International Journal of Sustainability in Engineering, Science and Management
Volume (6) Issue (9) | ISSN: 3156 – 2981
©IJSESM – Sep 2026 |1 - 20

DOI: doi.org/ijsesm/2610280

Effect of Pilotage Operations on Cargo Handling Capacity of Nigerian Ports

Okwe Esoleen Chima [1]; Azubuike John Chuku [2]; Ebere Nwabueze [3]; Daniel Tamunodukobipi [4]
[1, 2, 3 & 4] Department of Maritime Science, Rivers State University, Port-Harcourt
Corresponding author: azubuike.chuku1@ust.edu.ng

Abstract

This article examines the relationship between pilotage operations and perceived cargo handling capacity in six Nigerian port complexes, drawing on a doctoral survey reported by Okwe (2026). Pilotage was represented by navigation and manoeuvring, communication and coordination, risk management, and classified pilotage districts. The thesis records 65 usable questionnaires from 72 distributed instruments and reports multiple regression analysis. Its main results associate navigation and manoeuvring, communication and coordination, and classified pilotage districts positively with cargo handling capacity, while risk management is reported as statistically non-significant. These findings are presented as source-reported patterns rather than independently verified statistical results. Coefficient inconsistencies, conflicting estimator descriptions and questionnaire wording limit their evidential strength. The article interprets pilotage as an enabling component of the vessel-to-terminal interface whose contribution depends on berth readiness, terminal resources and cargo evacuation. It recommends integrated movement planning, operational communication and district-specific service review, accompanied by direct performance measurement. The available material supports an exploratory discussion of perceived operational relationships, but does not establish causal effects or quantify additional cargo capacity.

Keywords: Pilotage operations; cargo handling capacity; navigation and manoeuvring; port coordination; Nigerian ports

1. INTRODUCTION

Cargo handling capacity depends on the availability of terminal resources and the ability to bring vessels alongside when those resources are ready. Pilotage occupies an important interface in this process: vessels must navigate approach channels, manoeuvre within restricted waters and complete berthing before most loading or discharge operations can begin. A delay in vessel access may therefore leave a prepared berth unproductive. Equally, faster pilotage cannot create usable handling capacity when cranes, storage or landside evacuation are constrained.

The doctoral study by Okwe (2026) frames this relationship through four dimensions of pilotage operations: navigation and manoeuvring, communication and coordination, risk management, and classified pilotage districts. This article extracts the first objective, which concerns cargo handling capacity. It separates this outcome from hinterland connectivity and overall port productivity, the subjects of companion manuscripts from the same survey.

The central question is whether the four questionnaire dimensions of pilotage are associated with perceived cargo handling capacity in the selected port complexes. For each dimension, the null proposition is that its coefficient in the reported cargo-capacity model is zero. The article's contribution is an outcome-specific interpretation of the thesis evidence, together with an explicit account of the reporting and measurement conditions that limit its use. The word effect in the title follows the thesis framing; the design supports discussion of association rather than demonstrated causation.

1.1 Literature Review and Theoretical Framework

The literature assembled in the thesis places pilotage within a broader maritime logistics system. Panayides (2006), included in that review, provides a supply-chain framing of maritime logistics, while Notteboom *et al*. (2021) provide the port management context. These sources are used here as contextual works identified in the thesis rather than as evidence that a particular pilotage intervention has been tested in Nigeria. The relevant analytical distinction is between installing handling capacity and making that capacity operationally available.

The thesis's queueing perspective is useful for explaining why access and service stages must be coordinated. The queueing discussion associated with Enyioko (2016) directs attention to arrivals, service and waiting. In the present narrative, pilot availability, channel transit, berth allocation and cargo work are linked service stages. No queueing model is estimated, and no assumptions about arrival distributions are imposed on the survey. The framework simply identifies where waiting can arise and why improvements in one stage may be absorbed by a bottleneck elsewhere.

Navigation and manoeuvring are expected to relate to the reliability of vessel access. Communication and coordination concern the alignment of movement information with berth and terminal readiness. Risk management concerns the prevention and handling of operational

disruption. Classified pilotage districts are treated as the thesis's questionnaire construct concerning district arrangements and facilities; the score is not an independently verified classification of district quality or a comparison of legal regimes. These distinctions keep the proposed mechanisms separate from what the questionnaire actually measures.

Stakeholder reasoning, represented in the thesis by Dooms (2018), supports attention to the interests of pilots, port authorities, terminals, vessel operators and cargo interests. Capacity becomes usable when these actors can coordinate their decisions. The conceptual expectation is therefore conditional: pilotage may support cargo handling where the subsequent stages can absorb the vessel and cargo flow. This mechanism motivates the survey relationships but remains untested by direct process observations.

1.2 Pilotage as an interdependent service process

The review by Okwe (2026) treats pilotage as a locally specialised service involving the conduct of vessels through approach channels, restricted waters and berthing or unberthing manoeuvres. The relevant knowledge is specific to the operating environment. It encompasses the interaction between channel geometry, traffic, vessel characteristics and the supporting services available for a movement. This definition makes the pilotage service more extensive than the individual act of steering a vessel. It also helps distinguish the competence of the pilot from the quality of the organisational arrangements within which that competence is exercised.

The review identifies scheduling, dispatch, tracking and communication as elements of pilotage management. Their operational relationship is sequential and interdependent. A vessel may be ready before a berth is ready; a pilot may be available while supporting craft are committed elsewhere; an agreed movement may be delayed because another movement occupies the channel. The thesis therefore places pilotage planning alongside berth allocation, channel utilisation and anchorage management. This manuscript uses that system interpretation without claiming that the survey directly observes each of these stages.

The empirical review describes pilot scheduling and integrated vessel-scheduling studies, including work attributed to Wermus and Pope, Wu and colleagues, Jia and colleagues, and Abou-Kasm and colleagues. These studies are discussed here through Okwe's (2026) review because their original texts have not been supplied. Their relevance lies in the planning problem

they address: assigning limited marine-service resources to movements while respecting other operational constraints. Their reported numerical gains or specific optimisation performance are not transferred to the Nigerian survey. A scheduling model and a staff-perception regression answer different questions and cannot be treated as interchangeable evidence.

1.3 Human performance and service continuity

A second strand of the literature review concerns the human and organisational conditions of safe pilotage. Okwe (2026) reviews studies of ship collisions, risk assessment and human factors, including investigations attributed to Yan and Lu. The review moves from immediate unsafe actions to organisational influences, supervision and the conditions under which decisions are made. For the present manuscript, this distinction matters because an individual skill score cannot fully represent the system that enables or constrains the pilot's work.

Communication procedures and supporting information help turn local knowledge into a shared movement plan. A plan must be understood by the relevant participants and revised when circumstances change. The potential performance contribution is therefore linked to the quality of the handover, the clarity of responsibilities and the consistency of the supporting service. These are proposed mechanisms derived from the thesis's discussion, rather than independently observed intermediate variables in the regression.

Safety and efficiency should consequently be interpreted together. The absence of a significant coefficient for a risk-related questionnaire construct cannot establish that risk controls have no economic value. Conversely, the presence of a significant coefficient does not demonstrate that an intervention has reduced incidents or increased output. A service can contribute by preventing disruption whose occurrence is infrequent or not captured during the survey period. This framing supports an analysis of operational continuity without repeating the thesis's unverified numerical claims about accident proportions or near-elimination of human error.

1.4 Cargo capacity and the marine access interface

The objective-specific review in the study distinguishes the condition of the vessel from the capacity of the port system to receive it. A seaworthy and well-handled vessel may still wait when the berth is unavailable, the channel is occupied or the terminal cannot begin work. The implication for cargo handling is that safe arrival and effective use of terminal capacity are

related but distinct achievements. Pilotage should therefore be examined as one input into a coordinated service process, not as a substitute for terminal equipment or cargo storage.

Okwe (2026) discusses pilotage and tug constraints alongside vessel scheduling. In this setting, movement plans must be feasible for several participants at once. A berth allocation that ignores the time required to complete a preceding movement may not be executable. A pilot assignment that ignores tug availability may also fail to produce an actual berthing event. The relationship with capacity operates through the ability to place a vessel where cargo work can begin, at a time when the terminal is prepared. No such scheduling feasibility is measured directly by the thesis's perception score.

The review also discusses infrastructure, funding, integrated transport and congestion as conditions affecting Nigerian maritime business. These issues are relevant because cargo can occupy storage beyond the vessel's departure. If evacuation is slow, a technically available berth or crane may not translate into additional cargo movement. This is why a capacity interpretation should identify the limiting stage. A pilotage improvement can contribute to the availability of a service opportunity while leaving physical handling or evacuation constraints unchanged.

1.5 Research gap and objective specific propositions

The gap identified by the source is the limited integration of pilotage's operational dimensions with wider efficiency outcomes. Much of the literature reviewed focuses on safety, scheduling or the general economic role of ports. Those streams help explain why pilotage may matter, but they do not provide a direct estimate of its relationship with cargo handling in the six surveyed complexes. The first objective attempts to connect the four-dimensional pilotage construct to a specific port outcome.

For navigation and manoeuvring, the proposition is that dependable vessel access may make an existing handling opportunity usable. For communication and coordination, the proposition concerns aligning vessel movement with terminal readiness. For risk management, the relevant mechanism is avoiding or containing interruption. For classified districts, the proposition concerns local service arrangements and support facilities. These propositions are not four independent engineering mechanisms proven by the questionnaire; they organise the expected relationships that the source regression sought to examine.

The present extraction also narrows the outcome's meaning. Installed capacity, realised throughput and perceived organisational capacity should not be used interchangeably. The survey mainly asks whether respondents consider pilotage and decision processes relevant to capacity. It does not establish a terminal's nameplate capacity or observed tonnes handled. This conceptual boundary permits the thesis objective to be retained while preventing its score from being presented as a physical production measure.

2. METHODOLOGY

This manuscript is a secondary narrative extraction from the completed doctoral thesis by Okwe (2026), rather than a reanalysis of respondent-level data. The underlying investigation used a questionnaire survey covering Lagos Port Complex, Tin Can Island, Warri, Calabar, Port Harcourt and Onne. Its questionnaire administration table records 72 questionnaires distributed, 66 returned and 65 retained as usable. The usable-response proportion is 90.3%, calculated as 65 divided by 72. This figure describes usable questionnaires rather than the proportion of all returned questionnaires. Coverage of these six complexes should not be interpreted as exhaustive coverage of every Nigerian port or terminal.

The thesis describes coverage of all six selected port organisations as a census, with 12 intended respondents per port. This does not establish a census of all employees or marine pilots. Respondent descriptions also differ: the abstract and questionnaire identify harbour masters, marine pilots, signal station personnel and vessel movement officers, whereas the sampling section lists broader managerial positions. The achieved occupational composition and the basis for selecting individual respondents cannot be independently established from the available material.

Responses used five ordered categories, from very low extent, scored 1, to very large extent, scored 5. The reliability table reports five items for each construct, while the methods text describes four items per construct and 32 items overall. The appended instrument contains items numbered up to 40, although some sequences are incomplete. Consequently, the exact final item set and the procedure for computing composite scores remain uncertain. Reported reliability coefficients indicate internal consistency within the thesis record; they do not establish that the questions adequately measure the named operational constructs.

The thesis describes multiple regression using ordinary least squares and refers to SPSS version 25. Several embedded appendix tables instead identify SPSS version 22 and weighted least squares weighted by technology. No weight definition or justification is available. Accordingly, this manuscript describes a thesis-reported regression analysis without resolving its estimator. Reported statistics are transcribed as documentary evidence, not newly calculated estimates. No missing coefficients, confidence intervals, significance levels or model diagnostics have been invented.

The study concerns contemporaneous staff perceptions. It provides no verified basis for causal inference, and responses from staff within the same port may be correlated. The source does not establish that clustering was addressed. No independent ethics approval, consent documentation or permission to release participant data has been supplied; these matters require author confirmation before submission.

For this objective, the conceptual regression is $CHC = b_0 + b_1NM + b_2CC + b_3RM + b_4CPD + e$, where CHC denotes the reported cargo handling capacity score and the predictors denote the four pilotage constructs. Reliability coefficients reported in Table 4.1 are 0.861 for navigation and manoeuvring, 0.771 for communication and coordination, 0.857 for risk management, 0.740 for classified pilotage districts and 0.722 for cargo handling capacity. These values are retained as source reports, without asserting that the underlying item scores have been verified.

2.1 Research orientation and design

The methodology describes a quantitative approach within a critical-realist philosophical position. In the source's account, the intended task was to examine measurable relationships while recognising that organisational arrangements influence operational experience. For this extraction, that orientation is expressed as a distinction between reported perceptions and the underlying processes they are intended to represent. A questionnaire score provides evidence of a response pattern; it does not by itself establish that the corresponding operational mechanism has been observed.

The design is cross-sectional. The thesis describes online administration through SurveyMonkey and a three-month response window, with questionnaires returned through established port contacts. It also discusses interviews, observation and secondary data as possible methods, but

does not supply an objective-specific qualitative dataset or a clearly linked operational time series. Those generic methodological discussions are not represented here as additional completed analyses. The empirical basis retained for this article is the reported questionnaire survey and the tables associated with its research objective.

The thesis's organisational scope and respondent-level data require particular care. Multiple respondents were approached within each port, yet the available analysis does not explain aggregation to six port scores or adjustment for responses clustered within ports. The port coverage describes where respondents were drawn from. It does not automatically make each questionnaire an independent observation of a separate port organisation. Interpretation therefore remains at the level of staff-reported constructs, with organisational conclusions qualified accordingly.

2.2 Sampling coverage and questionnaire administration

The source allocated the same intended number of questionnaires to each of the six complexes. Equal allocation makes it possible to include every selected complex without allowing one location to account for all responses. It does not show that the resulting sample represents the proportional distribution of pilotage personnel, vessel movements or cargo activity across Nigeria. The thesis does not provide a verified complete employee sampling frame or selection probabilities from which national sampling weights could be calculated.

The administration record is reproduced below because it is central to the size and coverage of the reported study. Percentages in this table are calculated from the stated counts, not copied from conflicting prose or rounded source percentages. A useful questionnaire is counted as usable; a returned instrument is counted separately. The distinction matters at Port Harcourt, where the table records one returned instrument that was not retained. No reason for exclusion is inferred where none has been established.

Port complex	Distributed	Returned	Usable	Usable of distributed
Lagos Port Complex	12	10	10	83.33%
Tin Can Island	12	11	11	91.67%
Warri	12	11	11	91.67%

Calabar	12	10	10	83.33%
Port Harcourt	12	12	11	91.67%
Onne	12	12	12	100.00%
Total	72	66	65	90.28%

Table (1): Percentages recalculated as usable divided by distributed, multiplied by 100. The total rounds to 90.28% to two decimal places and 90.3% to one decimal place.
Source: counts from Okwe (2026), Chapter 4, Table 4.2.

The demographic tables also require a distinction between counts and accompanying interpretation. Table 4.3 lists 48 male and 17 female respondents, whereas its following prose refers to 71 and 62, which sum to 133. The latter figures are not used to describe the 65-response survey. Table 4.4 lists 11 respondents with SSCE or equivalent, 15 with National Diploma, 15 with degree or HND qualifications, 14 with a master's degree or above and 10 with professional certificates. These counts sum to 65, but the printed percentages do not consistently reproduce them. They indicate a mixture of reported educational backgrounds without establishing the detailed competency or job-role distribution of the sample.

2.3 Instrument validity and analysis procedure

Methodology 3 states that the questionnaire underwent face and content review by supervisors and knowledgeable academic or industry reviewers. This is the validation procedure described by the thesis. It should not be confused with evidence of factor structure, criterion validity against port records or invariance across the six locations. The supplied record does not establish those additional properties. The reliability coefficients are therefore reported separately from the substantive question of what the items measure.

The source's description of Cronbach's alpha as a test–retest procedure is not retained as a methodological claim. Alpha concerns internal consistency among items; temporal stability requires repeat observations. No newly completed temporal-stability study is inferred. Similarly, the average of several reported scale alphas is not treated as a separately validated reliability coefficient for the overall questionnaire or an efficiency aggregate.

The reported analysis moves from descriptive summaries to regression. Means and standard deviations describe the source's item-level response patterns. Regression is intended to examine the joint relationship between the outcome and the four pilotage constructs, rather than four

unrelated bivariate relationships. This distinction is useful because predictor scores may share information. However, the absence of the raw data prevents independent checks of score construction, influential cases, error structure or the consequences of correlated predictors. No additional hypothesis test has been performed during this expansion.

2.4 Reliability of the reported constructs

The following analysis coefficients provide the source's internal-consistency record for the common survey. All eight constructs are shown to make clear which items belong to the wider study and which outcome is selected in this article. They do not constitute eight independently validated operational measurements.

Construct	Reported items	Reported alpha
Navigation and manoeuvring	5	0.861
Communication and coordination	5	0.771
Risk management	5	0.857
Classified pilotage districts	5	0.740
Cargo handling capacity	5	0.722
Hinterland connectivity	5	0.877
Port productivity	5	0.796
Technology	5	0.790

Table 2: The source's mean of alpha coefficients is omitted because it does not establish reliability for an overall score.

Source: Okwe (2026),

3. RESULTS AND DISCUSSION

3.1 Descriptive analysis of the pilotage dimensions

The analyses summarize all four predictor dimensions. The following table retains the numerical values associated with those items in Tables (3) and their accompanying explanation. Labels are shortened for readability; marketing, patronage and purchase-related elements are retained to

avoid silently changing the meaning of the administered questions. The summaries are source-reported and have not been recalculated from response records.

Source construct and item focus	Mean	Standard deviation
Navigation and manoeuvring: use in conducting services	3.8496	1.0480
Navigation and manoeuvring: reported staff skill	3.7744	0.91797
Navigation and manoeuvring: opportunities for efficiency	3.9474	1.0023
Navigation and manoeuvring: product or service introduction	3.8271	1.0262
Navigation and manoeuvring: reputation for facilities	3.6992	1.1077
Communication: opportunities for efficiency	3.5188	1.16516
Communication: interaction and purchase decisions	3.3910	1.34747
Communication: marketing information	3.6992	1.10086
Communication: staff suggestions for information	3.7820	1.06841
Communication: stakeholder attraction	3.6316	1.06936
Risk management: navigational accuracy	3.7895	1.13520
Risk management: opportunities for efficiency	3.4962	1.14564
Risk management: staff development for attraction	3.3008	1.36507
Risk management: supporting facilities	3.6015	1.16085
Risk management: customer attraction	3.4211	1.23221
Districts: service facilities and satisfaction	3.7970	1.05715
Districts: facilities and profitable services	2.2782	1.24531
Districts: variety of products or services	3.3985	1.31965
Districts: interaction and purchase decisions	3.6917	1.10220
Districts: opportunities for efficiency	3.2030	1.22326

Table (3): accompanying item discussions. Values are not pooled scale means, port-specific estimates or new statistical calculations. Source: Okwe (2026), Chapter 4,

The navigation items are generally reported above the midpoint. Communication item means range from 3.3910 to 3.7820, while the district items show a wider range, from 2.2782 to 3.7970. These differences concern individual questions, not a tested ranking of the four dimensions. Several items already describe efficiency benefits, which can make predictor and outcome meanings overlap. The sample information associated with the reported summaries also cannot

be independently reconciled, so the values are presented as documentary results rather than verified estimates for all Nigerian pilotage personnel.

3.2 Descriptive analysis of the objective specific outcome

The corresponding outcome summaries are reproduced below from the relevant results table. Means use the source's five-point extent scale. Standard deviations are preserved as printed. The item descriptions should be read alongside the measurement discussion; a favourable rating does not establish a change in an independently measured operational indicator.

Abbreviated source item	Reported mean	Reported standard deviation
Pilotage contribution to rate conversion	3.7744	1.01217
Involvement in services said to improve capacity	3.9624	1.85213
Consideration of others before capacity decisions	3.8195	1.16567
Marketing staff discussion of capacity	3.9098	0.90837
Use of cargo capacity as a performance indicator	3.6992	1.04436

Table 4: Descriptions are abbreviated, with source wording issues discussed below.

Source: Okwe, (2026)

3.3 Cargo handling items and the meaning of the descriptive pattern

Table 4 supplies five item-level summaries for the outcome. Their means are all above the scale midpoint, but the items address different matters: personal involvement, consultation, discussion by marketing staff, an undefined rate-conversion concept and the use of capacity as a performance indicator. The descriptive pattern therefore indicates broadly favourable responses to the questions as written. It cannot demonstrate an increase in operational capacity or establish which terminal resource was improved.

The highest reported mean is attached to involvement in services said to improve cargo capacity. That wording already connects pilotage activity with the desired outcome, so a high response partly reflects agreement with the proposed relationship. The corresponding standard deviation is 1.85213, substantially larger than those printed for the other capacity items. It should be

preserved as reported rather than silently replaced with a more convenient value. Without the item responses, its calculation and the distribution behind it cannot be verified.

The item on use of cargo capacity as a performance indicator has the lowest of the five reported means, although its value of 3.6992 remains above the midpoint. This is a statement about the perceived use of an indicator, not the indicator's measured level. A respondent can report frequent use of a capacity indicator without reporting high capacity. Consequently, the five items may capture management practices and beliefs alongside the intended outcome.

The descriptive evidence and regression should be read together with that boundary in mind. The former suggests positive perceptions about capacity-related activities; the latter reports relationships between composites whose construction is not fully established. Neither provides an independently measured vessel-to-terminal conversion rate. The direction of a reported coefficient therefore cannot be translated into a percentage increase in cargo output.

3.4 Regression findings and hypothesis interpretation

The subsequent regression record addresses the objective-specific hypotheses. Its numerical entries should be interpreted as reported by the thesis and read with the qualifications about estimator, sample, measurement and arithmetic consistency. The descriptive tables above do not resolve those inferential uncertainties.

The questionnaire retrieval table gives usable counts of 10 for Lagos Port Complex, 11 for Tin Can Island, 11 for Warri, 10 for Calabar, 11 for Port Harcourt and 12 for Onne. These are respondent counts, not six independently measured operational capacity values. The regression results therefore should not be represented as a ranking of individual ports or a district-level causal comparison.

Table 5 reports positive, statistically significant relationships for navigation and manoeuvring, communication and coordination, and classified pilotage districts. Risk management is reported as non-significant. The reported test statistics are summarised below to preserve the thesis's findings without treating conflicting coefficient magnitudes as settled estimates.

Pilotage construct	Reported t	Reported p	Thesis classification
Navigation and manoeuvring	2.914	0.002	Positive and significant
Communication and coordination	3.592	0.001	Positive and significant
Risk management	0.295	0.649	Not significant
Classified pilotage districts	2.732	0.010	Positive and significant

Table 5: Values are transcribed as reported and have not been independently verified. The table does not resolve inconsistencies between the reported coefficients, standard errors and test statistics. Source: Okwe (2026)

The coefficient record cannot support a dependable estimate of effect size. For example, Table 5 gives communication and coordination a coefficient of 0.473, while Appendix I gives 0.224. The main equation gives the navigation coefficient as 0.020, whereas the coefficient table gives 0.920. The latter value and its reported standard error of 0.765 do not produce the printed t-value of 2.914. These discrepancies prevent statements about the precise change in cargo handling capacity associated with a one-unit change in a predictor.

At a narrative level, the reported navigation pattern is compatible with the proposition that reliable vessel approach and berthing help make terminal capacity usable. This is a proposed explanation, not a finding that faster or riskier manoeuvres improve capacity. The operational aim would be predictable execution within safe limits. Without timestamped movement and cargo records, the survey cannot distinguish fewer pilot delays from better berth readiness or more favourable vessel characteristics.

Communication and coordination also have a plausible enabling role. A movement plan is more useful when pilots, traffic control, tug providers and terminals share an accurate understanding of vessel readiness. The positive source-reported relationship suggests a topic for management attention, but the questionnaire's marketing-oriented wording weakens any claim that the score specifically measures marine operational communication. A future instrument should distinguish radio discipline, master–pilot exchange, berth readiness messages and inter-agency planning.

The classified-district result may reflect respondents' perceptions of local arrangements, facilities or service organisation. It does not demonstrate that redesignating districts would

increase capacity. The non-significant risk-management result likewise cannot justify reducing safety provision. Risk controls may protect continuity or avert infrequent disruption without being captured by a contemporaneous perception score. Both interpretations require direct operational evidence before intervention benefits can be quantified.

3.5 Operational implications for cargo handling management

The first practical implication is to assess whether a vessel can move from pilot availability to a berth that is actually ready to receive it. A joint movement review should distinguish a delay attributable to the marine service from a delay attributable to berth occupation or terminal preparation. This distinction follows from the system argument in Chapter 2. It is a recommendation for management evaluation, not a finding that one surveyed port has a particular type of delay.

A second implication is to identify the information required at each handover. The status of a preceding vessel, anticipated berth release, availability of supporting services and readiness to begin cargo work may all affect the feasibility of the next movement. A useful improvement would make the relevant information available to the people responsible for updating the plan. Merely increasing the number of messages or meetings would not establish better coordination.

A third implication concerns the relationship between installed and usable capacity. Before commissioning additional equipment on the assumption that pilotage is the bottleneck, management should examine the stage at which available resources are waiting. Conversely, a report of insufficient equipment should not automatically conceal a movement-planning problem. The survey cannot settle that diagnosis. It supports the need for a process review in which marine and terminal events are recorded together.

For monitoring, a movement record could connect pilot request, acceptance, boarding, start of passage, all-fast time and the beginning of cargo work. Cargo records could then distinguish active handling time from interruption. These are proposed future variables. They have not been reconstructed from the thesis and should not be reported as measurements already collected. Their value would be to connect the perceived capacity relationship with a time-based operational record.

Management should also preserve safety as a condition of any proposed improvement. A shorter passage or berthing time is not sufficient evidence of better service if conditions of execution deteriorate. Equally, the absence of a significant risk-management coefficient should not be used to remove safeguards. A balanced evaluation would consider service continuity, delays and safety outcomes together while allowing for differences in vessel and terminal requirements.

3.6 Limitations

Several limitations constrain interpretation. The original dataset and original SPSS output are unavailable, preventing verification of coding, missing-data treatment, composite construction, weights, residual behaviour and inference. Embedded tables are part of the thesis record and cannot substitute for independently reproducible output. Differences between chapters and appendices should therefore remain visible rather than be resolved by selecting whichever statistic appears most convenient.

Measurement validity is a substantive concern. Some questions refer to brands, purchase decisions, website patronage or marketing staff. Others ask respondents whether pilotage improves efficiency, embedding the proposed relationship within the measurement itself. Such wording can create conceptual overlap between predictors and outcomes and increase common-method bias. Rewriting these questions in the manuscript cannot change the instrument already administered. The findings must therefore be described as associations among reported questionnaire constructs, with limited correspondence to directly observed operational performance.

The cross-sectional design, six-port coverage and uncertain staff selection limit generalisation. The absence of validated operational records means that the analysis does not quantify additional tonnes handled, shorter vessel turnaround, reduced truck delays or measurable financial benefits. Statistical non-significance is not evidence that an activity is operationally unnecessary. Conversely, a reported significant coefficient does not establish the effectiveness of a specific proposed intervention.

6 CONCLUSION AND RECOMMENDATIONS

The thesis reports a positive relationship between perceived cargo handling capacity and three pilotage dimensions, with no significant relationship reported for risk management. Reporting

conflicts prevent these patterns from being presented as independently verified estimates. The defensible conclusion is that the study identifies possible links at the vessel-to-terminal interface that warrant operational evaluation.

Port management should consider integrated vessel movement and berth-readiness planning, regular review of communication procedures and district-specific assessment of pilotage support. These are proposed management responses to the conceptual analysis, not interventions proven effective by this survey. Safety controls should be maintained while their contribution is evaluated through incident, interruption and service-continuity records.

Monitoring should connect pilot request, boarding, channel transit, all-fast time, cargo-work start and handling rates. Linking these records would help distinguish marine access delays from terminal constraints and provide a stronger basis for evaluating usable cargo capacity. The present study provides an exploratory narrative for that work, rather than a quantified investment case.

Declarations

Thesis derivation and related manuscripts: This article derives from Okwe's 2026 doctoral thesis. Three companion drafts address other objectives from the same study. Any submission should disclose the shared survey, distinguish the article's outcome and contribution, and identify related manuscripts to the editor.

Data availability: The dataset and original SPSS output were unavailable for preparation of this manuscript. The extraction is based on the supplied thesis and its embedded tables. Availability of the underlying records must be confirmed by the study author; this draft makes no promise of data release.

Author contributions, funding, conflicts of interest and ethics: Statements require confirmation from the contributing authors. Supervisory status alone has not been used to assign manuscript authorship. No funding, conflict or ethics declaration has been inferred from the absence of documentation.

References

Dooms, M. (2018). Stakeholder management for port sustainability. In Green ports (pp. 63–83). Elsevier.

Enyioko, N. C. (2016). Relevance of the queueing theory to serviced-based organisations. https://doi.org/10.2139/ssrn.2757278

Notteboom, T., Pallis, A., & Rodrigue, J. P. (2021). Port economics, management, and policy. https://porteconomicsmanagement.org

Okwe, C. E. (2026). Effect of pilotage operations on maritime transport efficiency of ports Nigeria [PhD thesis, Rivers State University].

Onyeche, U & Enyioko, N. C (2025). Effect of maritime transport on unemployment rate in

Onyenucheya, A. (2022). Maritime grossly under-explored in Nigeria, stakeholders lament. The Guardian. https://guard ian.ng/business-services/maritime/maritime-grossly-under-explored-in-nigeria-stakeholders-lament/.

Osemwota, O., Okhaku, M. A., & Tomwe, D. A. (1996). Research and statistical methods Paflioti, P., Vitsounis, T.K., Tsamourgelis, I. and Bell, M.G.H., (2014). Proceedings of Panayides, P.M. (2006). Maritime logistics and global supply chains: towards a research agenda. Maritime Economics and Logistics, 8 (1), 3–18.

Paolo, F., Gianfranco, F., Luca, F., Marco, M., Andrea, M., Francesco, M., Vittorio, P., Mattia, P., & Patrizia, S. (2021). Investigating the role of the human element in maritime accidents

Park Y. and Dossani R. (2020). Port infrastructure and supply chain integration under the

Park, J.S. & Seo, Y. J. (2016). The impact of seaports on the regional economies in South Korea: Panel evidence from the augmented Solow model. *Transport Research in Entrepreneurship Logistics, 85*, 107–119.

Sakyi, D. & Immurana, M. (2021). Seaport efficiency and the trade balance in Africa. *Maritime Transport Research* 2(5), 19-36.

Stopford, M. (2009). Maritime Economics 3rd Edition. New York: McGraw Hill International Studies, retrieved from ff10.1080/00343404.2018.1474192ff. ffhal-01822851. study of Chinese imports and their hinterland destinations, *Maritime Economics &* system, HFACS. https://commons.erau.efu/ publications/737

Uzonwanne, M. C., Ezenekwe, U., Nzeribe G., Mathew, N., & Adonike, K. C., (2020). Visual geometry group based convolutional neural network. *Global Journal of*

Vorst, van der Jack G.A.J. (2004). Supply Chain Management: theory and practices. Wageningen University & Research

Wermus, M., & Pope, J.A. (1994). Scheduling harbour pilots. Interface s, 24, (2), 44-52. World Business Outlook (2025). Unlocking Blue Economy Growth: Private Sector Opportunities in Maritime Logistics.

Wrobel, K. (2021). Searching for the origins of the myth: 80% human error impact on maritime Wu, L., Jia, S., & Wang, S. (2020). Pilotage planning in seaports. European Journal of Operation Research. 287 (1), 90-105

Xiao, L., Sun, P., Wang, L., & He, M., (2024). Multi-class pilot dispatching problem with stochastic pilot duration. International Journal of Production Research. 62(10), 3585- 3599

Xuehao F., Mingyang,L., Wenwei,Y., & Yiying C., (2025). The impacts of pilots planning on Yan, G. (2019). Research on ship pilotage risks management and decision making in Guangzhou port. Dissertation on Master of Science at World Maritime University, Daliian China.

Ye, G., Zhou, J., Yin, W., & Feng, X., (2022). Are shore power and emissions control area policies always effective together for pollutant emission reduction?- an analysis of their joint

Yomere, G. O., & Agbonifoh, B. A. (1999). Research methodology in management and social Zaucha, J. & Kreiner, A. (2021). Engagement of stakeholders in the marine/maritime spatial planning process. *Mar Policy.* 1(32), 103-113

Zgonc, B., Tekavčič, M., and Marko Jakšič, M. (2019). The impact of distance on mode Zhang, G., Thai, V., Yuen, K. F., Loh, H.S., & Zhou, Q. (2018). Addressing the epistemic Zhang, Q., Geerlings, H., El, A. & Chen, S. (2018). Who governs and what is governed in port governance: a review study? *Transportation Policy, 64*(1), 51–60