



PIANC ANZ NORTHERN CHAPTER

PLANNING FOR AUTOMATION OF CONTAINER TERMINALS

Speakers:

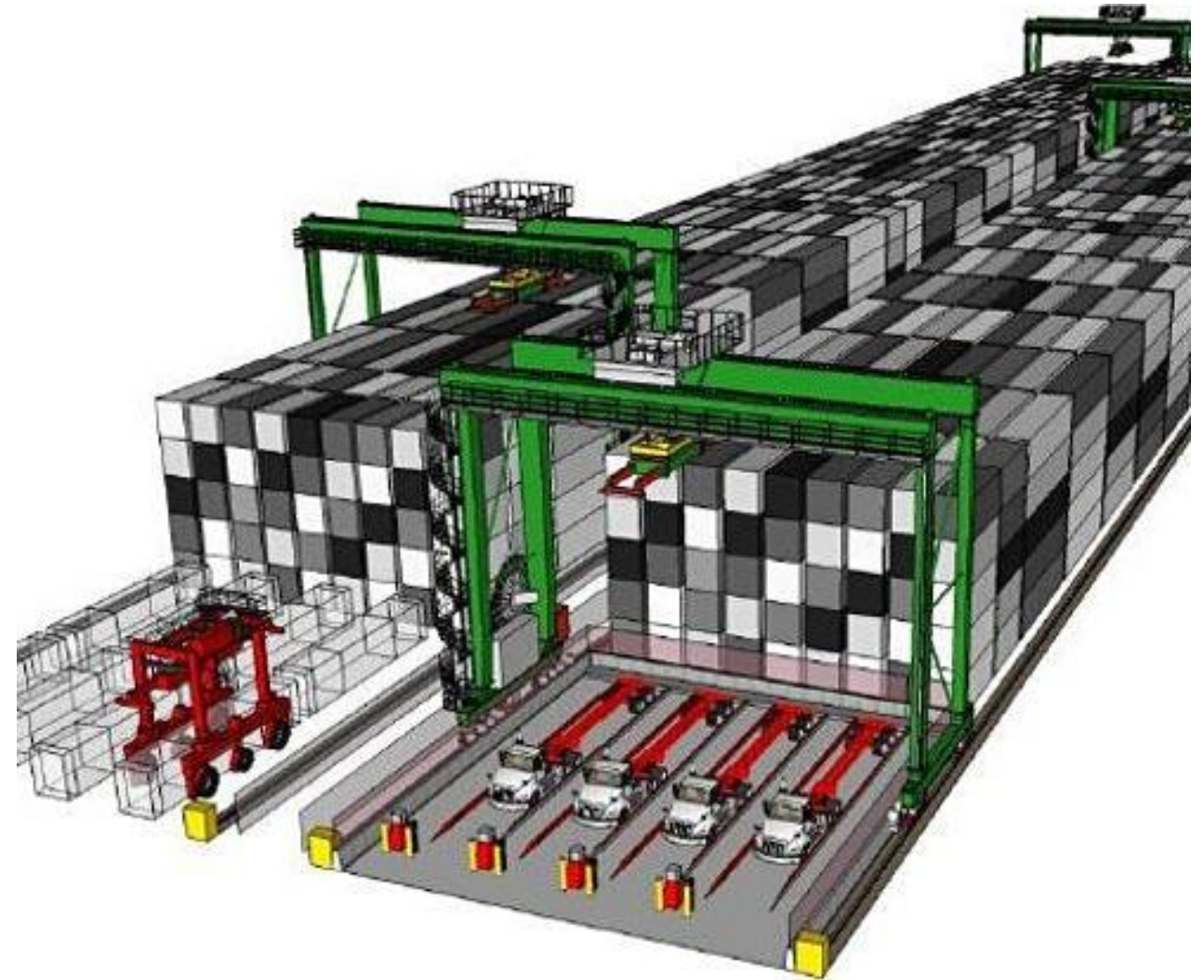
Tom Ward - WSP US

Tom Crawford-Condle - WSP Australia

Carsten Varming - NSW Ports

Michael Houen - Hatch

28 July 2021

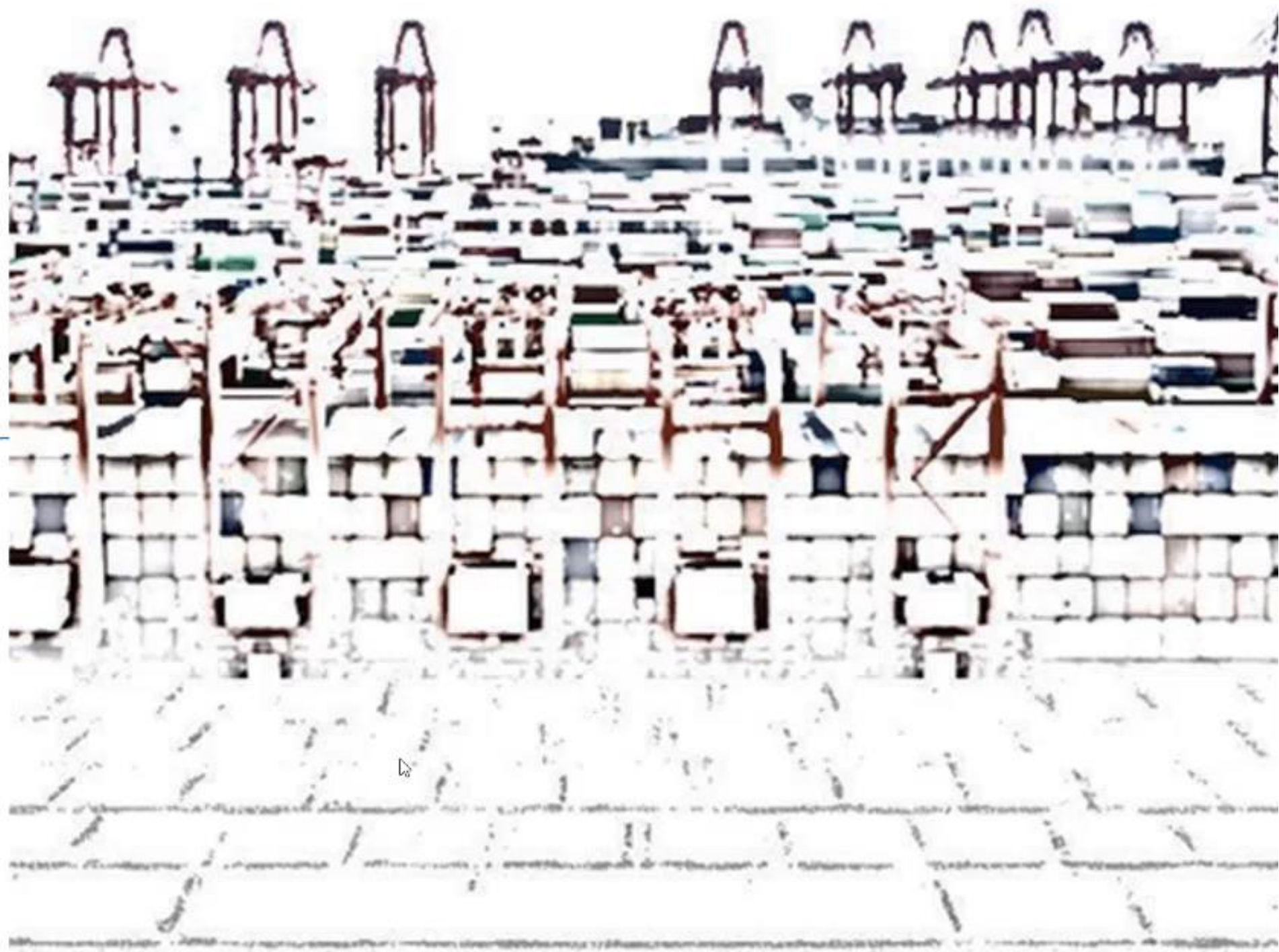




PIANC MARITIME COMMISSION WORKING GROUP 208

**Planning of Automated
Container Terminals**

July, 2021



GOALS & OUTLINE

❖ **Provide guidance to owners, operators and designers of container terminals worldwide, in order to provide safe, clean and cost-effective operation of the automated terminals.**

❖ **Chapters:**

1. General Aspects
2. Semi-Automated and Automated Terminals
3. Developing a Business Case for Automation
4. Planning for Automation
5. Integration
6. Engineering, Implementation, and Operation
7. Conclusions

Appendices: References, Terms, Glossary, Simulation, Survey, Inventory



WORKING GROUP 208

| Name | Company | Country |
|---|---|-----------|
| Ron Heffron <i>Commission Mentor</i> | COWI | USA |
| Ashebir Jacob <i>Chair, Ch.1 & 7 Lead</i> | Moffatt & Nichol | USA |
| Juan-Manuel Suárez <i>Vice Chair</i> | PortEco | Spain |
| Joost Achterkamp | Solid Port Solutions - SPS | NL |
| Daniel Allport | AECOM | UK |
| Peter Beamish | Royal HaskoningDHV | UK |
| Tom Crawford-Condle | WSP | Australia |
| Rafael Escutia | Port Insight Consulting | Spain |
| Madoka Ikemachi | JACMS | Japan |
| Felix Kasiske | HPC Hamburg Port Consulting GmbH | Germany |
| Jan Kees Krom | Royal HaskoningDHV | NL |
| Yoss Leclerc | Port Quebec | Canada |
| Nils Meyer-Larsen | ISL - Institute of Shipping Economics and Logistics | Germany |

| Name | Company | Country |
|--|--------------------------------------|-----------|
| Kenji Ono | Kobe-Osaka International Corporation | Japan |
| Dimitrios Pachakis <i>Ch. 4 Lead</i> | COWI | UK |
| Ben-Jaap Pielage <i>Ch. 3 Lead</i> | Witteveen+Bos | NL |
| Pekka Ranta | Total Terminals International | USA |
| Holger Schuett | Akquinet port consulting GmbH | Germany |
| Remmelt Thijs | TBA | NL |
| Carsten Varming <i>Ch. 6 Lead</i> | NSW Ports | Australia |
| Bart Vermeer | Moffatt & Nichol | USA |
| Pedro Vila | SENER | Spain |
| Thomas Ward <i>Ch. 2 Lead</i> | WSP | USA |
| Sylvia Wong <i>Ch. 5 Lead</i> | Hatch | Canada |
| Muneo Yoshie | Port and Airport Research Institute | Japan |



CORRESPONDING MEMBERS

| Name | Company |
|--------------------|-------------------------------|
| Ikka Annala | Kalmar |
| Alexandru Duca | APM Terminals |
| Jan Cuppens | DPW |
| Stephen E. Edwards | TraPac |
| Darren Honaker | TMEIC |
| Michael Houen | Patrick Terminals |
| Petar Karaivanov | Pema |
| Walter Leiler | Kuenz |
| Jorge Martin | HSSE Manager |
| Brendan McDonnell | Patrick Terminals |
| Amine Nebri | Long Beach Container Terminal |

| Name | Company |
|-----------------|---|
| Anthony Otto | Long Beach Container Terminal |
| Xavier Pascual | Global Ports Director, SENER |
| Scott Peoples | Navis |
| Oscar Pernia | Terminal Investment Limited |
| Pekka Ranta | Total Terminal International, LLC |
| Vikram Sharma | Retired as CEO, Terminal Investment Limited |
| Jussi Suhonen | Konecranes |
| Todd Tatterson | Tideworks |
| Marcel van Lith | Siemens |
| Haisheng Yang | ZPMC |



CONTEXT

- ❖ Automation is a moving target
- ❖ The Report presents the State of the Art and Craft, *as of the time of its writing*
- ❖ The Report does not focus on prospective, experimental, or prototype technologies
- ❖ The Report will likely be updated as new machines, technologies, systems, and approaches are proven
- ❖ Kickoff: January 31, 2019
- ❖ Structure: March 7, 2019
- ❖ 70%: December 3, 2019
- ❖ 90%: February 13, 2020
- ❖ 95%: March 19, 2020
- ❖ 100%: May 7, 2020
- ❖ Feedback: July 16, 2020
- ❖ To MarCom: September 18, 2020
- ❖ Closeout: October 1, 2020
- ❖ Publication: December 1, 2020



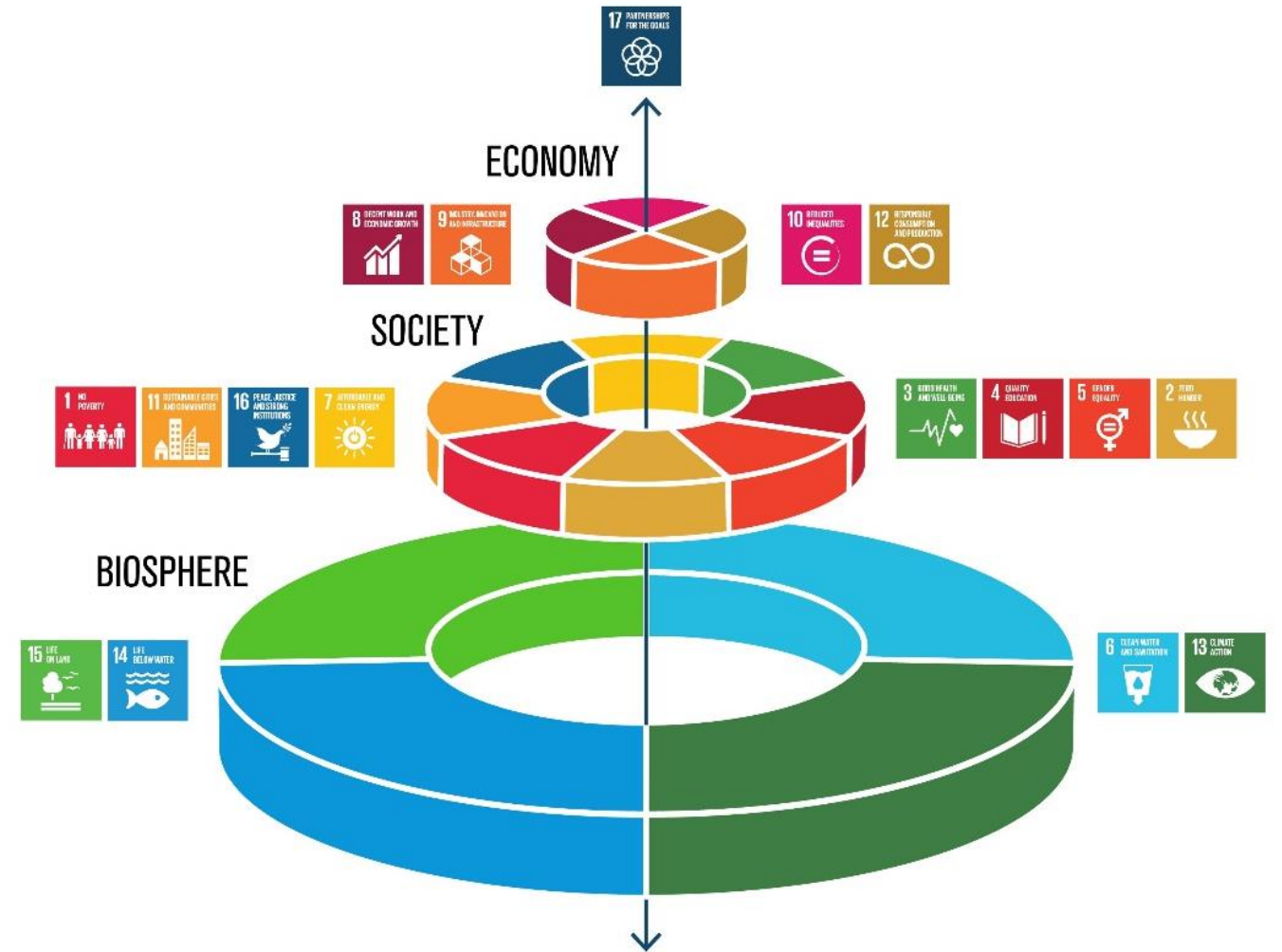
1 - GENERAL ASPECTS

1.1 Scope

1.2 Members

1.3 Meetings

1.4 The Report at a Glance



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SUSTAINABLE DEVELOPMENT GOALS

- ❖ **SDG 7**
Affordable and Clean Energy
- ❖ **SDG 9**
Industry, Innovation & Infrastructure
- ❖ **SDG 11**
Sustainable cities and communities
- ❖ **SDG 12**
Responsible production and consumption
- ❖ **SDG 13**
Climate Action
- ❖ **SDG 17**
Partnership for the goals
- ❖ **Automation provides an opportunity for:**
 - Electrification
 - Gradual transition towards greener energy sources
 - Reduction of emissions

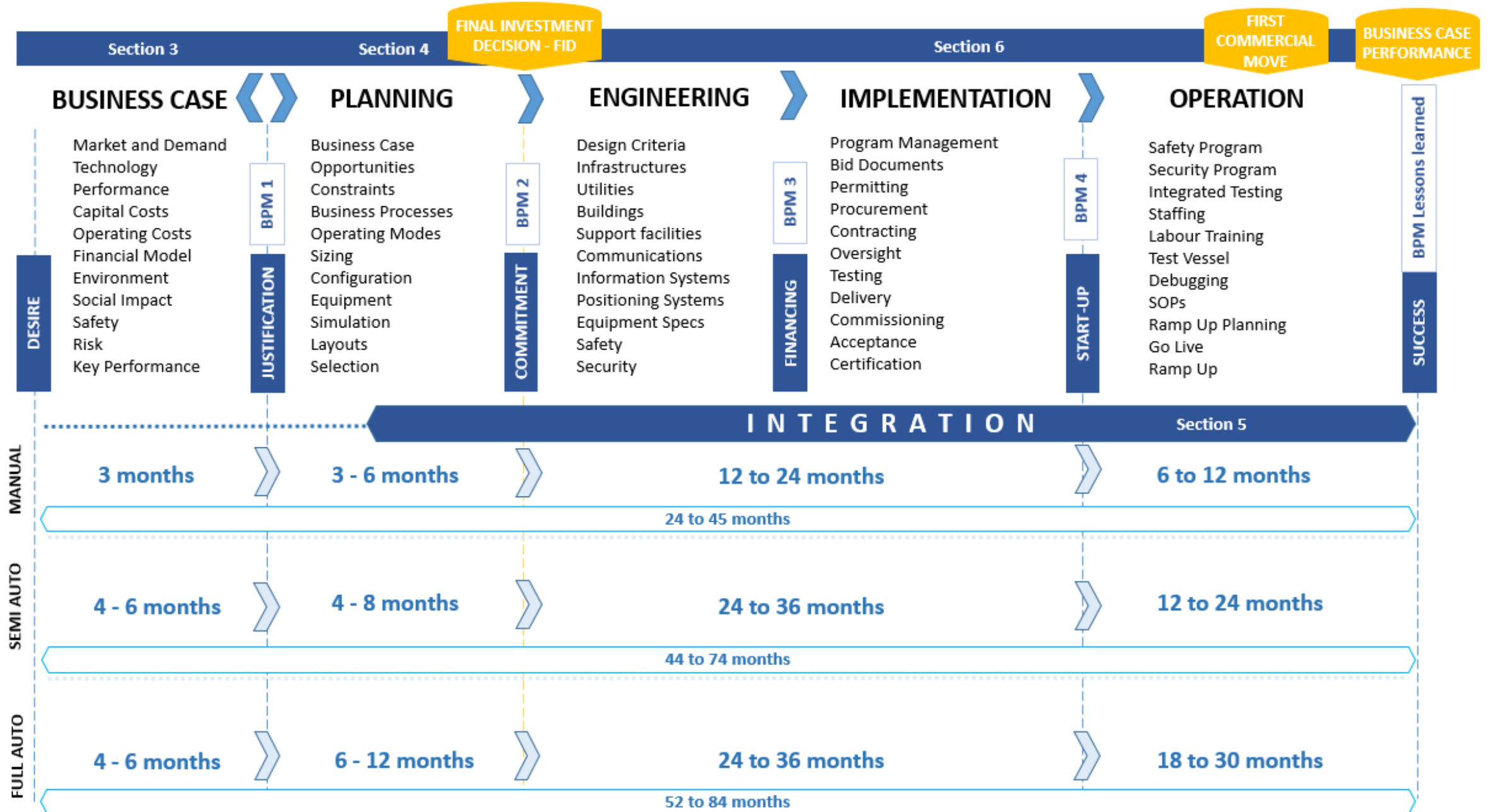


FRAMEWORK

- ❖ **Ports handle ~90% of global trade, by tonnage**
- ❖ **Ports are under steady pressure to increase capacity**
- ❖ **Ports are constantly responding to maritime evolution**
- ❖ **The container trade is crucial, complex, and lucrative**
- ❖ **Port competition is high and infrastructure is capital intensive**
- ❖ **Port development must consider:**
 - Geographical location
 - Natural competitive advantages
 - Maritime access
 - Supply chain strength
 - Infrastructure quality
 - Technological competitiveness
 - Trained and skilled labour



DEVELOPMENT PHASES & TIMELINE



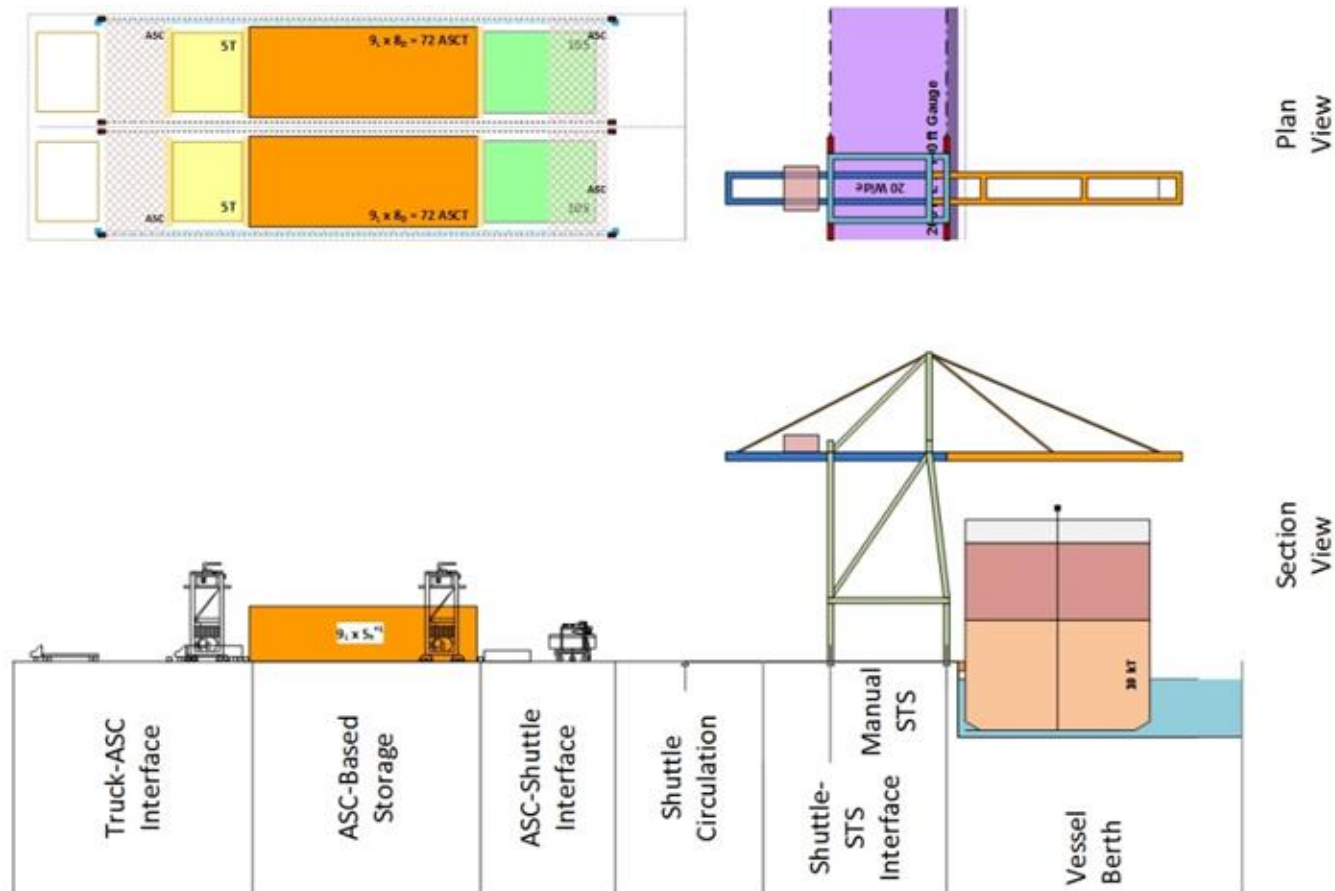
2 - SEMI-AUTOMATED & AUTOMATED TERMINALS

2.1 Definitions

2.2 Replacement and New-build

2.3 Key Elements of Automated Systems

2.4 Proven Concepts



2.1 DEFINITIONS

Key Definitions

❖ Automation

- At a machine level, the technology by which a process or procedure is performed *without* human assistance.

❖ Semi-Automation

- At a machine level, automation that requires *intermittent* human assistance.

❖ Remote Control

❖ Semi-Automated Terminal

- Storage and retrieval

❖ Fully Automated Terminal

- Storage, retrieval AND transport

Report Terminology

❖ Crane

- Raising, shifting, lower

❖ Transporter

- Moving from place to place

❖ Crane Automation

❖ Transport Automation

❖ Crane / Transport Interface

❖ Interface Automation



2.2 REPLACEMENT AND NEW-BUILD

Replacement

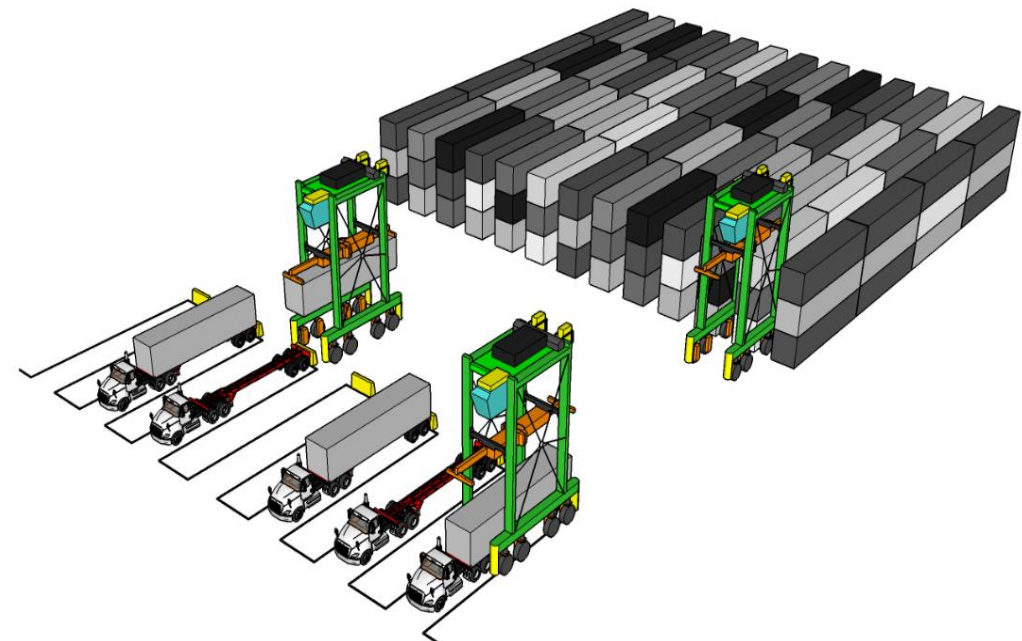
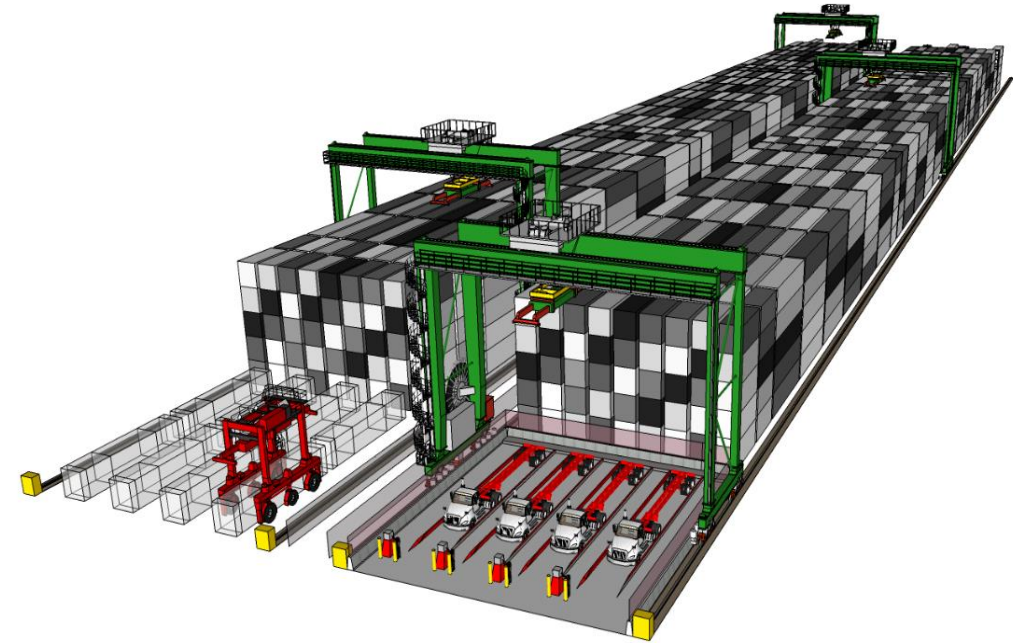
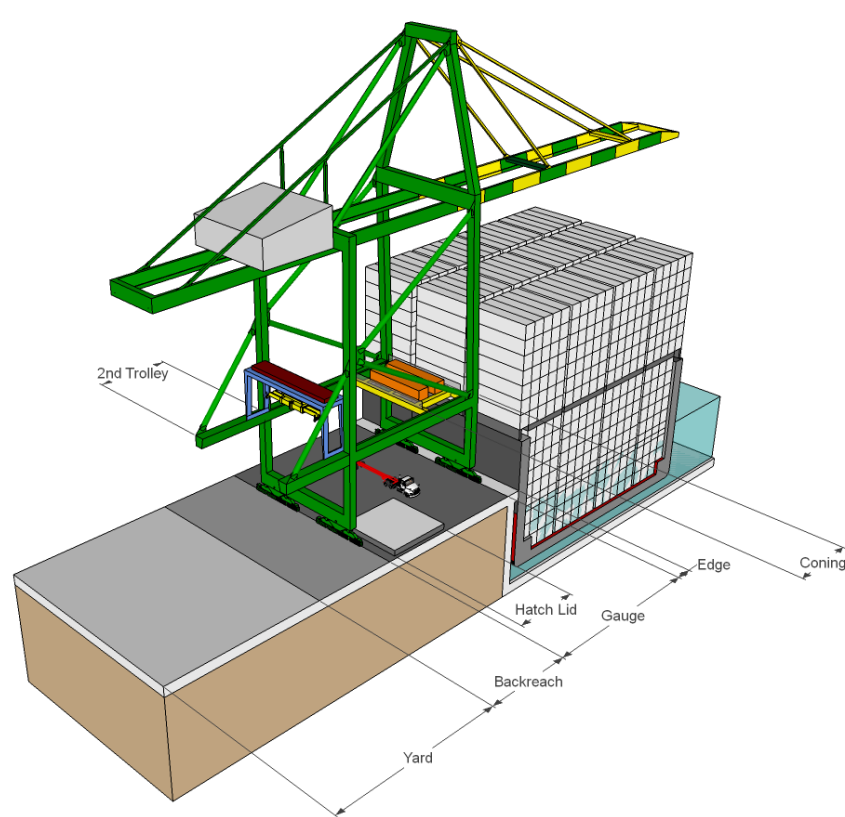
- ❖ **Replace an existing port operation**
 - Reducing its capacity and associated revenues during the development process
- ❖ **Existing container ports involved replacement development in existing harbours, port facilities and landward settings**

New-Build

- ❖ **Largely or entirely on existing land that is not currently used for port operation**
 - Capacity and associated revenues are *not* reduced during the development process.
- ❖ **Many of the world's existing automated terminals involved new-build development**



2.3 KEY ELEMENTS OF AUTOMATED SYSTEMS



- ❖ Quay Cranes
- ❖ Yard Cranes
- ❖ Transporters
- ❖ Interfaces

2.3 KEY ELEMENTS OF AUTOMATED SYSTEMS

Positioning

- ❖ GPS
- ❖ Differential GPS
- ❖ RF Positioning
- ❖ Inertial Navigation
- ❖ Ground Transponder
- ❖ Radar Navigation
- ❖ Laser Range Finders
- ❖ Ground Loops
- ❖ Registration Monuments

Machine

- ❖ Machine Telemetry
- ❖ Limit Switches
- ❖ Shaft Encoders
- ❖ Proximity Detectors
- ❖ RF Identification
- ❖ OCR
- ❖ Intelligent Cameras
- ❖ Bar Code Readers



2.3 KEY ELEMENTS OF AUTOMATED SYSTEMS

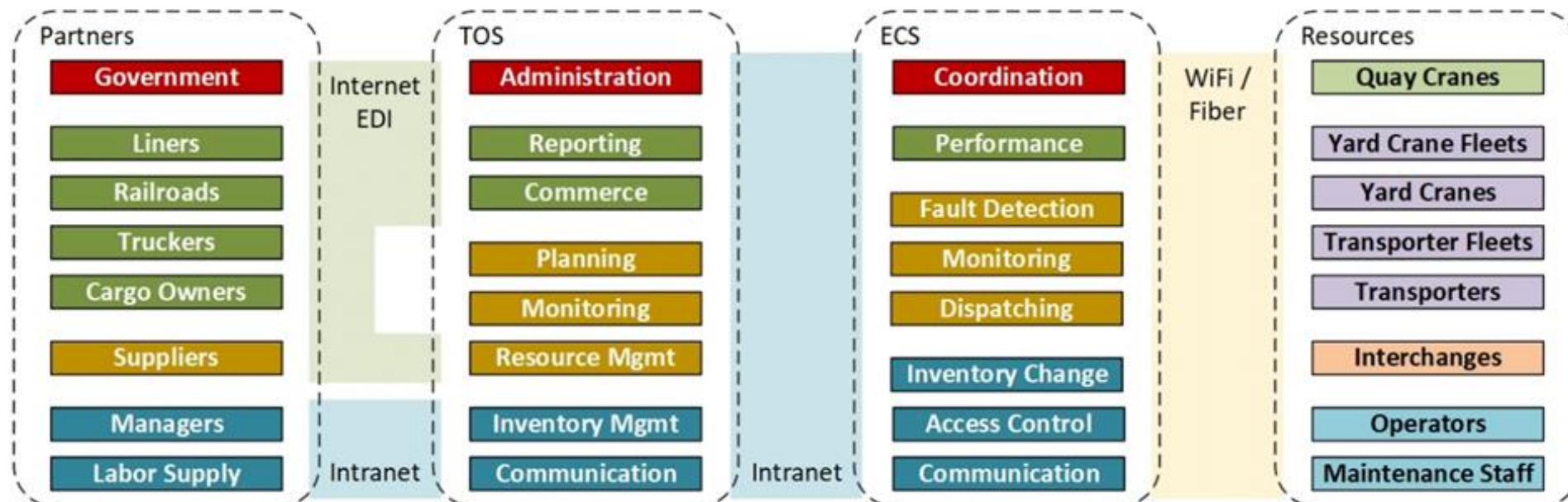
❖ Terminal:

- Inventory management
- Equipment condition
- Data center
- Data transmission
- Cyber Security

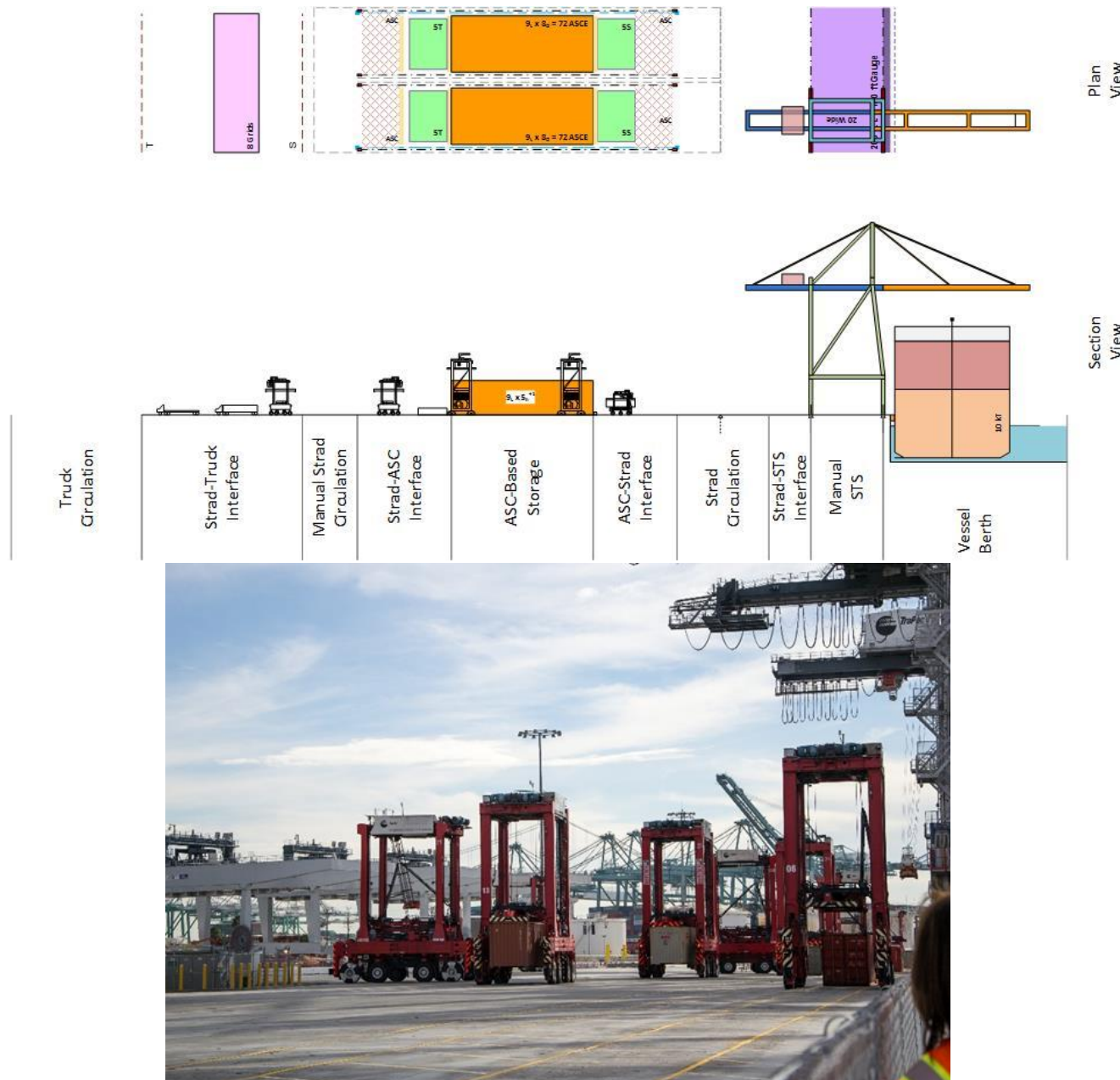
❖ Infrastructure:

- Wharf and apron
- Pavement and drainage
- Electrical network
- Lighting
- Fire protection
- Buildings

❖ Terminal Operating and Equipment Control Systems



2.4 PROVEN CONCEPTS



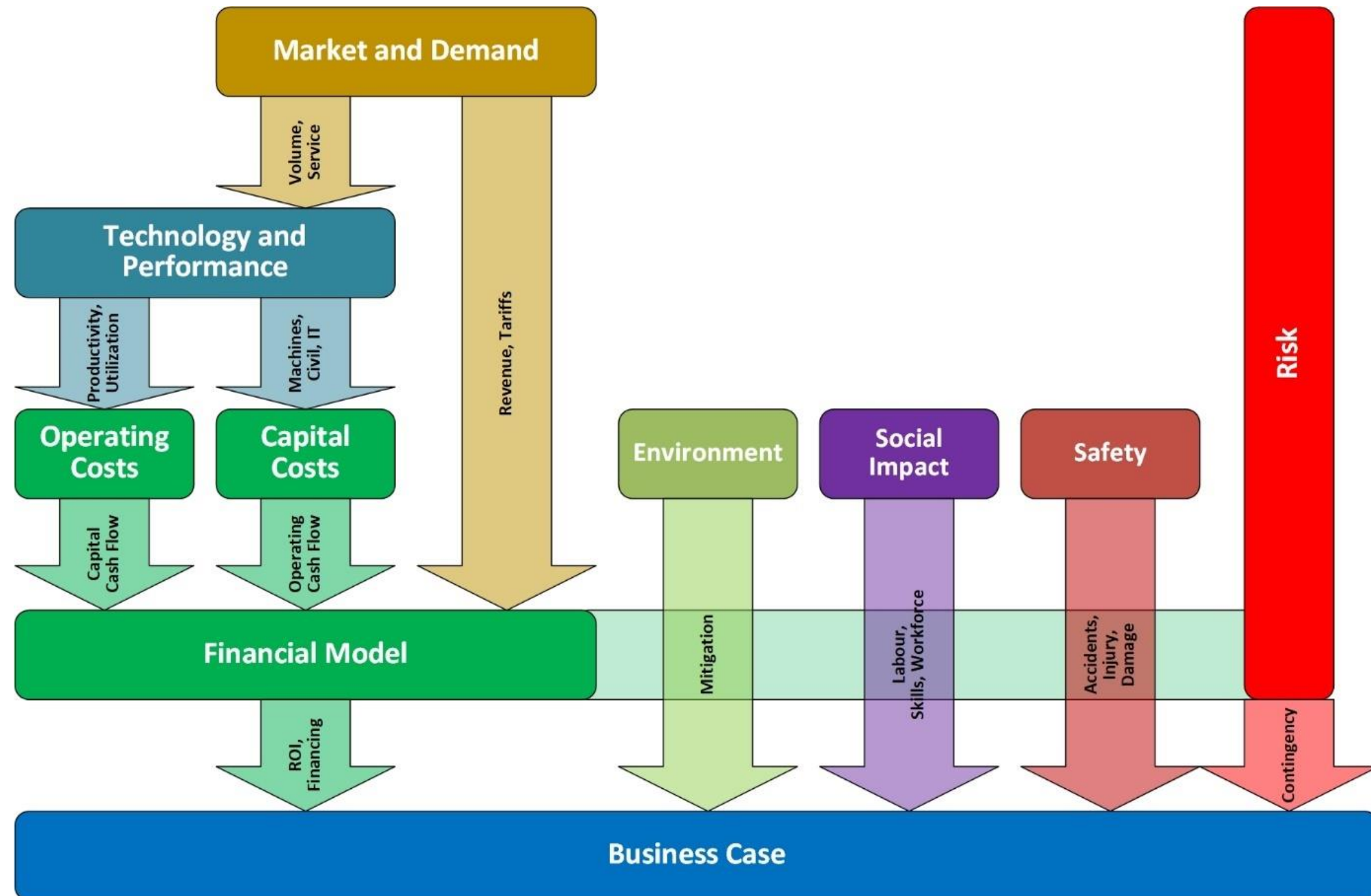
- ❖ **Manual**
 - Wheeled
 - RTG / FEL
 - Strad
 - CRMG
- ❖ **Semi-Automated**
 - ASC / Manual Shuttle
 - CRMG / Manual Truck
- ❖ **Fully Automated**
 - ASC / Auto Shuttle
 - ASC / AGV
 - Auto Strad
 - High Bay AS/RS
- ❖ **Less Common**
 - Automated RTG

3 - THE BUSINESS CASE

- 3.1 Introduction**
- 3.2 Market and Demand**
- 3.3 Technology and Performance**
- 3.4 Capital and Operating Costs**
- 3.5 Financial Model**
- 3.6 Environmental**
- 3.7 Social Impact**
- 3.8 Safety**
- 3.9 Risk**
- 3.10 The Business Case**



3.1 INTRODUCTION



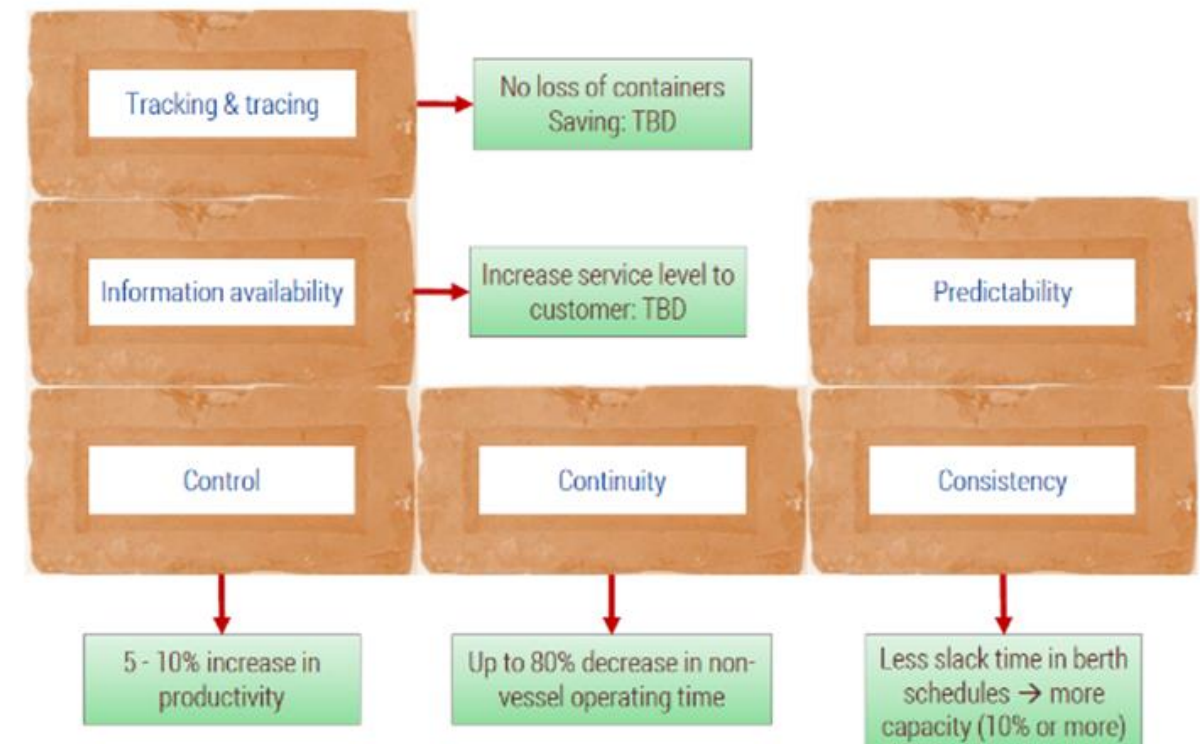
3.2 MARKET AND DEMAND

- ❖ Economic performance
- ❖ Regional trade volumes
- ❖ Competitive analysis
 - Port & terminal
- ❖ Regional carrier activity
- ❖ Pricing and elasticity

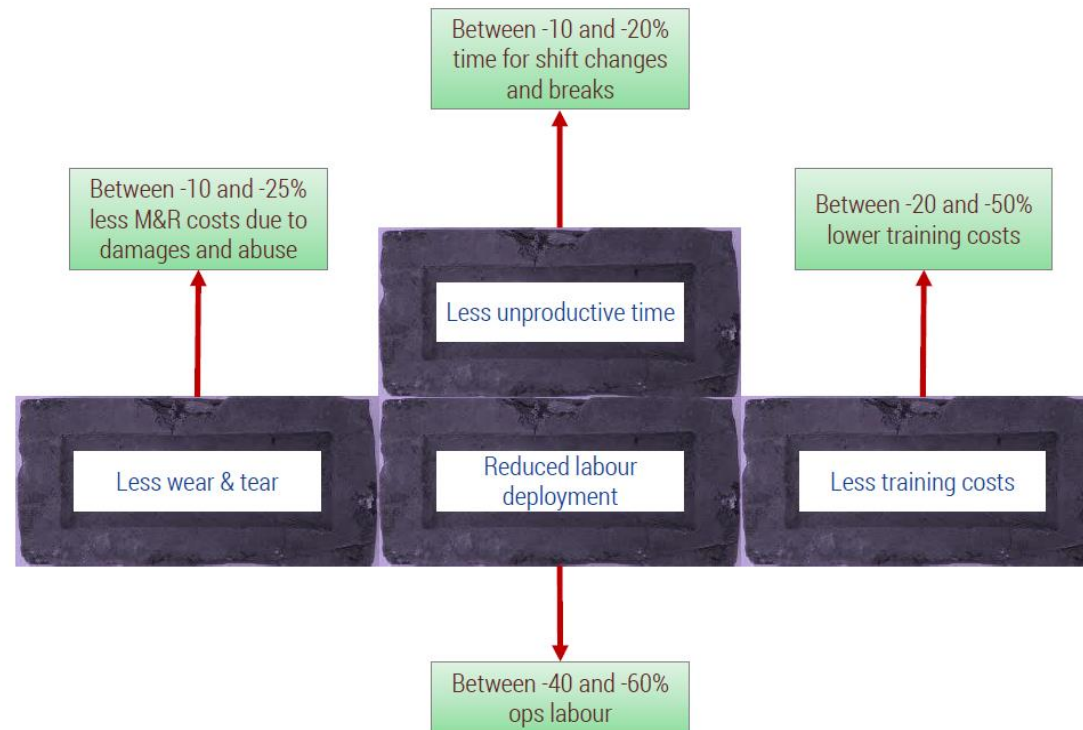
- ❖ If you build it they will come...
Right?

3.3 TECHNOLOGY & PERFORMANCE

- ❖ Capacity
- ❖ Productivity
- ❖ Balance
- ❖ Flexibility
- ❖ Efficiency

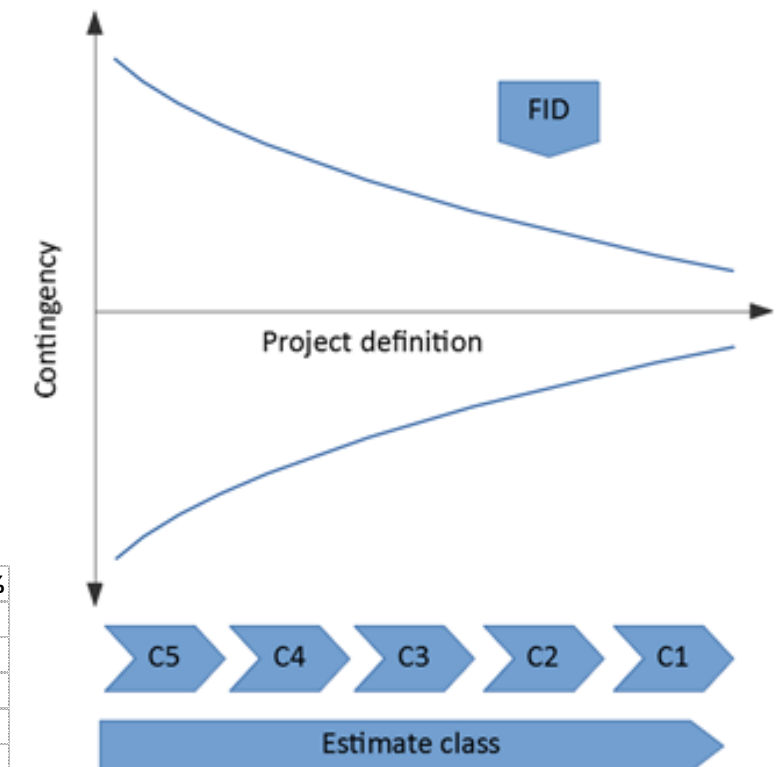


3.4 CAPITAL, OPERATING COSTS



3.5 FINANCIAL MODEL

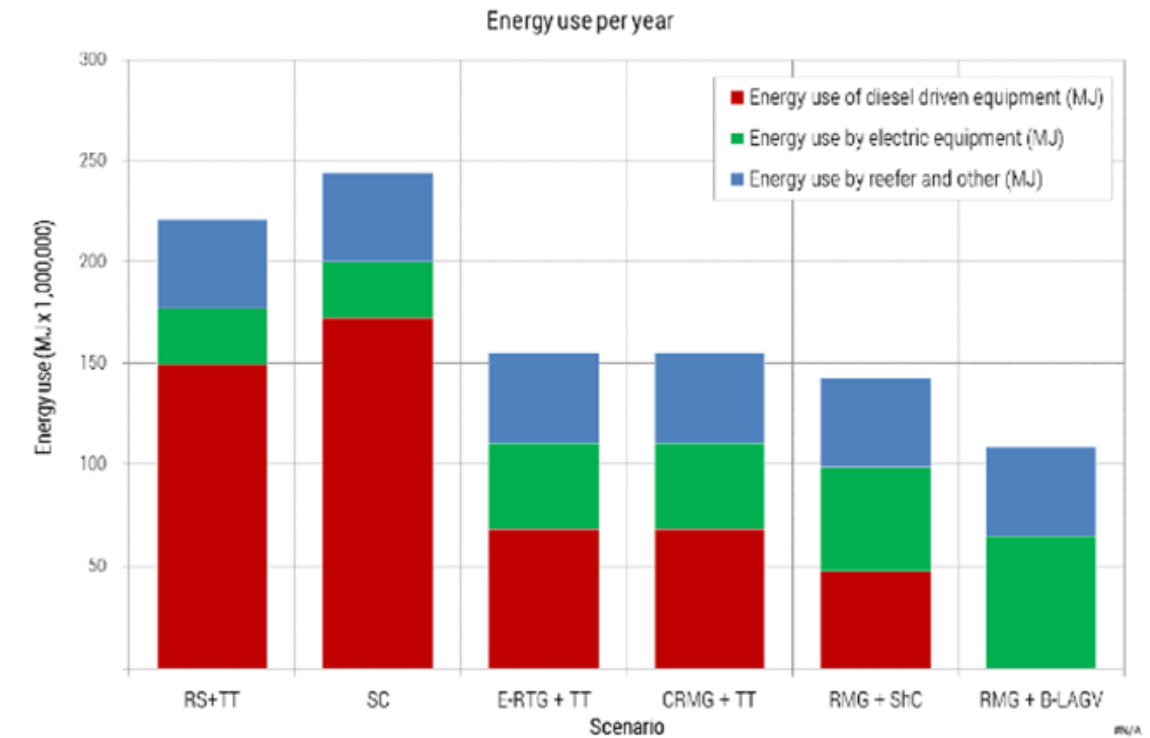
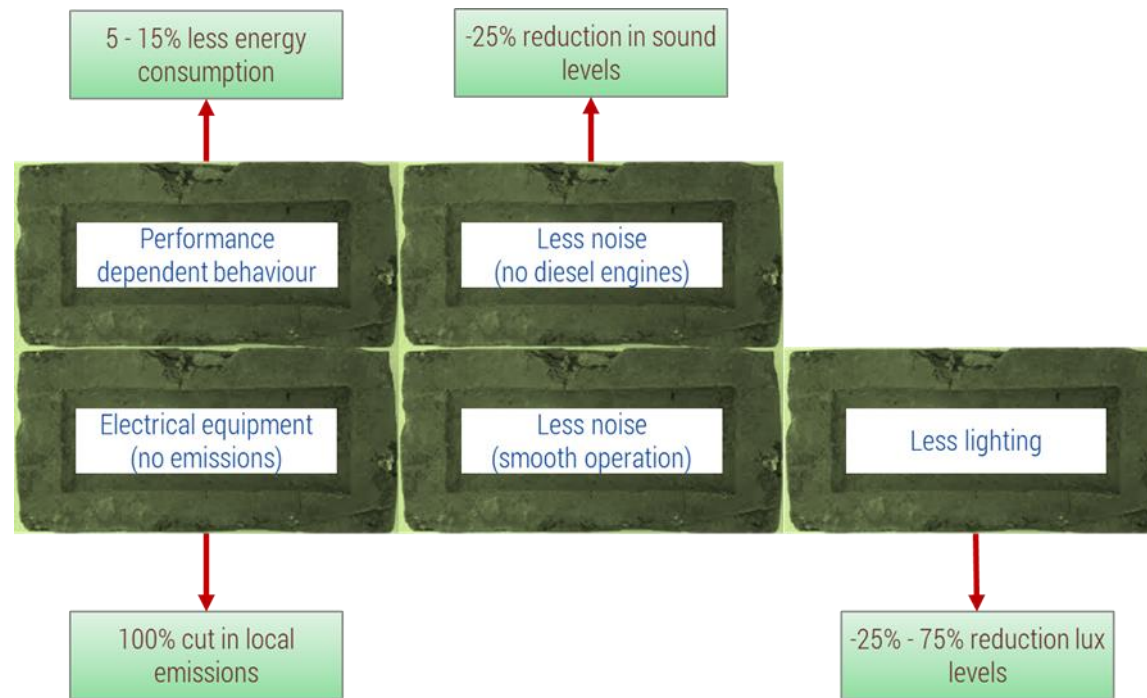
- ❖ Long lead time
- ❖ High cost of first lift
- ❖ Long productivity ramp
- ❖ Public / private mix
- ❖ Volume risk



| Estimate class | Use | Project definition level % |
|----------------|-----------------------|----------------------------|
| Class 5 | Concept screening | 0 - 2 |
| Class 4 | Study or feasibility | 1 - 15 |
| Class 3 | Budget, authorization | 10 - 40 |
| Class 2 | Bid, tender | 30 - 70 |
| Class 1 | Bid, tender | 50 - 100 |



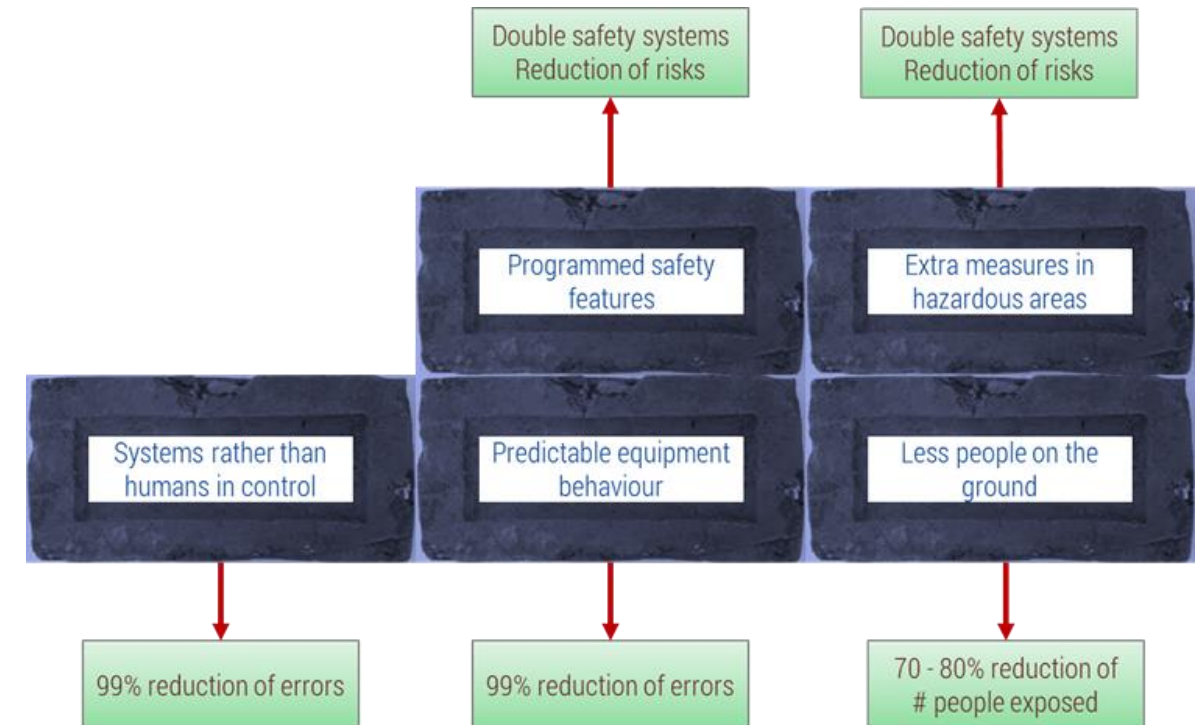
3.6 ENVIRONMENTAL



3.7 SOCIAL IMPACT

- ❖ **The nature of work**
 - Management
 - Operations
- ❖ **Organized labor**
- ❖ **Workforce demographics**
 - Generations
- ❖ **Port-city influence**
 - The social contract
- ❖ **Regional technical capability**
 - If you build it, who will fix it?

3.8 SAFETY



3.9 RISK

- ❖ Institutions
- ❖ Infrastructure
- ❖ Macroeconomics
- ❖ Health & primary education
- ❖ High education & training
- ❖ Technological readiness
- ❖ Business sophistication
- ❖ Innovation

“It ain’t what you *don’t know* that gets you into trouble.

It’s what you *know for sure* that just *ain’t so*.”



3.10 THE BUSINESS CASE

Key Performance
Indicators

| Public KPI Fields | Private KPI Fields |
|----------------------|----------------------|
| Political Acceptance | Image and Reputation |
| Innovation | Sustainability |
| Health | Safety |
| Environment | Security Regulation |
| Competitiveness | Performance |
| Reliability | Efficiency |
| Digitization | Standardization |
| Capital Cost | Capital Cost |
| Tariff Revenue | Operating Cost |
| Goods Movement | Flexibility |
| Resilience | Controllability |

