Simulation & Bulk Terminal Performance

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Portwise is a TBA Consultancy B.V. brand

Our 25+ years expertise and worldclass tools …
ready to future-proof logistics

Simulation

Ports & Terminals

Warehouses

Portwise uses state-of-the-art models, tooling, and expertise, to design smarter, more efficient and more sustainable ports and terminals for future-proof logistics around the world.

Bulk & General Cargo

Entered Market In

1996

Automation

Harness the true potential of terminals

Data driven decision-making for dry bulk, general cargo and multi-purpose terminals

Understand the impact of decisions without the burden of cost and uncertainty of implementing wasted resources

Validate
Strategies / Plans

Identify
Bottlenecks

Improve
Terminal Performance

Simulation & Bulk Terminal Performance Outline

- **Why and when to start a simulation study**
  - Design **|** Expansion **|** Optimization

- **Modelling possibilities**
  - Waterside **|** Storage **|** Internal transport **|** Gate **|** Hinterland

- **Debottlenecking case study with real-world examples**
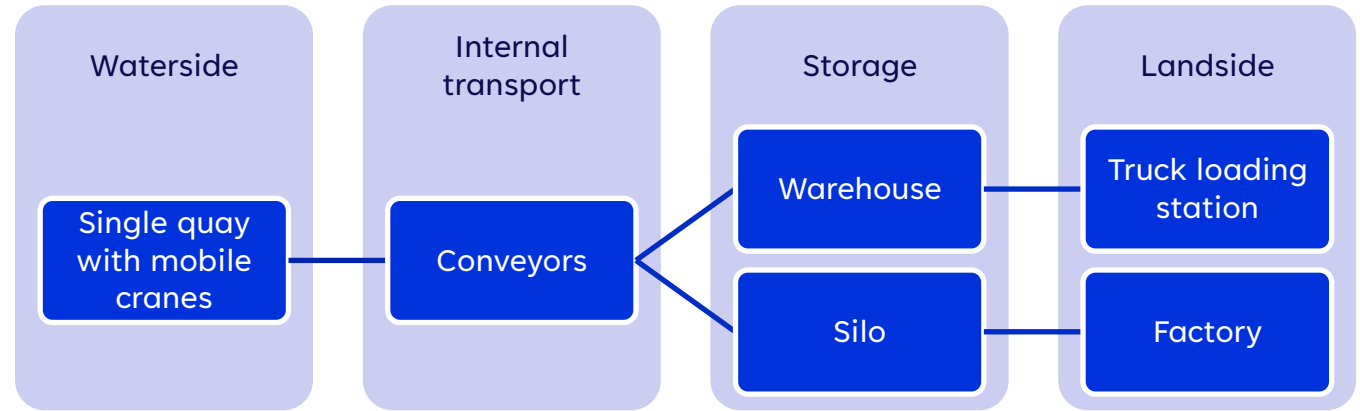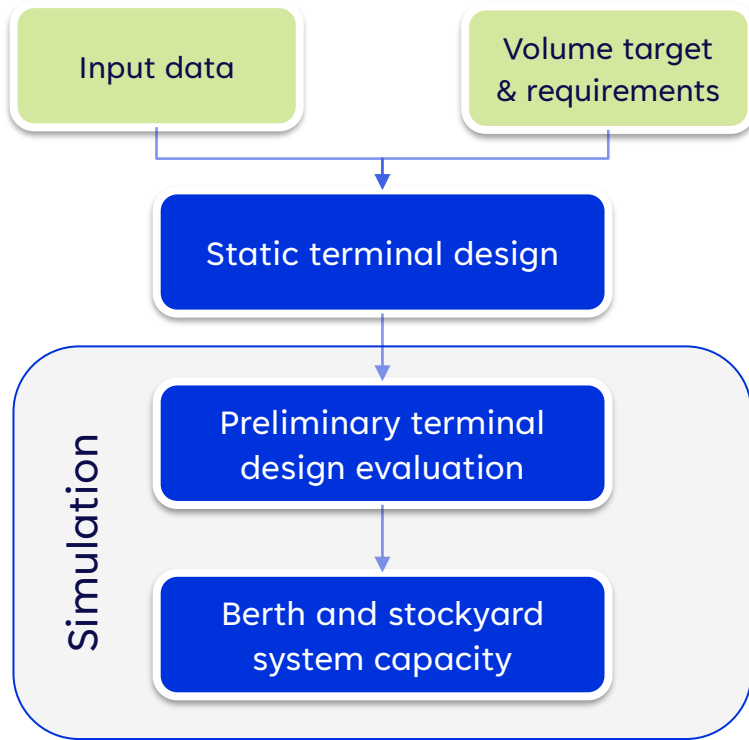 - Grab-crane **|** Internal transport **|** Storage
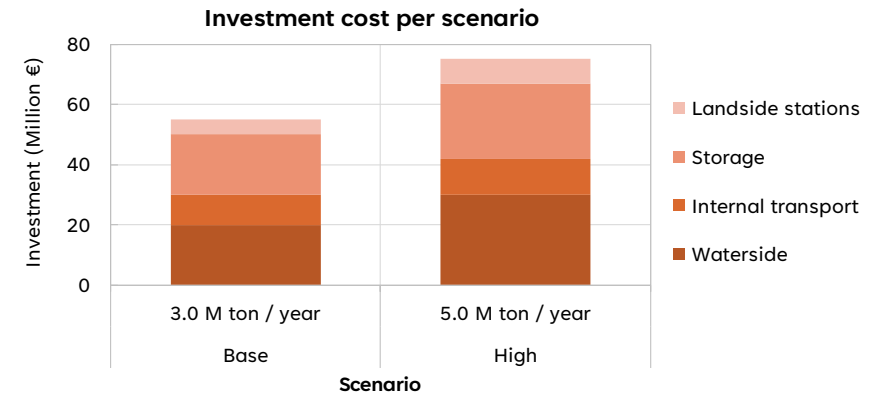
Why and when to start a simulation study
Design and expansion studies

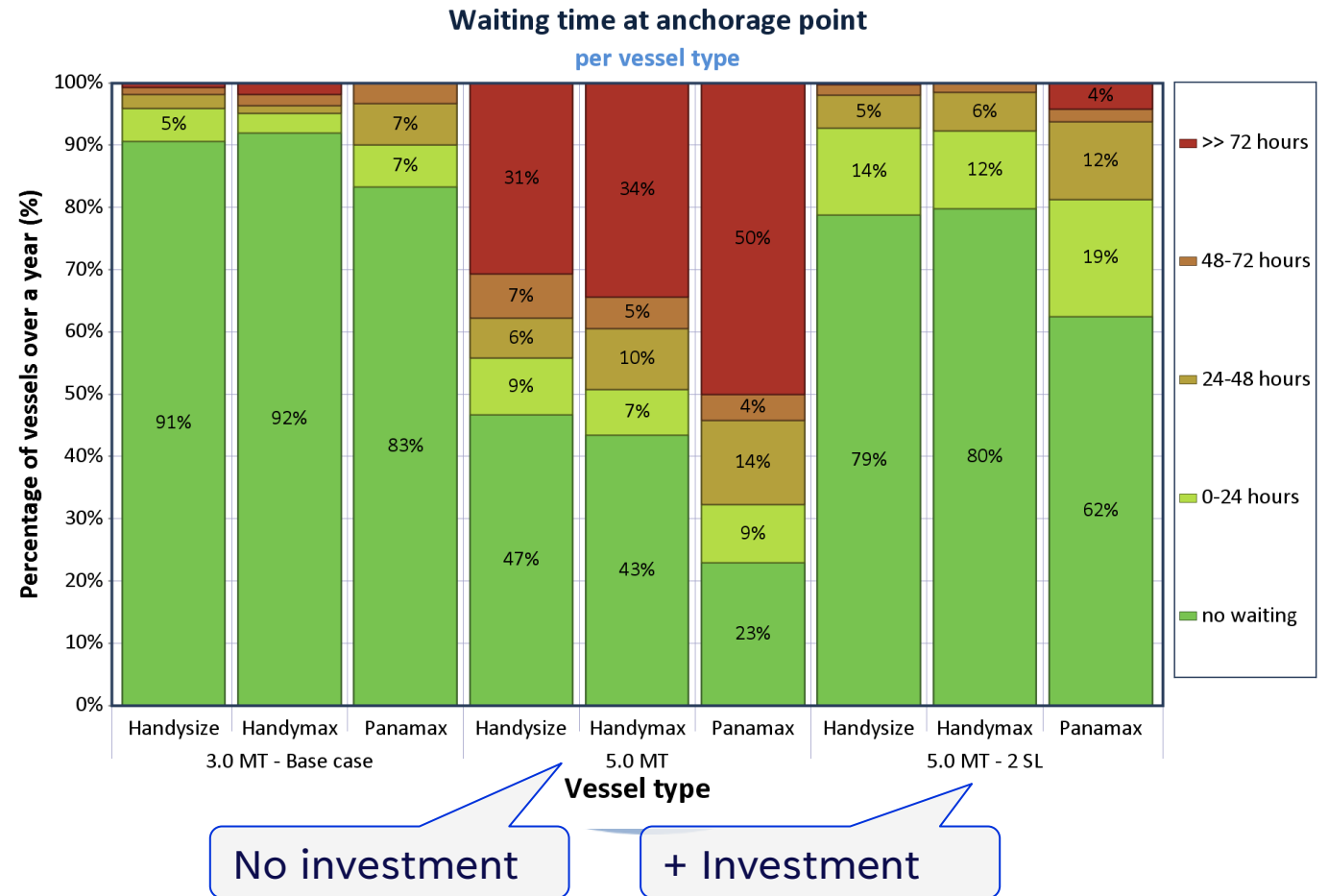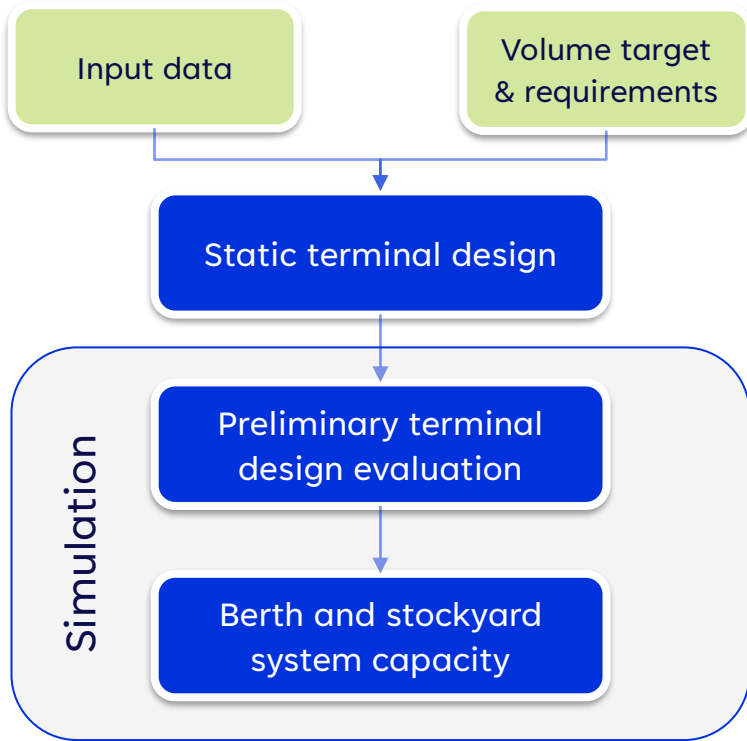### Static terminal design (example)

1. Layout, logistic process, equipment

Input data **Volume target & requirements**

Static terminal design

Simulation

Preliminary terminal design evaluation

Berth and stockyard system capacity

Waterside	Internal transport	Storage	Landside
Single quay with mobile cranes	Conveyors	Warehouse	Truck loading station
		Silo	Factory

2. Investment, technical and operational evaluation

Investment cost per scenario

Investment (Million €)

80
60
40
20
0

3.0 M ton / year — Base

5.0 M ton / year — High

Scenario

- Landside stations
- Storage
- Internal transport
- Waterside

Why and when to start a simulation study
Design and expansion studies

Dynamic simulation (example)

Static terminal design

Preliminary terminal design evaluation

Berth and stockyard system capacity

Input data

Volume target & requirements

Simulation

Waiting time at anchorage point
per vessel type

Legend:
- >> 72 hours
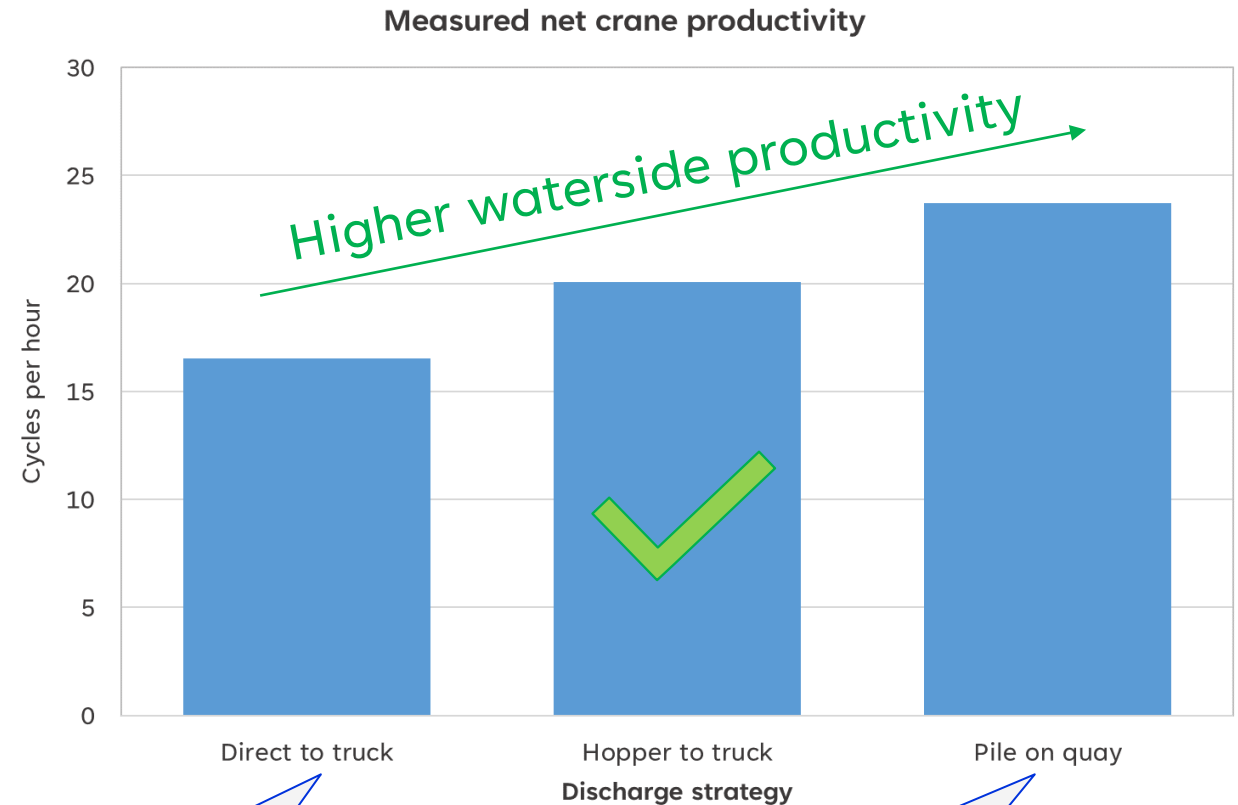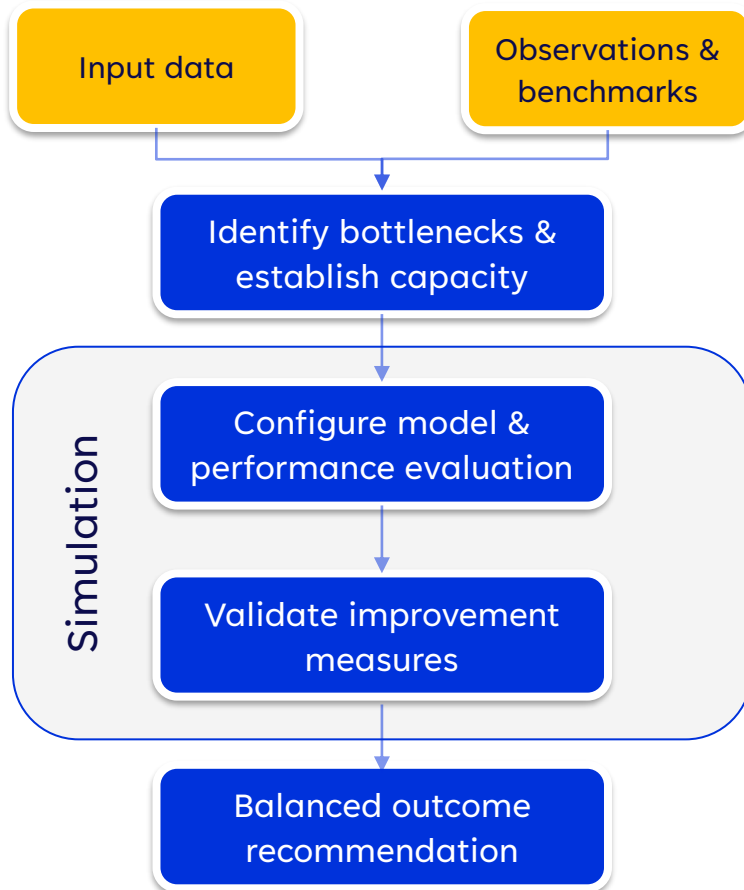- 48-72 hours
- 24-48 hours
- 0-24 hours
- no waiting

No investment

+ Investment

Why and when to start a simulation study
Optimization and debottlenecking studies

Identify bottlenecks (example)

Flow diagram:

- Input data
- Observations & benchmarks

↓

- Identify bottlenecks & establish capacity

Simulation
- Configure model & performance evaluation
- Validate improvement measures

↓

- Balanced outcome recommendation

Chart: Measured net crane productivity

Cycles per hour (0–30)

Discharge strategy: Direct to truck, Hopper to truck, Pile on quay

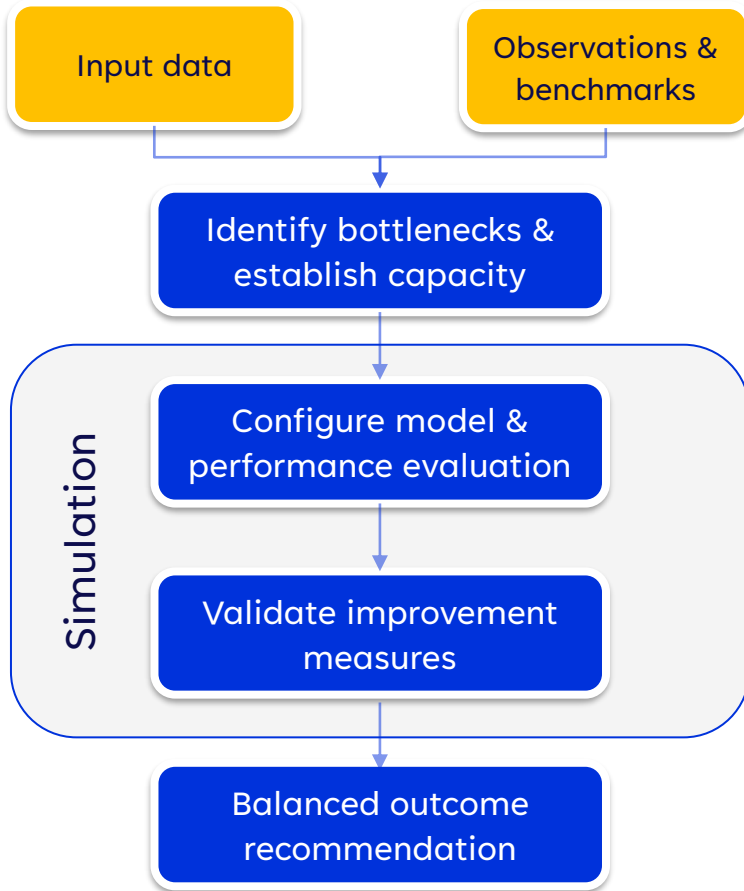*Higher waterside productivity*

Direct to truck:
- Frequent delays
- Low filling rate
- Congestion

Pile on quay:
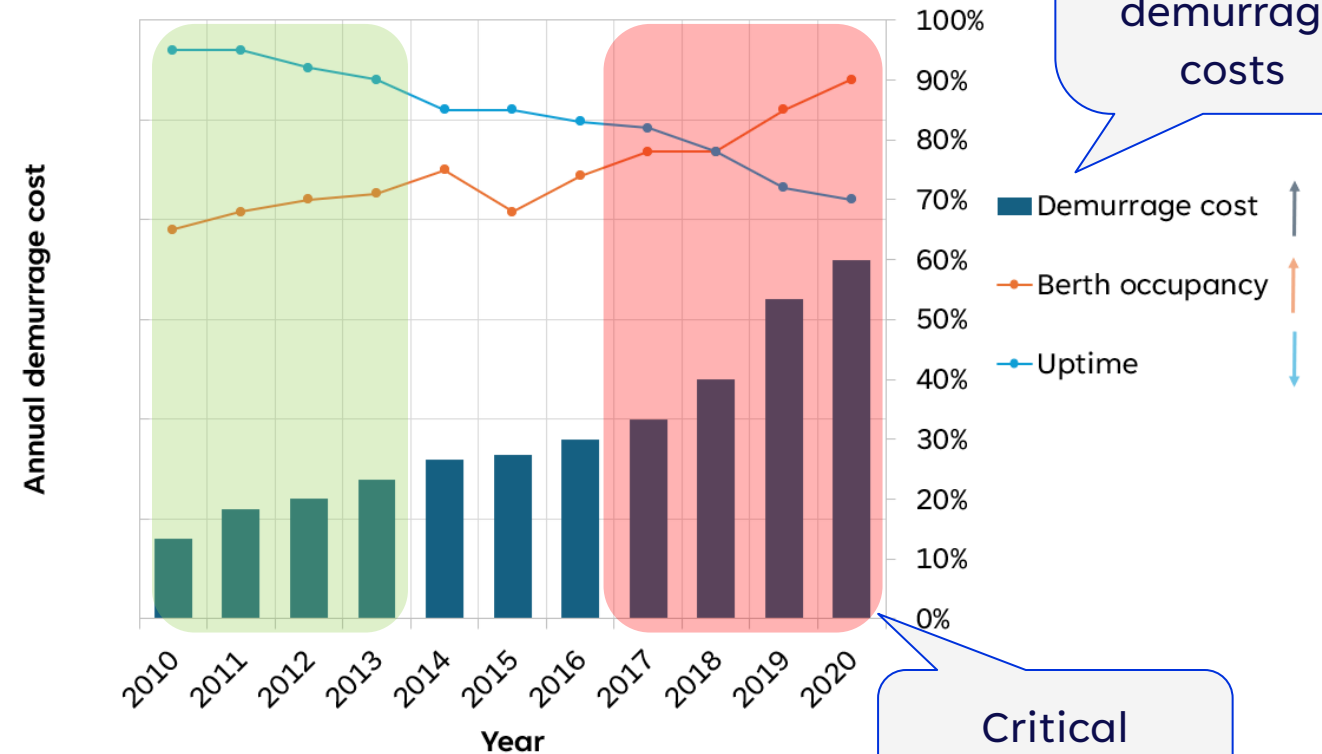- Not possible for weather sensitive cargoes
- Additional handling cost

Why and when to start a simulation study
Optimization and debottlenecking studies

Input data

Observations & benchmarks

Identify bottlenecks & establish capacity

Simulation

Configure model & performance evaluation

Validate improvement measures

Balanced outcome recommendation

Identify bottlenecks
(more complex example)

Demurage, berth occupancy, and downtime

Annual demurrage cost

Year

- Demurrage cost
- Berth occupancy
- Uptime

Problem: Rapid increase in demurrage costs

Critical situation

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Why and when to start a simulation study
Optimization and debottlenecking studies

Dynamic simulation (example)
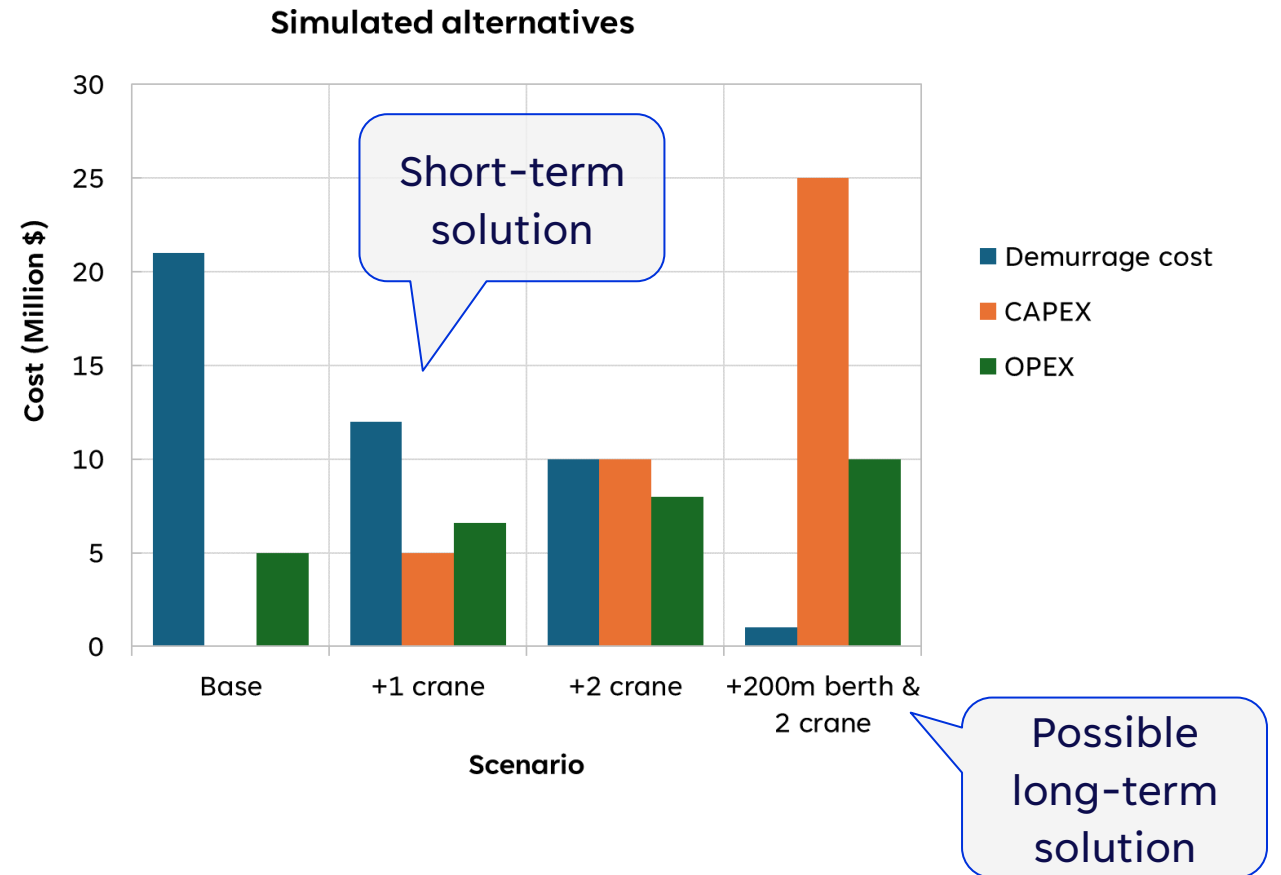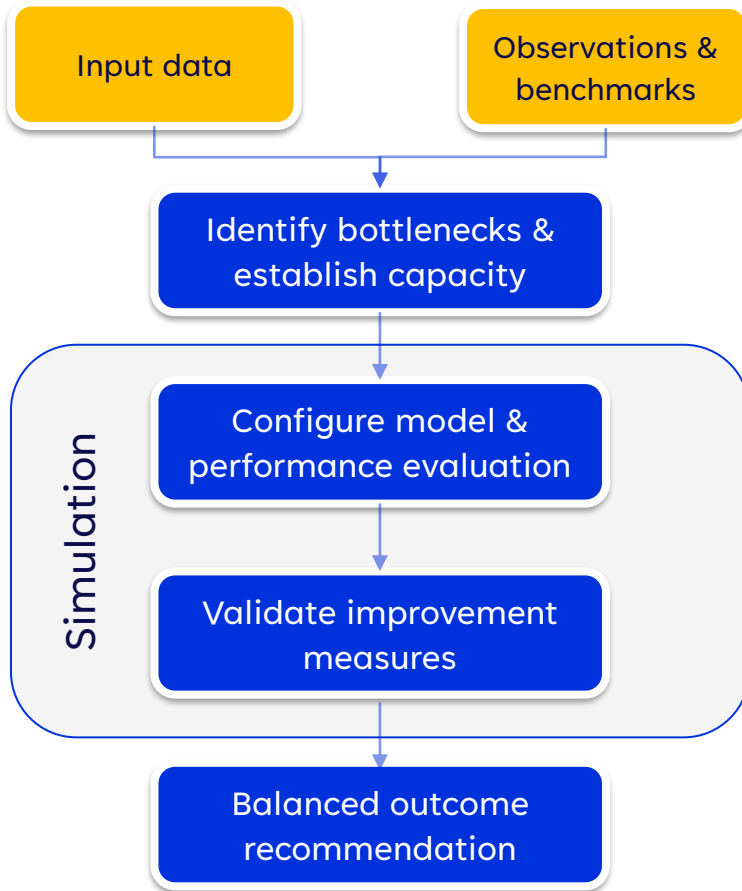
Simulation components – with examples of input and output parameters

Vessels
Schedule, call size, cargo, RTA, draft

Berth
Length, crane ranges, mooring rules
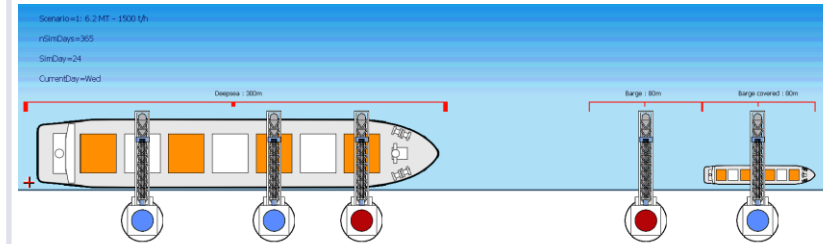
Equipment
Cranes, productivity per cargo, maintenance

Operators
Gang size, shifts, breaks

Environment
Tide constraint, weather stoppage

Planning
Crane and operator deployment, service levels, priority of vessels

Berth simulation (dry bulk)

Vessels
Service time, waiting time, demurrage cost

Berth
Occupancy per berth, realized schedule

Equipment
Working hours, efficiency

Operators
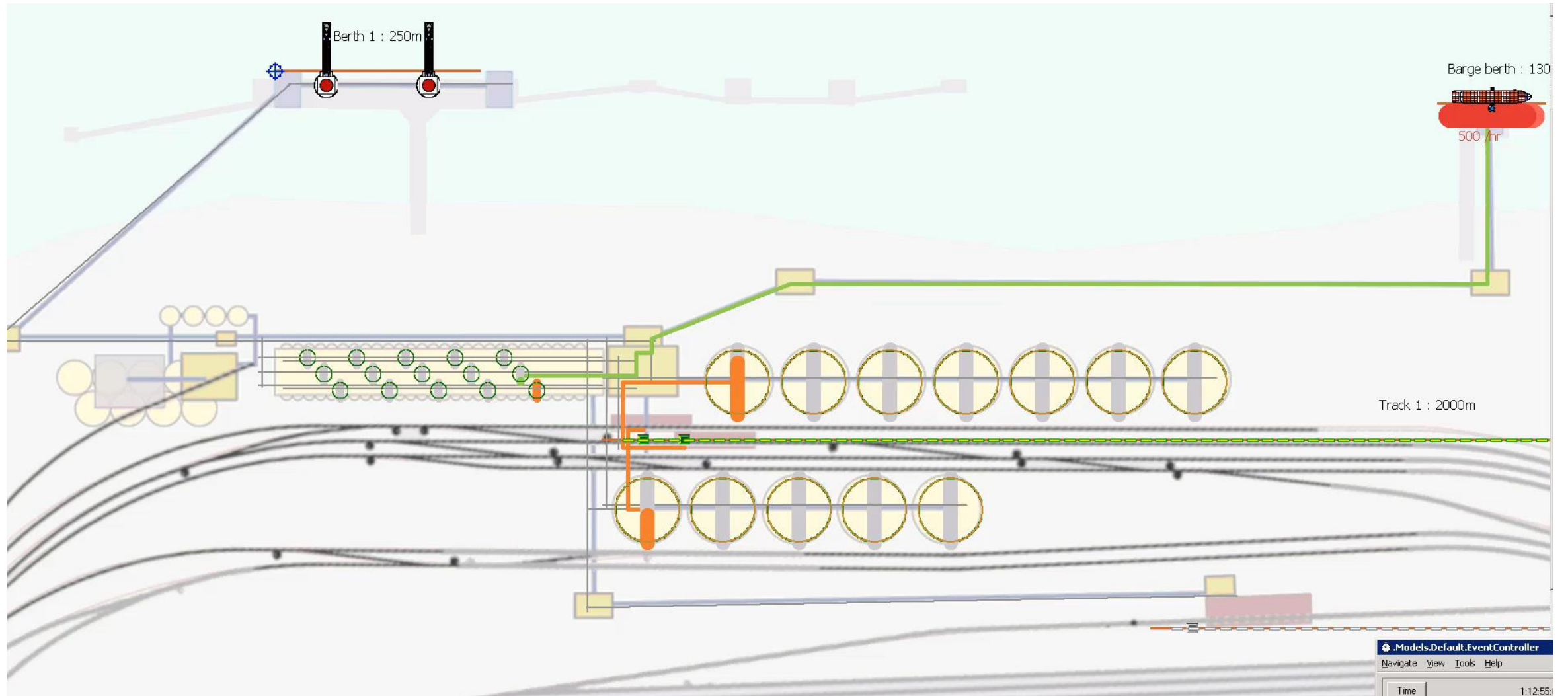Working hours, required operators per shift
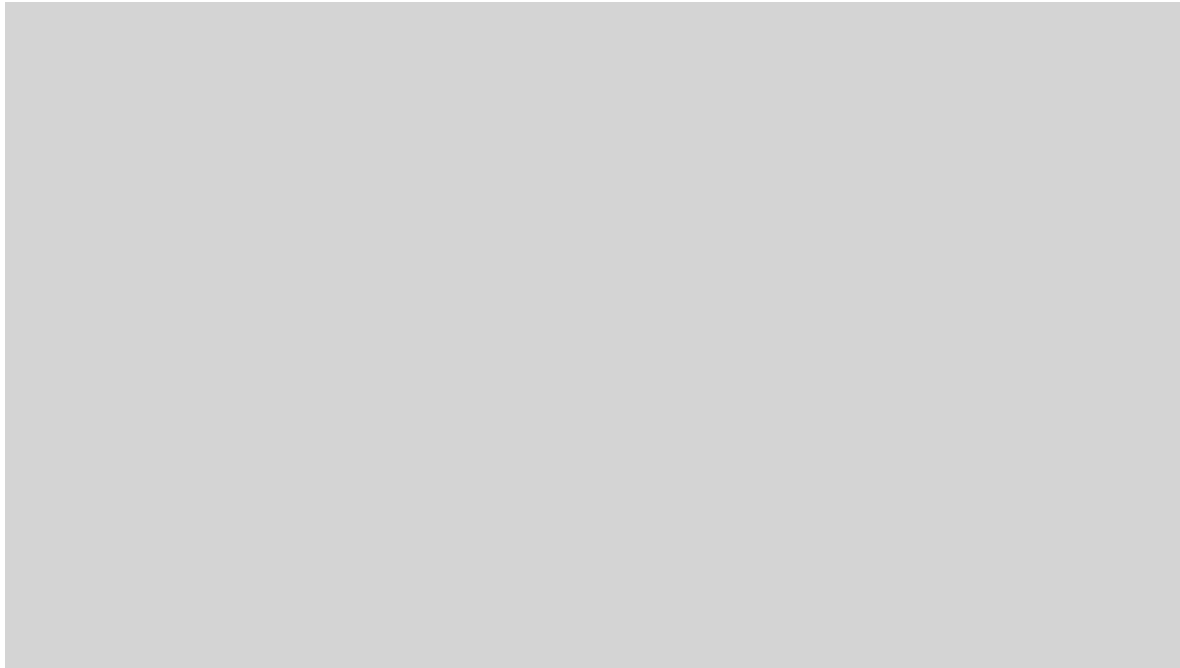
Environment
Energy consumption

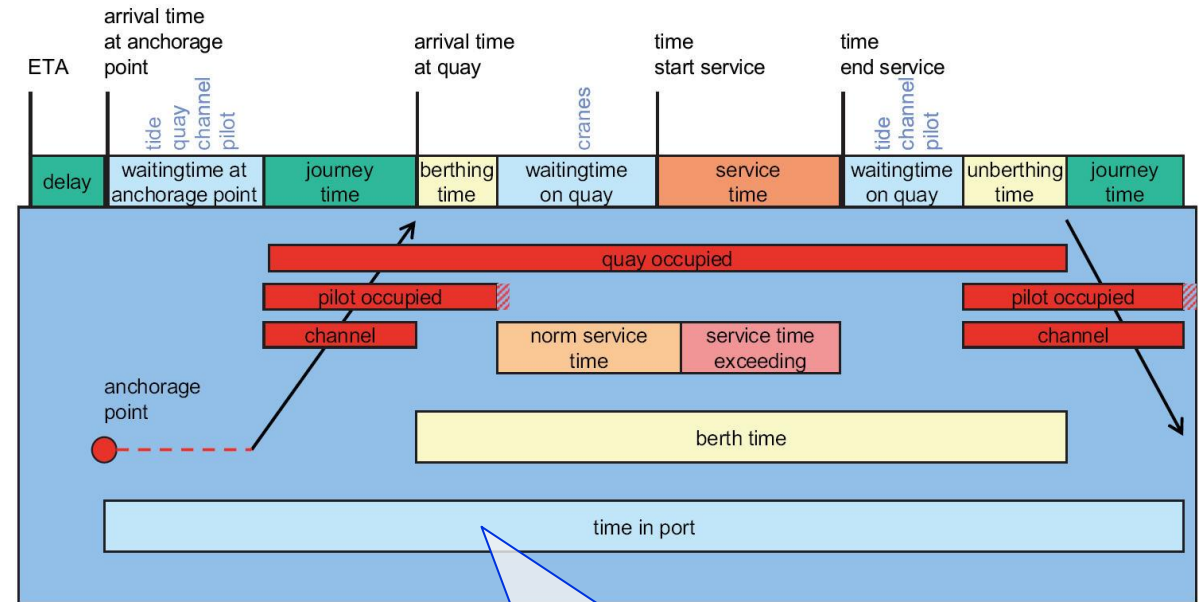**Planning**
Deployment frequency, workload distribution

2D simulation model integrates major parts, incl. trucks, storage, conveyors, (un)loaders of a bulk terminal
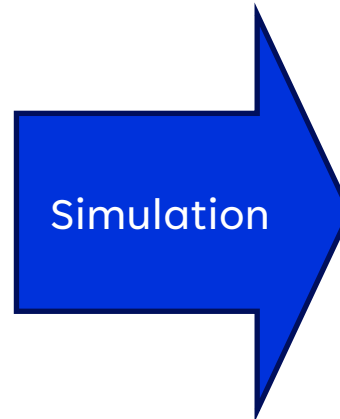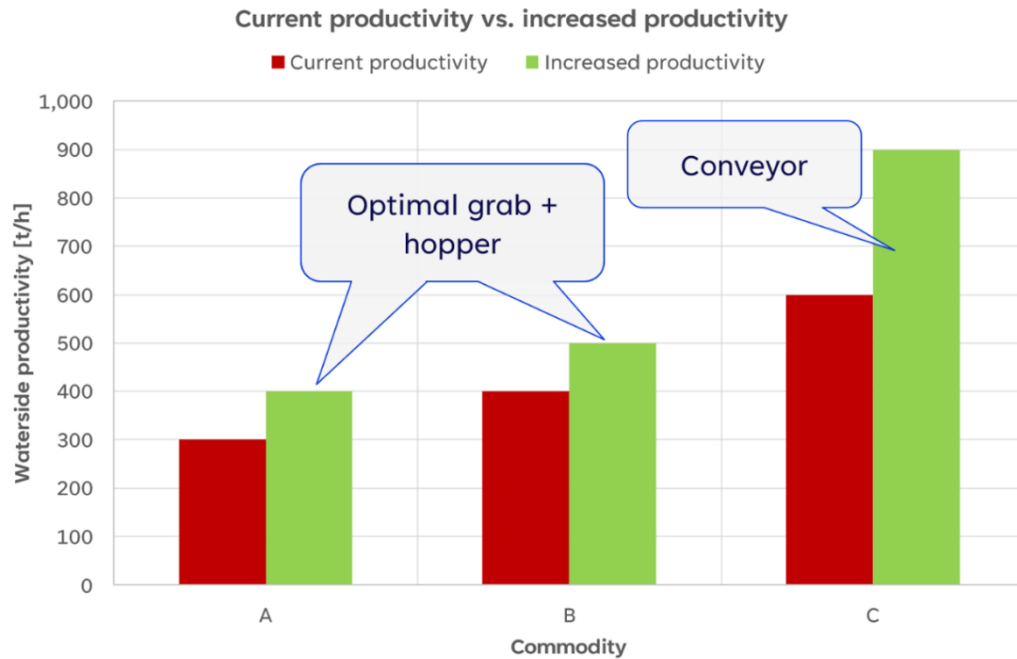
Realistic vessel process → Realistic KPIs
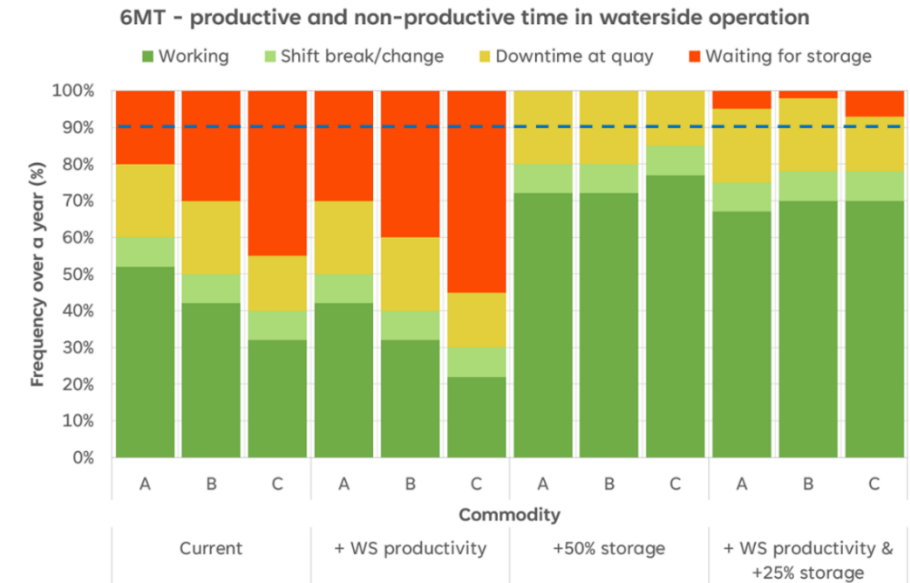

Video: Unloading operation

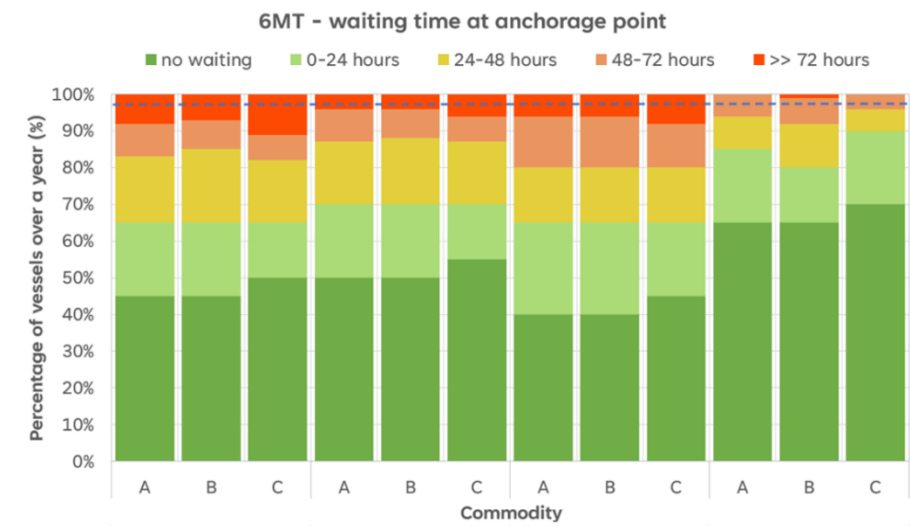Ship owner and terminal operator have different perspectives

Case study: Increasing volume 4.0 → 6.0MT Equipment & bulk terminal simulation

- Improvements must be made in an integrated way, considering waterside, internal transport, and storage operations.
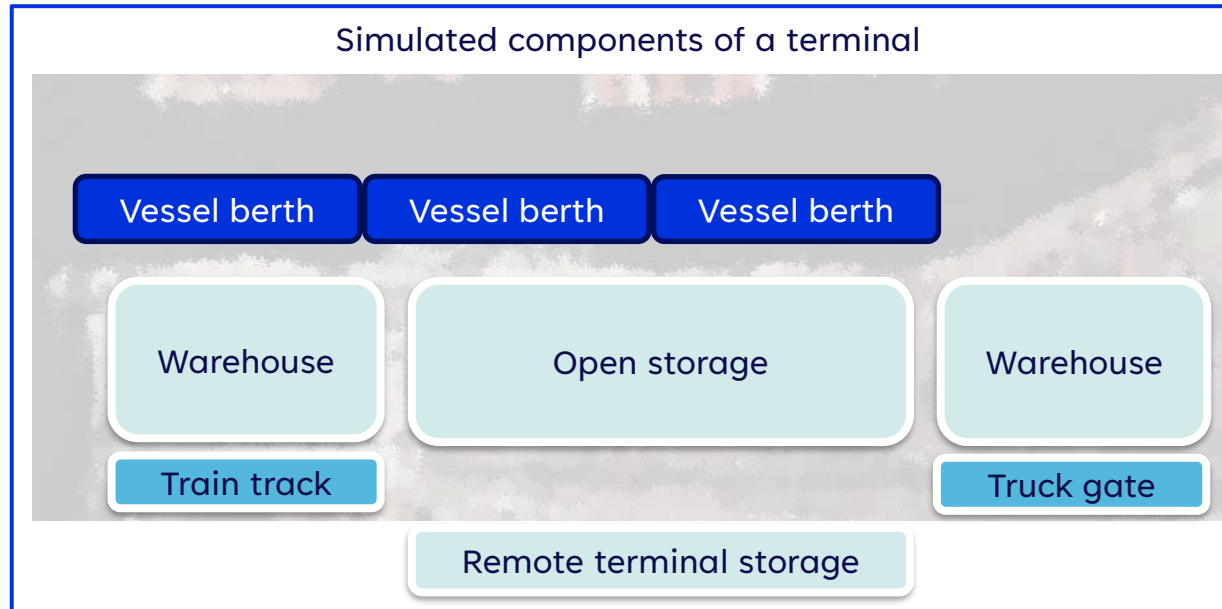
Real-world example
100% increase in throughput, using the same quay

Type: Import
Cargo: Various
Size: 4.0 MT

- Identified bottlenecks → Observation, data analysis, simulation
- Crane-grab systems → Upgrade to optimum equipment
- Delays of internal transport → Proper maintained hoppers, larger trucks
- Storage issues → Design additional storage capacity
- Validated improvements through simulation

Simulated components of a terminal

| Vessel berth | Vessel berth | Vessel berth |

| Warehouse | Open storage | Warehouse |

| Train track | | Truck gate |

Remote terminal storage

Outside terminal

Landside transport to customer per commodity

Flows

Vessels

Trucks

Trains

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Challenges for bulk terminal simulation studies

Data

Data

Data

Data

Automated solutions

Solutions

Accuracy and quality of data → TOS

Observation & measurements

Previous projects, calculation, detailed simulation

Data synchronization →Keep connected to real operation

Limited solutions compared to other terminal types, so …
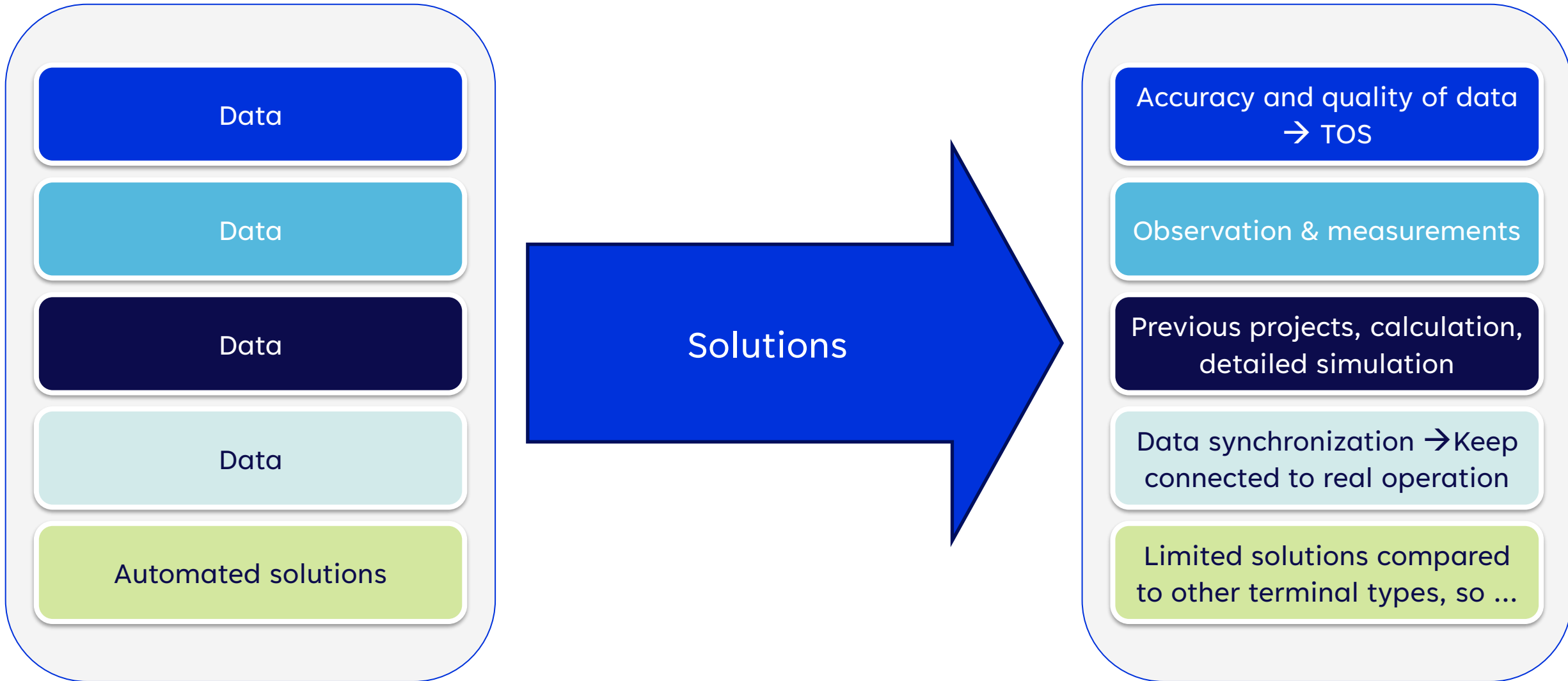
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