



Reducing Information Asymmetry in UAE Port Planning

Through Predictive Analytics

Today's structure

1

PROBLEM

Why ETA uncertainty matters
in UAE ports

2

METHOD

6 interviews + 11 documents,
qualitative

3

FINDINGS

16 findings → 4 key headline
findings

4

ANSWER

From algorithm-centred to
architecture-centred

UAE ports — the scale that makes this matter

21M+

TEUs handled in 2023

(UNCTAD, 2024)

15M

Jebel Ali Port volume

(UNCTAD, 2024)

5M

Khalifa Port volume

(UNCTAD, 2024)

10,000+

Vessels at Fujairah anchorage / year

(industry data)

At this scale, even a small ETA error costs millions in pilots, berths, and tugs.

The problem isn't bad AI — it's bad info flow

1

Ports plan around ETA

(berths, pilots, tugs, terminal labour)

2

ETA info is often LATE, INCOMPLETE, or OUTDATED

static reports don't reflect transit changes

3

Result: "vessel reality planning gap"

between sea-side reality and shore-side plan

4

Even perfect AI fails if info isn't:

Right TIME, right FORMAT, trusted SOURCE

RESEARCH QUESTION

"To what extent can AI-based predictive information improve the management of vessel arrival uncertainty in UAE port planning?"

A degree question — not yes/no. About management of uncertainty, not its elimination.

Aim + 3 sub-objectives — a doctor's diagnosis chain

AIM

To examine the extent to which AI-based predictive information can improve management of vessel arrival uncertainty in UAE port planning.

1

FIND THE GAP

Where do information gaps occur between vessel-side updates and port-side planning?

2

MEASURE THE DAMAGE

How does ETA uncertainty affect berth, pilotage, tug allocation, and coordination?

3

TEST IF AI HELPS

How does AI-based predictive information influence planners' decision-making?

Find the gap → Measure the damage → Test if AI fixes it.

Conceptual framework — a 5-link chain



Static → Asymmetry → Uncertainty → Satisficing → AI fix (only if used)

First 4 dominoes fall automatically. AI is the only thing that can stop the chain — but ONLY if planners trust and use it.

Methodology — qualitative interpretivist

PHILOSOPHY

Interpretivist

meaning, not numbers

DESIGN

Qualitative

exploratory-descriptive

STRATEGY

Two methods

interviews + documents

ANALYSIS

Braun & Clarke (2006)

6-step thematic

6

semi-structured
interviews

11

documents
(7 public + 4 anonymised)

25-45

minutes per
interview

April 2026

data
collection

6 participants — full UAE coordination chain

P1	AD Ports Marine Pilot	<i>Live pilotage decisions</i>
P2	AD Ports Senior Pilot (ex-Master Mariner)	<i>Senior leadership + Master experience</i>
P3	ADNOC L&S Senior Specialist	<i>Supply base coordination</i>
P4	MOEI Marine Inspector	<i>Regulatory compliance</i>
P5	AD Ports VTS Operator	<i>Real-time vessel monitoring</i>
P6	Shipping Agency General Manager	<i>Agent perspective — closes Akerlof loop</i>

Cross-role coverage: pilot, senior pilot, supply base, regulator, VTS, agent.

Findings 1–4 — Where the gaps are

GROUP 1 — INFORMATION GAPS (F1–F4)

F1 — WHERE

Gaps live in the agent–vessel–port chain. P1–P6 unanimous. P6 confirms upstream (charterers + email admin).

F2 — WHAT

Static documents (MUR, Pilot Card, Ship Particulars) are still default — Simon's bounded rationality.

F3 — WHY DIGITAL FAILS

Updates arrive after the event. Format clashes. 2025 GPS Notice = even foundational tech has limits.

F4 — ROOT CAUSE

Human discipline, not technology. ADPC byelaws already classify erroneous info supply as Penalty Level 2.

Killer pair: F1 (where) + F4 (why it persists despite tech and rules).

Findings 5–8 — What uncertainty does to ops

GROUP 2 — OPERATIONAL IMPACT (F5–F8)

F5 — ROUTINE

ETA variation in ~90% of cases (P3). 2-4 changes per international voyage (P5). Variability is the norm.

F6 — CASCADE

Pilot boarding + berth allocation hit first. Then tugs. Then traffic sequencing.

F7 — COSTS

Wasted pilot time, tug repositioning, missed berthing windows, VTS overload, supply chain fragility.

F8 — PHYSICAL

Tides, weather, under-keel clearance, Sheikh Khalifa Bridge air draught (HM Direction 03/2013).

Killer pair: F5 (variability is routine) + F7 (cost piles up at every layer).

Findings 9–12 — How planners view AI

GROUP 3 — AI PREDICTIVE INFORMATION (F9–F12)

F9 — FOUNDATION AIS, VHF, digital messaging already deployed. Question: does AI add value on top?

F10 — SUPPORT AI = decision SUPPORT, not replacement. Captains beat algorithms in last mile (Pellemans 2025).

F11 — PLATFORM P1, P2, P5 independently propose unified platform: agent + vessel + VTS + port. Heikkilä 2022 confirms.

F12 — SYNC ETA + ETB + ETC must be synchronised. ETA alone isn't enough for fleet coordination.

Killer pair: F11 (unified platform = practical contribution) + F10 (AI supports, not replaces).

Findings 13–16 — The synthesis layer

GROUP 4 — CROSS-CUTTING (F13–F16)

F13 — CONSENSUS Multiple roles independently call for unified platform. Architecturally based, not algorithmic.

F14 — SYNC AT FLEET LEVEL Multi-time-stamp data (ETA + ETB + ETC) is the necessary unit of operational decision.

F15 — UPSTREAM CONSTRAINT P3: 'gap is in the planners, not the vessels'. AI value = coordination + trust, NOT algorithm quality.

F16 — RESIDUAL GAP What remains is behavioural + environmental. Su, Khazzar, Catana confirm: governance is binding constraint.

Killer pair: F15 (AI value = coordination + trust) + F16 (residual gap is human, not tech).

Discussion — 4 contributions to the literature

1

Structural variability

ETA variation is structural — codified in ADPC byelaws notice cascade, beyond algorithmic limitation alone.

2

Multi-party asymmetry

Akerlof (1970) extended from 2-party to multi-party maritime chain. Gap = reporting + coordination, not technology.

3

AI value at fleet level

AI's value is at multi-vessel sequencing — not single-vessel last-mile (Pellemans 2025).

4

Architectural binding constraint

Coordination + trust + reporting discipline = the binding constraint. Not algorithm quality.

Reframe the question: from algorithm to architecture.

QUALIFIED ANSWER TO THE RESEARCH QUESTION

"AI-based predictive information CAN support the management of vessel arrival uncertainty in UAE port planning — BUT ONLY to the extent that the surrounding coordination architecture is capable of receiving, trusting, and acting on the better information."

Yes — but only IF architecture absorbs and trusts it.

Practical implications — algorithm → architecture

CURRENT FOCUS

Algorithm-centred

- Better ETA prediction models
- AIS data feature engineering
- Berth allocation optimisation
- Single-vessel forecasting accuracy

RECOMMENDED FOCUS

Architecture-centred

- Unified multi-stakeholder platform
- ETA + ETB + ETC synchronisation
- Reporting discipline + standards
- Organisational trust + governance

Tech is necessary but not sufficient.

Professional development



RESEARCH SKILLS

Designed and ran 6 semi-structured interviews; performed thematic analysis; triangulated 11 documents.



DOMAIN INSIGHT

Bridged my marine engineering background with a managerial / coordination perspective on UAE port operations.



ACADEMIC FRAMING

Applied Akerlof and Simon — economic theories — to a multi-party maritime supply chain.



PRACTICAL VALUE

Findings translate into concrete operational recommendations for AD Ports / ADNOC / regulators.



CAREER TRAJECTORY

Strengthens my role at ADNOC L&S Musaffah supply base — connects shore-side coordination to academic evidence.

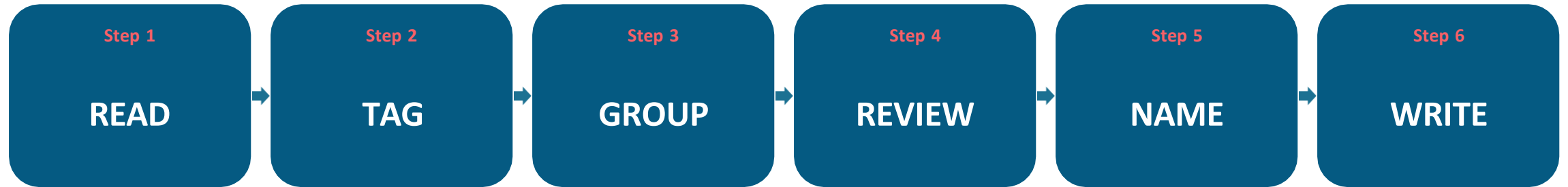


Thank you.

Questions and discussion welcome.

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BACKUP — Methodology detail



1. READ

Read all 6 transcripts repeatedly until familiar.

2. TAG

Highlight quotes — "agent delay", "AI distrust", "conflicting ETA".

3. GROUP

Cluster similar tags into themes.

4. REVIEW

Check themes are clear, distinct, well-supported.

5. NAME

Define + name each theme with a one-line description.

6. WRITE

Use themes to structure Chapter 4 — the 16 findings.

BACKUP — All 16 findings

INFORMATION GAPS (Sub-Obj 1)

- F1** Gaps live in agent–vessel–port chain. P1–P6 unanimous.
- F2** Static documents dominate (MUR, Pilot Card, Ship Particulars).
- F3** Digital tech delays — late updates, format mismatch.
- F4** Root cause = human discipline. ADPC Penalty Level 2.

OPERATIONAL IMPACT (Sub-Obj 2)

- F5** ETA variation is the norm (~90%).
- F6** Cascade: pilot → tug → traffic.
- F7** Costs accumulate across every layer.
- F8** Physical constraints — tides, weather, bridges.

AI PREDICTIVE INFO (Sub-Obj 3)

- F9** AIS + digital tools already foundational.
- F10** AI = decision support, not replacement.
- F11** Unified platform — proposed by 3 roles independently.
- F12** ETA + ETB + ETC must be synchronised.

CROSS-CUTTING (synthesis)

- F13** Practitioner consensus on integrated platform.
- F14** Multi-time-stamp data = unit of decision.
- F15** AI value = coordination + trust, NOT algorithm.
- F16** Residual gap is behavioural + environmental.

BACKUP — 11 documents triangulated

7 PUBLIC REGULATORY

- AD Ports Group Port Rules
- Mina Zayed Pilotage Directions (2010)
- HM Direction 03/2013 — Sheikh Khalifa Bridge
- HM Direction 04/2013 — Tug requirements
- ADPC Port Management Byelaws (2011)
- Notice to Mariners 08/2025 — GPS disruptions
- Marine Notice 04/2014 — Safety of navigation

4 ANONYMISED OPERATIONAL

- Daily Vessel Movement Plan
- Pilot timesheet
- Master's Uniform Report (MUR)
- Pilot–Master Information Exchange Form

BACKUP — Theoretical anchors

AKERLOF (1970)

Information Asymmetry

Original idea:

Used the used-car market to show: when one side has more info, the market breaks. The seller knows; the buyer doesn't. So buyers offer low → only bad cars sold → market fails.

In your thesis:

Vessel knows reality at sea. Shore office has stale info. Multi-party (vessel, agent, VTS, port).

Anchor:

"One side knows more than the other — the structural gap."

SIMON (1957)

Bounded Rationality

Original idea:

Humans don't make perfectly rational decisions. Limited time, info, and brainpower. We satisfice — pick the first good-enough option.

In your thesis:

Planners don't run AI dashboards on every vessel — they trust the agent's email and move on.

Anchor:

"Humans pick good-enough, not perfect — the behavioural response."

BACKUP — Limitations and future research

LIMITATIONS

- 6 participants — qualitative interpretive sample (Guest et al. 2006 = 12 for homogeneous; here heterogeneous, saturation via cross-role coverage).
- All UAE-based — findings transferable, not statistically representative.
- 4 of 6 within AD Ports / ADNOC L&S network. P4 + P6 outside.
- No pilot study — addressed via supervisor protocol review and iterative refinement.
- Documentary set is public + a few anonymised — internal coordination data restricted on commercial grounds.

FUTURE RESEARCH

- Quantitative test of multi-vessel sequencing with AIS time-series + observed berth-allocation outcomes.
- Comparative GCC study — does the binding-constraint argument generalise to DP World, Fujairah, Khor Fakkan?
- Design-science study — multi-stakeholder integration architecture as concrete artefact.