly and heavily involved in container transport.

Regarding educational level, respondents holding a master's degree ranked first, with 30.1%, followed by bachelor's degree holders, at 25.7%. The technician or senior technician category came next, with 17.7%, then secondary level or less, at 15.0%, while doctoral degree holders represented the lowest percentage, at 11.5%. This distribution shows that most respondents had a university-level education, which supports their ability to understand the questionnaire items and respond to them with an appropriate level of awareness.

Overall, the general characteristics of the study sample reveal a suitable degree of diversity in professional affiliation, experience, relationship with the port, involvement in logistics activities, and educational level. This diversity gives the subsequent analysis a stronger basis, as it allows the phenomenon under study to be viewed from more than one angle within the port and logistics environment concerned. See Appendix No. 01.

2. Testing the Validity and Reliability of the Study Instrument

2.1 Internal Consistency Validity

To examine the internal consistency validity of the study instrument, corrected item-total correlation coefficients were calculated between each item and the total score of the dimension to which it belongs. The results showed that all items obtained positive and statistically acceptable correlation values within their respective dimensions. This indicates that the items were sufficiently consistent with the dimensions they were intended to measure, and that they contributed appropriately to capturing the underlying construct of each dimension.

For the independent variable, the corrected correlation coefficients for the items of the logistics infrastructure dimension (A) ranged from 0.502 to 0.557. In the speed of logistics operations dimension (B), they ranged from 0.413 to 0.470, while in the efficiency of logistics procedures dimension (C), they ranged between 0.366 and 0.574. The coordination among actors dimension (D) recorded values ranging from 0.410 to 0.572, whereas the digitalization and technology dimension (E) showed coefficients between 0.423 and 0.553.

For the dependent variable, the corrected correlation coefficients for the quality of logistics services dimension (F) ranged between 0.339 and 0.506. In the speed and responsiveness dimension (G), the coefficients ranged from 0.372 to 0.589. The economic efficiency dimension (H) recorded values between 0.423 and 0.492, while the customer satisfaction dimension (I) ranged from 0.338 to 0.474. As for the effectiveness dimension (J), the coefficients ranged between 0.400 and 0.572.

Taken together, these results point to an acceptable level of internal consistency among the items of the instrument across its different dimensions. This supports the suitability of the questionnaire for subsequent statistical analysis. See Appendix No. 02.

2.2 Reliability of the Study Instrument

The reliability of the study instrument was tested using Cronbach's alpha coefficient, both at the level of each dimension and at the level of the main variables, as well as for the instrument as a whole. The results showed that the reliability coefficients of the sub-dimensions were generally acceptable. The coefficient reached 0.734 for logistics infrastructure (A), 0.665 for speed of logistics operations (B), 0.657 for efficiency of logistics procedures (C), 0.714 for coordination among actors (D), and 0.691 for digitalization and technology (E). For the dimensions of the dependent variable, Cronbach's alpha reached 0.646 for quality of logistics services (F), 0.717 for speed and responsiveness (G), 0.687 for economic efficiency (H), 0.619 for customer satisfaction (I), and 0.715 for effectiveness (J).

At the level of the main variables, the overall reliability coefficient for the independent variable, logistics performance, reached 0.839. The coefficient for the dependent variable, efficiency of logistics services, reached 0.838. As for the questionnaire as a whole, across all its items, the reliability coefficient reached 0.906. This value indicates a high level of overall reliability and confirms that the instrument is suitable for the purposes of the study and for statistical processing.

Accordingly, the results of the validity and reliability tests show that the study instrument possesses an appropriate degree of internal consistency and reliability. It can therefore be relied upon in analyzing the responses of the sample and in testing the hypotheses of the study.

3. Analysis of Sample Respondents' Answers Toward the Study Variables

This section aims to analyze the responses of the study sample toward the two main study variables, namely logistics performance and logistics service efficiency, by relying on arithmetic means and standard deviations for the dimensions of each variable, in order to determine the direction of responses and identify the most prominent dimensions in the perceptions of the respondents.

3.1 Analysis of Sample Responses Toward the Dimensions of Logistics Performance

The results showed that the overall mean of the logistics performance variable (AE) reached 3.1902, with a standard deviation of 0.53074. At the level of sub-dimensions, the logistics infrastructure dimension (A) ranked first with a mean of 3.4181 and a standard deviation of 0.62718, followed by the efficiency of logistics procedures dimension (C) with a mean of 3.2456 and a standard deviation of 0.72732, then the coordination among actors dimension (D) with a mean of 3.1504 and a standard deviation of 0.76949, followed by the digitalization and technology dimension (E) with a mean of 3.0929 and a standard deviation of 0.80678, while the speed of logistics operations dimension (B) ranked last with a mean of 3.0531 and a standard deviation of 0.75994.

These results indicate that the highest mean among the dimensions of logistics performance was recorded for the logistics infrastructure dimension, while the lowest mean was observed for the speed of logistics operations dimension, with the remaining dimensions showing relatively close mean values.

3.2 Analysis of Sample Responses Toward the Dimensions of Logistics Service Efficiency

With regard to the logistics service efficiency variable (FJ), its overall mean reached 3.2836, with a standard deviation of 0.51106. At the level of sub-dimensions, the economic efficiency dimension (H) ranked first with a mean of 3.3473 and a standard deviation of 0.72536, followed by the quality of logistics services dimension (F) with a mean of 3.3341 and a standard deviation of 0.74523, then the customer satisfaction dimension (I) with a mean of 3.3164 and a standard deviation of 0.71419, followed by the effectiveness dimension (J) with a mean of 3.2765 and a standard deviation of 0.67262, while the speed and responsiveness dimension (G) ranked last with a mean of 3.1438 and a standard deviation of 0.75726.

These results indicate that the highest mean among the dimensions of logistics service efficiency was achieved in the economic efficiency dimension, while the speed and responsiveness dimension recorded the lowest mean, with a relative convergence among the remaining dimensions.

By comparing the overall means of the two variables, it is evident that the mean of the logistics service efficiency variable (3.2836) is higher than the mean of the logistics performance variable (3.1704), which indicates that the respondents' evaluations of logistics service efficiency were relatively higher than their evaluations of the level of logistics performance. See Appendix No. 03.

Overall, these results reveal a relative convergence between the mean values of the dimensions of both variables, with limited variation in the ranking of dimensions, which paves the way for testing the statistical significance of these means using the one-sample t-test.

4. Testing the Normal Distribution of Study Data

To check whether the study data followed a normal distribution, the Kolmogorov–Smirnov test was applied to both the sub-dimensions and the overall variables. The results showed that the significance values were higher than 0.05. This means that the study dimensions and the overall variables can be considered normally distributed. On this basis, the data were appropriate for the use of parametric statistical tests in the subsequent analysis, including the one-sample t-test, Pearson's correlation coefficient, and multiple linear regression. See Appendix No. 04.

5. One-Sample t-Test

The one-sample t-test was used to determine whether the calculated means differed significantly from the hypothetical mean. For the dimensions of logistics performance, the results showed statistically significant differences in three dimensions. The first was logistics infrastructure (A), where $T = 7.087$ at a significance level of 0.000. The second was the efficiency of logistics procedures (C), where $T = 3.589$ at a significance level of 0.000. The third was coordination among actors (D), where $T = 2.078$ at a significance level of 0.040.

By contrast, the results did not show statistically significant differences in the speed of logistics operations dimension (B), where $T = 0.743$ at a significance level of 0.459. The same was observed for the digitalization and technology dimension (E), where $T = 1.224$ at a significance level of 0.223.

At the level of logistics service efficiency, the picture was more uniform. All dimensions recorded statistically significant differences. The T value reached 4.765 at a significance level of 0.000 for the quality of logistics services dimension (F), 4.734 at a significance level of 0.000 for speed and responsiveness (G), 5.090 at a significance level of 0.000 for economic efficiency (H), 5.606 at a significance level of 0.000 for customer satisfaction (I), and 4.371 at a significance level of 0.000 for effectiveness (J). See Appendix No. 05.

These results indicate that statistical significance was present across all dimensions of logistics service efficiency. In the case of logistics performance, however, significance appeared only in three dimensions, while it was absent in the dimensions of speed of logistics operations and digitalization and technology.

6. Testing the Correlation Relationship Between Study Variables

Pearson's correlation coefficient was used to examine the relationship between logistics performance and logistics service efficiency, both at the level of the sub-dimensions and at the overall level of the variables. The results showed a positive and statistically significant correlation between overall logistics performance (AE) and overall logistics service efficiency (FJ), with a correlation coefficient of 0.746 at a significance level of 0.000. This value points to a relatively

strong positive relationship between the two variables. In other words, higher levels of logistics performance tend to be associated with higher levels of logistics service efficiency.

The results also showed positive and statistically significant correlations between each dimension of logistics performance and the overall logistics service efficiency variable (FJ). The correlation coefficient reached 0.432 for logistics infrastructure (A), 0.465 for speed of logistics operations (B), 0.609 for efficiency of logistics procedures (C), 0.510 for coordination among actors (D), and 0.556 for digitalization and technology (E), all at a significance level of 0.000. These figures suggest that improvement in any of the logistics performance dimensions is accompanied, to varying degrees, by an improvement in logistics service efficiency. The strongest correlation appeared in the efficiency of logistics procedures dimension, followed by digitalization and technology.

Accordingly, the correlation results confirm the existence of a positive and statistically significant relationship between logistics performance, in its different dimensions, and logistics service efficiency. This finding supports the general direction of the study hypotheses and provides a suitable basis for moving to the next stage of analysis, namely testing the effect relationship through multiple linear regression. See Appendix No. 06.

7. Testing the Effect of Logistics Performance Dimensions on Logistics Service Efficiency Using Multiple Linear Regression

Multiple linear regression was used to determine how the five dimensions of logistics performance contribute to explaining logistics service efficiency. The model included logistics infrastructure (A), speed of logistics operations (B), efficiency of logistics procedures (C), coordination among actors (D), and digitalization and technology (E) as independent dimensions, while logistics service efficiency (FJ) was treated as the dependent variable.

The first indication comes from the model summary. The multiple correlation coefficient reached $R = 0.759$, with a coefficient of determination of $R^2 = 0.576$ and an adjusted coefficient of determination of $\text{Adjusted } R^2 = 0.556$. In practical terms, this means that 57.6% of the variance in logistics service efficiency can be explained through the dimensions of logistics performance included in the model. This proportion gives the model a noticeable explanatory value, especially since the standard error of the estimate reached 0.34051, which remains within an acceptable range for the purposes of this analysis.

The ANOVA results move the analysis a step further. The F value reached 29.059 at a significance level of 0.000, confirming the statistical significance of the regression model as a whole. The effect, therefore, is not limited to isolated relationships between single dimensions and the dependent variable. Rather, the five dimensions together form a statistically meaningful explanatory structure for logistics service efficiency.

At the level of individual coefficients, all dimensions of logistics performance showed a positive and statistically significant effect. Logistics infrastructure (A) recorded $B = 0.112$, with a t-value of 2.453 and a significance level of 0.016. The speed of logistics operations (B) also had a positive effect, though with a relatively lower coefficient, recording $B = 0.100$, a t-value of 2.087, and a significance level of 0.039.

More clearly, the efficiency of logistics procedures (C) occupied the strongest position in the model. Its regression coefficient reached $B = 0.246$, with a t-value of 4.735 and a significance level of 0.000. This result gives the procedural dimension particular weight, since it shows that service efficiency is affected not only by what the port possesses in terms of infrastructure or equipment, but also by how procedures are organized, simplified, and carried out.

Coordination among actors (D) follows with a positive and statistically significant effect, as its coefficient reached $B = 0.146$, with a t-value of 3.086 and a significance level of 0.003. Here, the

organizational side of port activity becomes more visible: the efficiency of logistics services appears to depend, in part, on the quality of interaction among the different actors involved in port operations. Digitalization and technology (E), for its part, recorded $B = 0.121$, with a t-value of 2.455 and a significance level of 0.016, confirming its contribution to the dependent variable, although its effect remained below that of procedural efficiency and coordination.

The standardized Beta coefficients provide another reading of the same relationship. Efficiency of logistics procedures (C) ranked first, with $Beta = 0.350$. Coordination among actors (D) came next, with $Beta = 0.220$, followed by digitalization and technology (E), with $Beta = 0.192$. Logistics infrastructure (A) ranked after that, with $Beta = 0.173$, while speed of logistics operations (B) came last, with $Beta = 0.149$. This ranking is revealing: the strongest effects are located mainly in the procedural and organizational dimensions, rather than in the operational speed dimension alone.

Based on the unstandardized regression coefficients (Unstandardized Coefficients B), the multiple linear regression equation can be formulated as follows:

$$\hat{Y} = 0.974 + 0.112A + 0.100B + 0.246C + 0.146D + 0.121E$$

The model indicates that logistics service efficiency (Y) is positively affected by the five dimensions of logistics performance, holding other variables constant, and that the efficiency of logistics procedures dimension (C) represents the largest relative contribution in explaining the variation in the dependent variable among the dimensions included in the model.

Accordingly, it can be stated that the results of the multiple linear regression confirm the existence of a positive and statistically significant effect of the dimensions of logistics performance on logistics service efficiency, and that improvement in these dimensions is associated with an increase in the level of logistics service efficiency, with the efficiency of logistics procedures dimension emerging as the most influential factor in explaining variation in the dependent variable within this model. See Appendix No. 08.

8. Discussion of Study Results and Hypothesis Testing

The results of the study provided clear support for the main hypothesis, which assumes the existence of a statistically significant effect of logistics performance, across its different dimensions, on the efficiency of logistics services within the Port of Algiers. The correlation analysis revealed a relatively strong positive relationship between overall logistics performance and overall logistics service efficiency. Multiple linear regression went further in the same direction, showing that the dimensions of logistics performance, taken together, explain a substantial share of the variance in logistics service efficiency, reaching 57.6%, with the model as a whole proving statistically significant. In practical terms, this means that any improvement in logistics performance is reflected, to a noticeable extent, in the efficiency level of the logistics services provided within the port. This result gives direct empirical support to the general orientation of the study hypothesis in the specific case of the Port of Algiers.

What makes this result meaningful is that it corresponds with what earlier studies have already suggested: port logistics performance cannot be reduced to a narrow operational indicator. It is formed, rather, through the interaction of infrastructure, procedures, coordination among actors, and digitalization, and these elements eventually affect service quality, speed, reliability, and economic efficiency. Previous literature has repeatedly shown that port efficiency depends on the fluidity of operations, the smoothness of procedures, and the integration of roles among stakeholders, not simply on the presence of material resources. The findings of the present study move in this same direction, particularly through the positive and statistically significant effect of logistics performance dimensions on logistics service efficiency.

At the level of individual dimensions, the descriptive results showed that logistics infrastructure (A) recorded the highest mean among the dimensions of logistics performance. It was also one of the dimensions that showed statistical significance in the t-test. This reflects the respondents' perception of infrastructure as a basic foundation for improving performance in the port environment. Such a finding is consistent with the literature, which emphasizes the quality of berths, warehouses, equipment, and links with hinterland logistics networks as major determinants of port logistics performance. Any weakness in this dimension is likely to appear directly in the movement of flows, the level of congestion, and the quality of service delivery.

The efficiency of logistics procedures (C), however, occupied the most influential position in the regression model. It recorded the strongest effect both through the unstandardized coefficient and through the standardized weight, and it also showed the strongest correlation with logistics service efficiency. This result has considerable explanatory value, because it shows that improving service within the port does not depend only on material capacities. It depends, more sharply perhaps, on the simplicity of procedures, the speed of processing, and the reduction of administrative and organizational complexity. This corresponds especially with studies dealing with the Algerian context, where procedural complexity, the multiplicity of actors, and the length of processing chains are often identified as major obstacles to better port performance and service efficiency.

These findings are also in line with previous studies that view port logistics performance as a multidimensional structure rather than as a limited operational matter. Infrastructure, procedures, coordination among actors, and digitalization interact with one another, and their combined effect appears in service quality, speed, reliability, and economic efficiency. In this sense, port efficiency is not produced by material resources alone. It is also shaped by the smooth flow of operations, the organization of procedures, and the degree of role integration among the different stakeholders. This is exactly what the present study confirms through the positive and statistically significant effect of logistics performance dimensions on the efficiency of logistics services.

The descriptive results, again, gave a particular place to logistics infrastructure (A), which ranked first among the logistics performance dimensions and also showed statistical significance in the t-test. This indicates that respondents clearly recognized the importance of infrastructure as a core basis for enhancing performance within the port. The result agrees with the literature, which considers berths, warehouses, equipment, and connectivity with hinterland logistics networks among the most important factors explaining the efficiency of port logistics performance. Deficiencies in this area tend to be reflected directly in flow fluidity, congestion levels, and service improvement.

The results also showed, once more, the centrality of the efficiency of logistics procedures (C). This dimension appeared as the strongest in the model, whether through the unstandardized regression coefficient, the standardized weight, or the strength of its correlation with logistics service efficiency. The meaning of this result is fairly clear: service improvement inside the port is not determined only by physical facilities or equipment. It is strongly tied to the way procedures are organized, the extent to which processing is accelerated, and the degree to which administrative and organizational burdens are reduced. This is particularly consistent with Algerian-context studies, which have underlined the complexity of procedures, the multiplicity of intervening actors, and the length of processing chains as central barriers to improving performance and services in Algerian ports.

Another important result concerns coordination among actors (D). This dimension was statistically significant and ranked relatively high in terms of its contribution to explaining the dependent variable. The result confirms that logistics service efficiency within the port is not the outcome of one actor working alone. It is shaped by the level of integration among several stakeholders, including port authorities, customs, freight forwarders, transport companies, and other parties involved in port activity. This finding is consistent with previous studies, which indicate that

the quality of logistics services depends heavily on institutional coordination, the flow of information, and the smoothness of interaction among actors, rather than on technical elements alone.

The results related to digitalization and technology (E) and the speed of logistics operations (B) revealed a noteworthy analytical contrast. These two dimensions did not show statistical significance in the one-sample t-test, which means that respondents' evaluations of them did not clearly rise above the hypothetical mean. Yet both dimensions had a positive and statistically significant effect in the regression model, and both were positively associated with logistics service efficiency. This suggests that, from a field perspective, operational speed and digitalization remain areas that require further improvement, while still playing an important role in explaining differences in logistics service efficiency. This interpretation is consistent with the literature, which indicates that digital transformation in ports, especially in developing contexts, may not yet have reached full readiness or institutional maturity, even though it remains essential for improving accuracy, coordination, and processing speed once the conditions for effective implementation are in place.

With regard to the dependent variable, all dimensions of logistics service efficiency showed statistical significance. Economic efficiency (H) recorded the highest mean, whereas speed and responsiveness (G) ranked last. This may indicate that respondents perceive a relatively acceptable level of efficiency in economic aspects, service quality, and effectiveness, while speed and responsiveness still appear as a weaker point within the service system. This finding fits with the literature that links logistics service efficiency in ports to indicators such as speed, waiting time, procedural accuracy, and service reliability. It also confirms that weakness in any of these aspects can limit overall efficiency, even when other dimensions show more favorable results.

The importance of these findings becomes clearer when they are placed against the research gap from which the study began. Previous studies have often focused either on the macro level of logistics performance and its relationship with trade, competitiveness, and growth, or on certain operational and digital dimensions in broader contexts. What remained less developed was a direct field-based analysis linking port logistics performance to logistics service efficiency within the same port institution, especially in the case of the Port of Algiers. From this perspective, the present study does not merely confirm what the literature has already established regarding the role of infrastructure, procedures, coordination, and digitalization. It also provides direct empirical evidence showing how these dimensions, collectively, are reflected in the efficiency of logistics services within a specific Algerian port institution.

On this basis, it can be stated that the study results clearly supported the main hypothesis. They confirmed that the efficiency of logistics services within the Port of Algiers is closely connected to the level of logistics performance, particularly through the dimensions related to the efficiency of procedures, coordination among actors, infrastructure, digitalization, and operational speed. The real issue, therefore, is not whether a relationship exists between the two variables. The results have already shown that it does. The more important question concerns which dimensions carry the strongest weight in improving service efficiency. In this regard, the study showed that the efficiency of logistics procedures was the most significant contributing dimension. Still, this effect should be understood within its statistical and field limits: it is an explanatory effect produced by a regression model based on cross-sectional data and respondents' perceptions, not an absolute causal judgment extending beyond the study design and its instrument.

IV- Conclusion:

This study began from a central question: to what extent does the logistics performance of the Port of Algiers affect the efficiency of the logistics services provided within it? To approach this question, the field study was built around five dimensions of logistics performance: logistics infrastructure, speed of logistics operations, efficiency of logistics procedures, coordination among actors, and digitalization and technology. These were linked to five dimensions of logistics service

efficiency: quality of logistics services, speed and responsiveness, economic efficiency, customer satisfaction, and effectiveness.

Before the relationship itself could be tested, the study instrument had to be examined. Its validity and reliability results showed that the questionnaire possessed an appropriate level of internal consistency and reliability. The data also met the requirements for parametric statistical analysis, which gave the testing of the main hypothesis a sufficiently stable methodological basis.

The results did not point to a sharp or extreme evaluation. Rather, both logistics performance and logistics service efficiency appeared at a moderate level, with a slightly upward tendency. Yet the dimensions were not equal in their weight. Within logistics performance, logistics infrastructure recorded the highest mean, while the speed of logistics operations came last. On the side of logistics service efficiency, economic efficiency ranked first, whereas speed and responsiveness occupied the lowest position.

The relationship between the two variables became clearer through the correlation results. These results confirmed a positive and statistically significant relationship between logistics performance and logistics service efficiency. Regression analysis then added another layer: the dimensions of logistics performance, when taken together, explained a considerable proportion of the variance in logistics service efficiency. The most influential dimension in this model was the efficiency of logistics procedures.

From here, the main conclusion becomes difficult to reduce to one factor. Improving the efficiency of logistics services within the Port of Algiers cannot depend only on infrastructure, nor only on speed, nor only on technology. It requires a connected effort across several fronts: simplifying procedures, improving infrastructure conditions, strengthening institutional coordination, supporting digitalization, and raising the speed of operations. In this sense, the study supports its main hypothesis and confirms that logistics performance is a key determinant of logistics service efficiency within the port. This also corresponds with the general orientation of previous studies, which treat port performance as a composite phenomenon shaped by operational, organizational, technological, and service-related dimensions.

The first practical implication concerns procedures. Since the efficiency of logistics procedures was the strongest dimension in explaining changes in logistics service efficiency, priority should be given to simplifying logistics, administrative, and customs procedures. Reducing complexity, unifying steps, and accelerating processing would likely improve the quality and effectiveness of services within the port.

Coordination comes next, though not as a separate issue. Port authorities, customs services, freight forwarders, transport companies, and supporting service providers all participate in shaping the service experience. When interaction among them is weak or fragmented, the effect appears directly in the efficiency of logistics services. For this reason, it is necessary to improve information exchange, strengthen institutional cooperation, and define operational responsibilities more clearly.

Technology enters the picture from another angle. Digitalization should not be treated as a purely technical addition to the port system, but as part of a wider organizational and operational reform. The results showed that digitalization and technology have a positive effect on logistics service efficiency, even though their descriptive evaluation remained below the desired level. This means that the dimension still carries a real margin for improvement, especially if institutional readiness, human competencies, and system integration are reinforced.

The issue of speed cannot be left aside. Speed and responsiveness ranked last among the dimensions of logistics service efficiency, while the speed of logistics operations did not record a high descriptive level, despite its significant effect in the regression model. This makes operational speed one of the areas requiring direct intervention, particularly in relation to transaction processing, flow handling, and the reduction of delays inside the port.

Infrastructure, although it recorded the highest relative evaluation among the dimensions of logistics performance, still requires continued development. Its improvement should include maintenance, upgrading, and capacity enhancement, but without limiting the matter to physical facilities alone. It should also be linked to the organization of internal traffic and to better integration with hinterland transport networks. Maintaining the positive role of infrastructure remains necessary for sustaining improvements in logistics service efficiency over the medium and long term.

The research path itself also remains open. Future studies could extend the analysis to other Algerian ports or develop comparative studies between different ports. They may also include mediating organizational, digital, or institutional variables capable of explaining the relationship between logistics performance and logistics service efficiency in greater depth. Broader designs would be useful as well, especially those that combine questionnaire-based perceptions with actual operational indicators.

In conclusion, the efficiency of logistics services within the Port of Algiers appears closely tied to logistics performance across its various dimensions. Improving this efficiency therefore requires more than scattered or partial interventions. What is needed is an integrated approach in which infrastructure, procedures, coordination, digitalization, and operational speed are addressed together. Within the limits of the field data used, this study provides an applied contribution to understanding the relationship between logistics performance and logistics services in the Algerian port context, and offers a basis that may support decision-making, practical improvement, and future research.

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- Appendices:

Appendix 01 – Statistics

	Position/role	Years of experience	Relationship with Algiers Port	Linkage to container traffic	Educational level
N (Valid)	113	113	113	113	113
Missing	0	0	0	0	0

Position/role in the institution

Category	Frequency	Percent	Valid Percent	Cumulative Percent
Executive/manager at Algiers Port Authority	33	29.2	29.2	29.2
Other administrative entity inside the port (“customs, border police, ...”)	30	26.5	26.5	55.8
Representative of a logistics/road transport company	29	25.7	25.7	81.4
Representative of a shipping company or shipping agent	21	18.6	18.6	100.0
Total	113	100.0	100.0	–

Years of experience in the port or logistics field

Category	Frequency	Percent	Valid Percent	Cumulative Percent
20 years or more	32	28.3	28.3	28.3
Less than 5 years	24	21.2	21.2	49.6
From 10 to less than 20 years	27	23.9	23.9	73.5
From 5 to less than 10 years	30	26.5	26.5	100.0
Total	113	100.0	100.0	–

Nature of your institution's relationship with Algiers Port

Category	Frequency	Percent	Valid Percent	Cumulative Percent
Intermittent dealings (a few times per year)	34	30.1	30.1	30.1
Regular dealings (several times per month)	35	31.0	31.0	61.1
Permanent presence inside the port (head office/office)	44	38.9	38.9	100.0
Total	113	100.0	100.0	–

Degree of linkage between your daily activity and container traffic (Container Traffic)

Category	Frequency	Percent	Valid Percent	Cumulative Percent
Not directly linked	29	25.7	25.7	25.7
Weakly linked	27	23.9	23.9	49.6
Strongly linked	28	24.8	24.8	74.3
Moderately linked	29	25.7	25.7	100.0
Total	113	100.0	100.0	–

Educational level

Category	Frequency	Percent	Valid Percent	Cumulative Percent
Secondary or below	17	15.0	15.0	15.0
Doctorate	13	11.5	11.5	26.5
Technician/advanced technician diploma	20	17.7	17.7	44.2
Bachelor's degree (Licence)	29	25.7	25.7	69.9
Master's degree	34	30.1	30.1	100.0
Total	113	100.0	100.0	–

Appendix 02 Results of Internal Consistency Validity and Reliability Testing of the Study Instrument

Variable / Dimension	Code	Number of items	Range of corrected item–total correlations	Cronbach's alpha	Judgment
Logistics infrastructure	A	4	0.502 – 0.557	0.734	Acceptable
Speed of logistics operations	B	4	0.413 – 0.470	0.665	Acceptable
Efficiency of logistics procedures	C	4	0.366 – 0.574	0.657	Acceptable
Coordination among actors	D	4	0.410 – 0.572	0.714	Acceptable
Digitization and	E	4	0.423 – 0.553	0.691	Acceptable

technology					
Overall logistics performance	A–E	20	—	0.839	Good
Quality of logistics services	F	4	0.339 – 0.506	0.646	Acceptable
Speed and responsiveness	G	4	0.372 – 0.589	0.717	Acceptable
Economic efficiency	H	4	0.423 – 0.492	0.687	Acceptable
Customer satisfaction	I	4	0.338 – 0.474	0.619	Acceptable
Effectiveness	J	4	0.400 – 0.572	0.715	Acceptable
Overall logistics services efficiency	F–J	20	—	0.838	Good
Study instrument as a whole	A–J	40	—	0.906	High

Appendix 03 – Descriptive Statistics of Main Variables

Main variable	Dimension	Code	Mean	Std. deviation	Rank within variable
Logistics performance	Logistics infrastructure	A	3.4181	0.62718	1
Logistics performance	Efficiency of logistics procedures	C	3.2456	0.72732	2
Logistics performance	Coordination among actors	D	3.1504	0.76949	3
Logistics performance	Digitization and technology	E	3.0929	0.80678	4
Logistics performance	Speed of logistics operations	B	3.0531	0.75994	5
Overall logistics performance	Overall mean	AE	3.1704	0.53074	—
Logistics services efficiency	Economic efficiency	H	3.3473	0.72536	1
Logistics services efficiency	Quality of logistics services	F	3.3341	0.74523	2
Logistics services efficiency	Customer satisfaction	I	3.3164	0.71419	3
Logistics services efficiency	Effectiveness	J	3.2765	0.67262	4
Logistics services efficiency	Speed and responsiveness	G	3.1438	0.75726	5
Overall logistics services efficiency	Overall mean	FJ	3.2836	0.51106	—

Appendix 04 – Tests of Normality

Kolmogorov–Smirnov and Shapiro–Wilk tests for normality

Code	Kolmogorov–Smirnov Statistic	df	Sig.	Shapiro–Wilk Statistic	df	Sig.
A	0.083	113	0.054	0.986	113	0.317
B	0.103	113	0.005	0.981	113	0.118
C	0.093	113	0.017	0.984	113	0.182
D	0.086	113	0.040	0.984	113	0.200
E	0.108	113	0.002	0.978	113	0.059
F	0.102	113	0.006	0.977	113	0.053
G	0.086	113	0.040	0.982	113	0.133
H	0.091	113	0.022	0.979	113	0.079
I	0.085	113	0.042	0.985	113	0.225
J	0.104	113	0.004	0.980	113	0.087
AE	0.048	113	0.200*	0.993	113	0.836
FJ	0.055	113	0.200*	0.992	113	0.763

Appendix 05 – One-Sample t-Test

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

One-Sample Test

Variable	t	df	Sig. (2-tailed)
A	7.087	112	0.000
B	0.743	112	0.459
C	3.589	112	0.000
D	2.078	112	0.040
E	1.224	112	0.223
F	4.765	112	0.000
G	4.734	112	0.000
H	5.090	112	0.000
I	5.606	112	0.000
J	4.371	112	0.000

Appendix 06 – Correlation with Logistics Services Efficiency (FJ)

Dimension	Correlation coefficient with logistics services efficiency (FJ)	Significance level
A	0.432**	0.000
B	0.465**	0.000
C	0.609**	0.000
D	0.510**	0.000
E	0.556**	0.000
AE	0.746	0.000

Note: ** indicates statistical significance at the 0.01 level.

How to cite this article by the APA method:

Wissem Mehibel, (2026). Logistics Performance of the Port of Algiers and Its Impact on the Efficiency of Logistics Services: A Field Study, Roa Iktissadia Review, Algeria: University of El-Oued.16 (01), 89-107.

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