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Simulation of handling equipment for container terminals

4th Intermodal
AFRICA

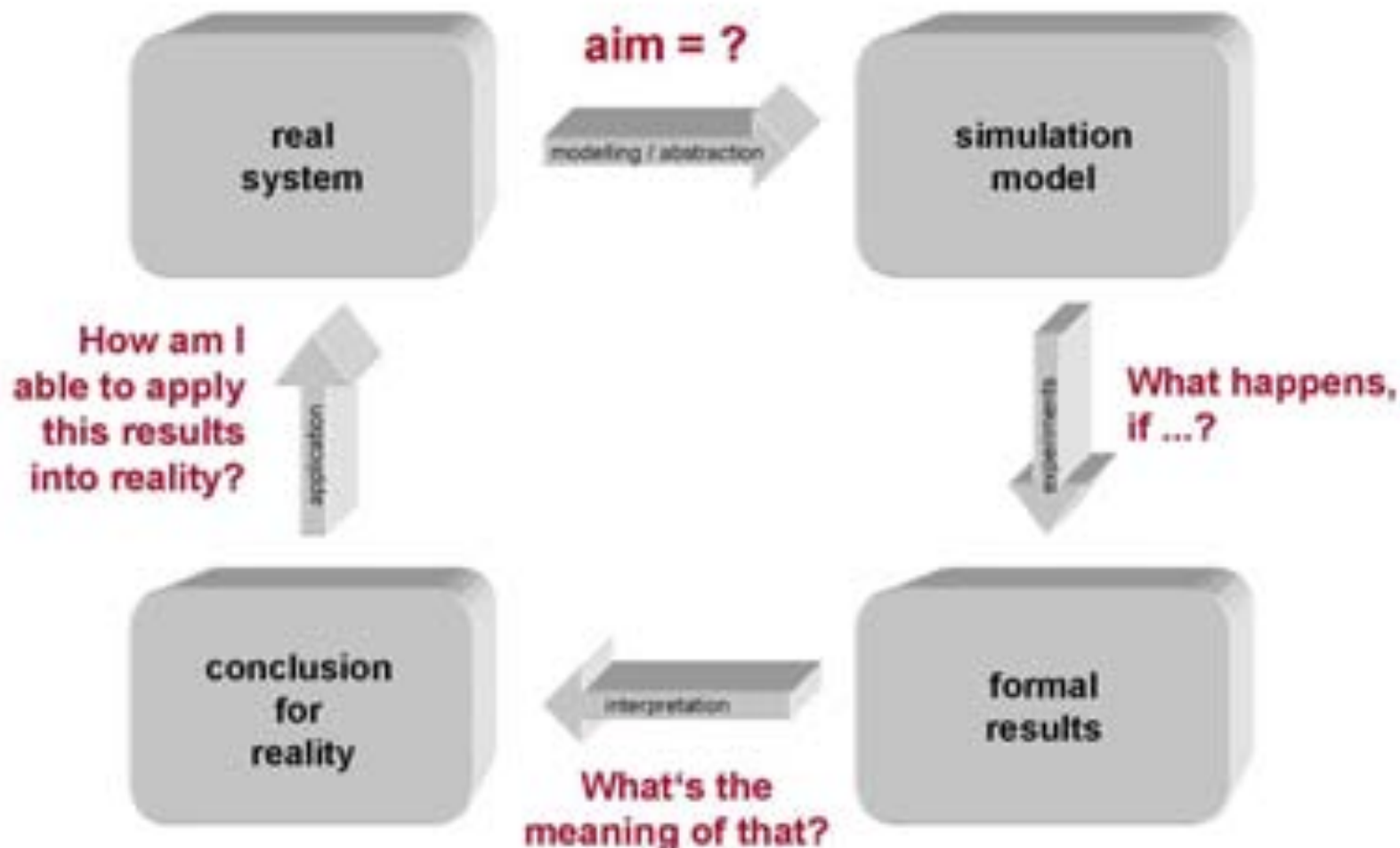
Swakopmund Hotel and Entertainment Centre, Namibia
2 and 3 February 2006

Changes of the market environment have been driven by

- globalisation of the economy
- continuous development of container shipping
- added customer requirements

Also the increasing competition within the global market forces the terminals to optimise their container terminal productivity.

Simulations will contribute to identify improvements!

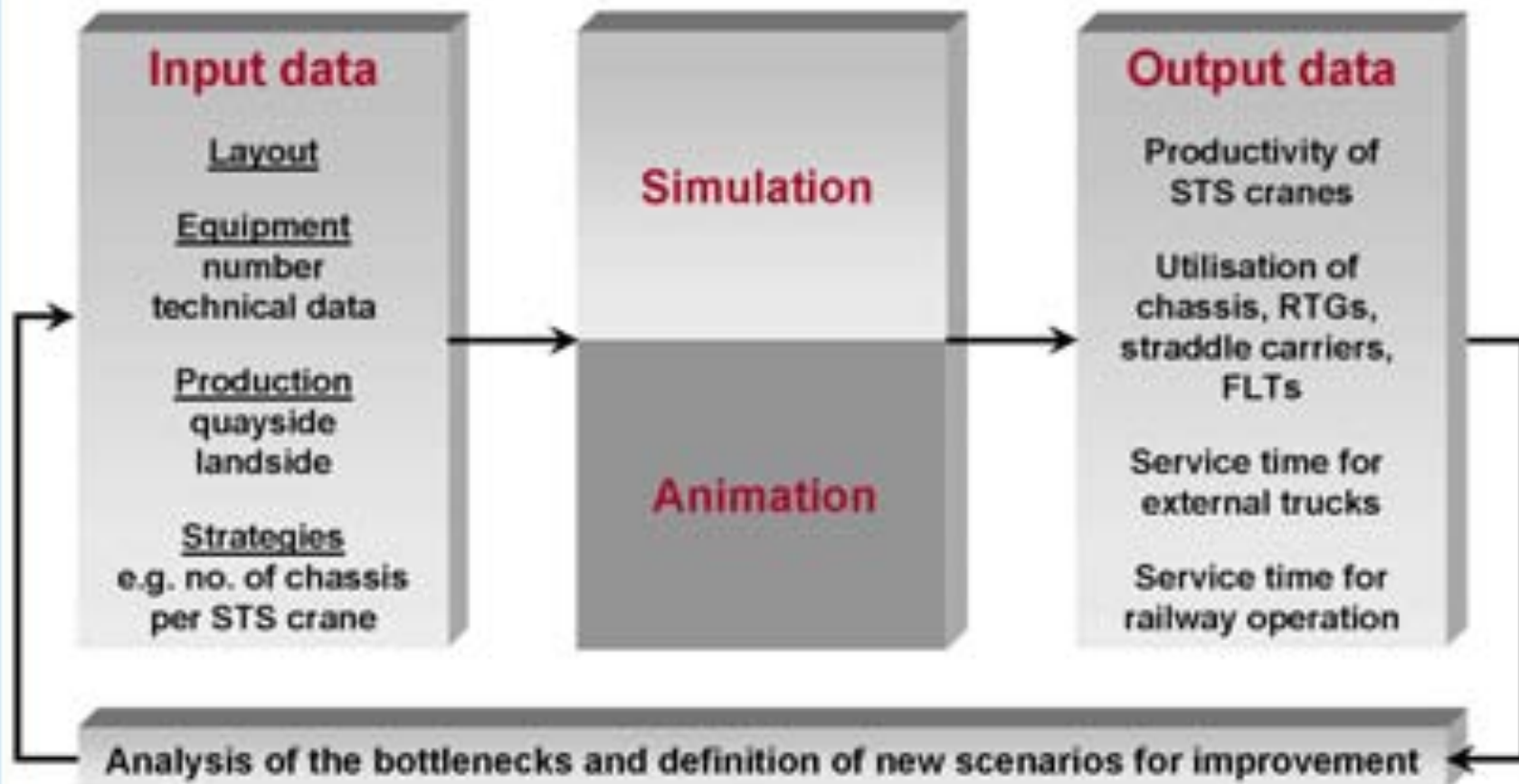


Tool for decision making processes on the strategic and design level

- **planning of new terminals**
- **expansion or reorganisation of existing terminals**

Analysis

- **best type of equipment**
- **handling equipment needed**
- **modifications of terminal layout**
- **test of different operation strategies**





Locations of STSCs

Railway operation areas

Stacking blocks

Traffic network

In gate, out gate and
truck service areas



no. of loading and unloading boxes

	1	2	3	4	5	6	7	8	9	10
1210	1	1	1	1	1	1	1	1	1	1
1220	1	1	1	1	1	1	1	1	1	1
1230	1	1	1	1	1	1	1	1	1	1
1240	1	1	1	1	1	1	1	1	1	1
1250	1	1	1	1	1	1	1	1	1	1
1260	1	1	1	1	1	1	1	1	1	1
1270	1	1	1	1	1	1	1	1	1	1
1280	1	1	1	1	1	1	1	1	1	1
1290	1	1	1	1	1	1	1	1	1	1
1300	1	1	1	1	1	1	1	1	1	1

Allocation of STSCs

Types of equipment

- travel speed
- stacking height
- hoisting speed
- pick up/drop off time

Virtual Crane Type

ID: 0C Description:

manual automatic

Stacking height FEU Length m

Travel speed	laden	unladen
aver. speed in stack	100 m/min	100 m/min
max./aver. speed outside stack	267 m/min	300 m/min
aver. speed on tracks	133 m/min	133 m/min
acceleration	0.00 [m/s ²]	0.00 [m/s ²]
deceleration	0.00 [m/s ²]	0.00 [m/s ²]

Hoisting speed m/min Ext./retract spreader sec

Drop-off time sec Pick-up time sec

Twin lift operation Changover twi/hlogle lift: sec

Fix cost/p.a.	<input type="text" value="72500"/> MU	Fix cost/hr	<input type="text" value="95"/> MU
Variable cost/hr	<input type="text" value="76.43"/> MU	Operation time p.a.	<input type="text" value="5000"/> hrs

Stack utiliz.	Time for shuffling	Stand. deviation
20%	50 sec	30 sec
40%	70 sec	40 sec
60%	120 sec	50 sec
80%	220 sec	100 sec
100%	300 sec	150 sec

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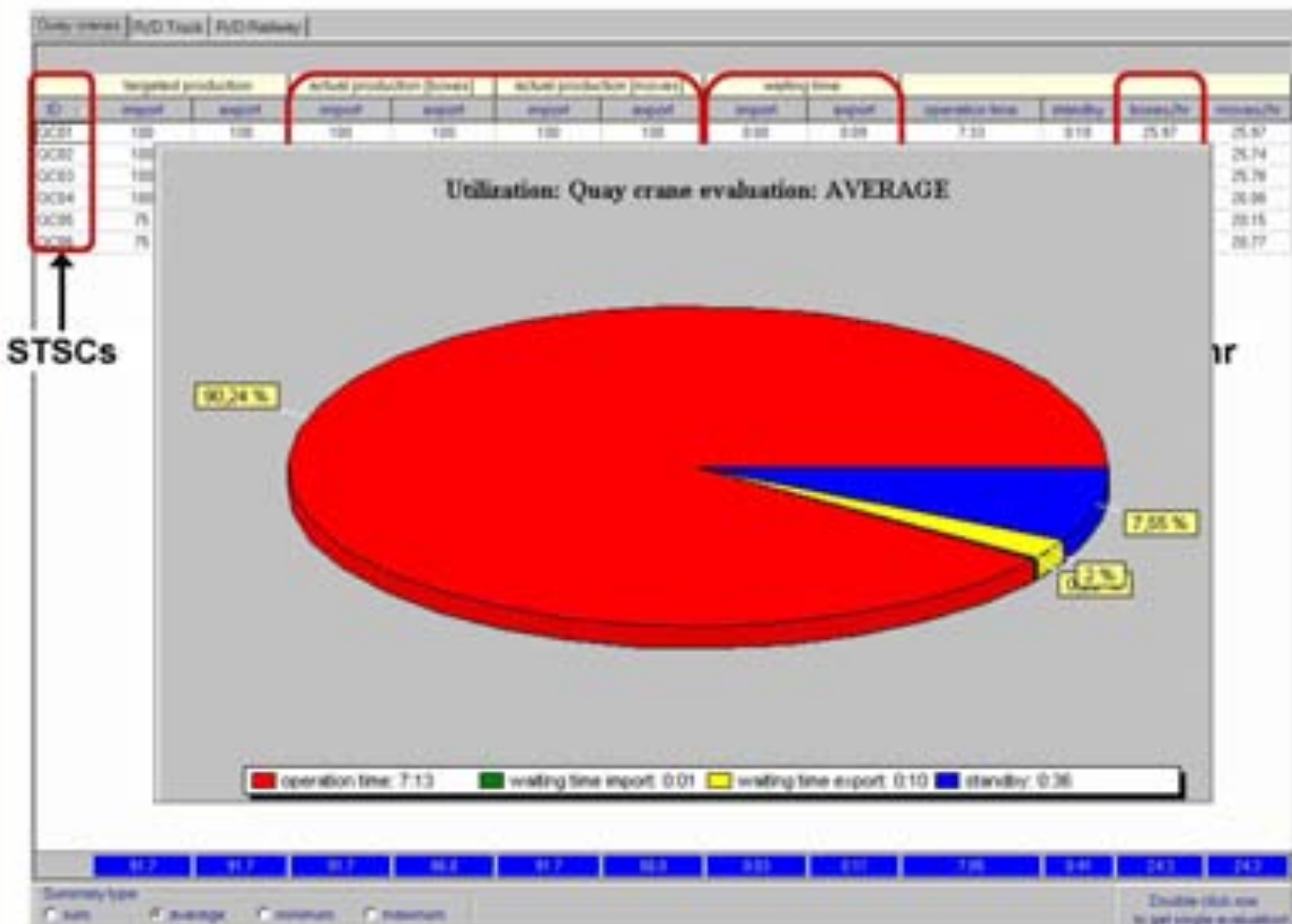
- cost parameters

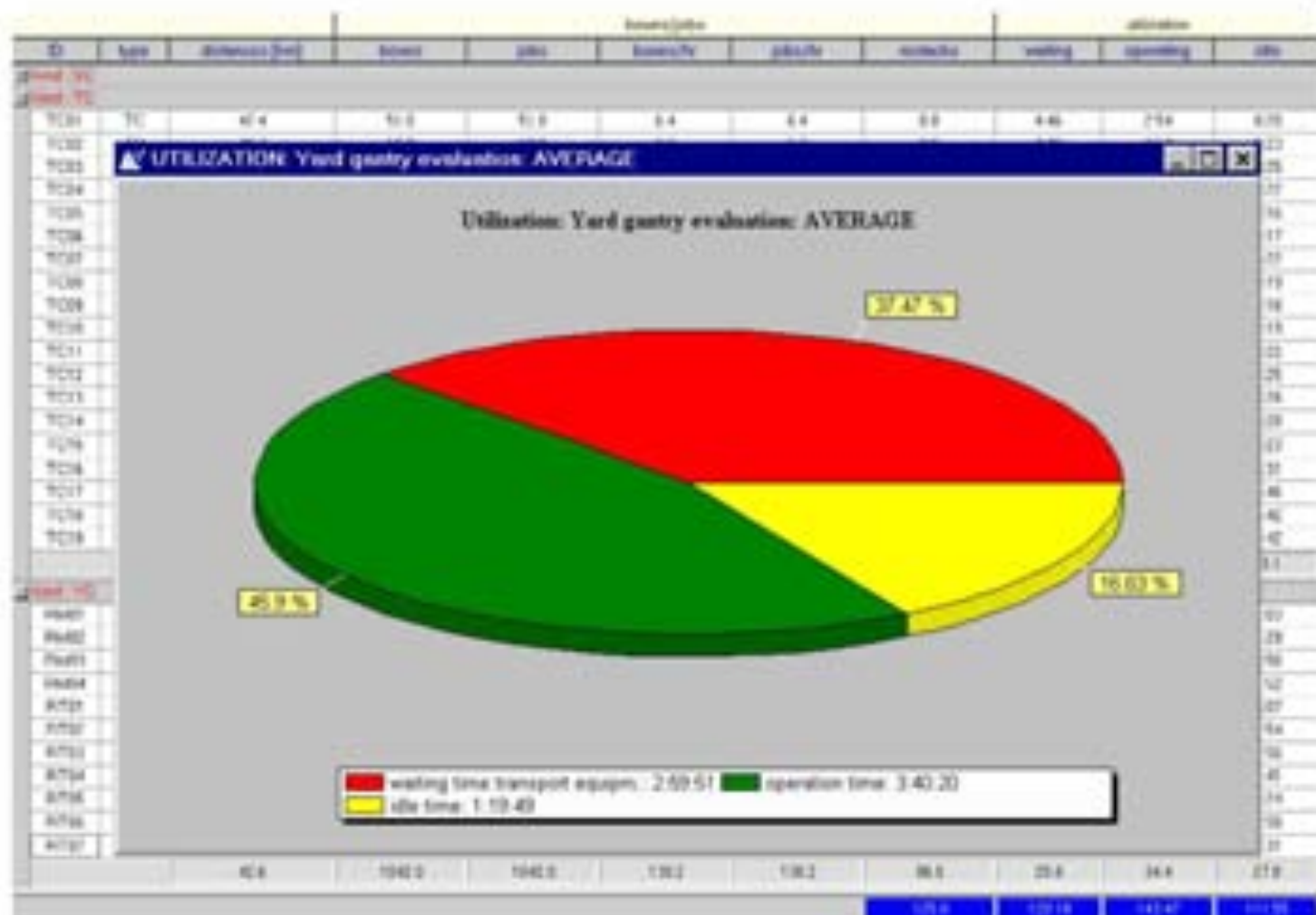
- Allocations of transport equipment to production centers
- Allocations of stacking blocks to production centers
- Allocations of stacking equipment to stacking blocks
- Pre-stacking rates for each production center
- Container mix for each production center
(reefer, dangerous, oversize, empties)
- ...

The simulation module contains

- **Simulation**
 - basis: data input
 - orders are generated and processed
 - evaluation data are derived and stored

- **Animation**
 - basis: terminal layout
 - movements of the equipment and containers are represented by means of defined symbols.





production center				allocated equipment				
ID	total costs	no. of boxes	costs/box	OC	FLT	SC	TC	YG
type: RM								
RM1	1577.86	15.00	71.86	0.00	0.00	753.60	0.00	324.26
RM2	1436.39	25.00	57.46	0.00	0.00	1014.76	0.00	424.63
	2914.25	40.00	129.42	0.00	0.00	1768.36	0.00	748.89
type: P&D TRUCK								
PDPM	3960.66	83.00	46.51	0.00	0.00	0.00	0.00	3960.66
PDRT	3177.27	183.00	17.36	0.00	0.00	0.00	0.00	3177.27
PDSC	1732.40	83.00	20.87	0.00	12.29	1720.19	0.00	0.00
PDSP	898.30	11.00	81.66	0.00	263.04	635.24	0.00	0.00
	9768.71	359.00	130.12	0.00	285.33	2355.43	0.00	7927.94
type: P&D CRANE								
TRM1	1575.51	40.00	39.39	0.00	101.09	1474.42	0.00	0.00
TRM2	3713.48	35.00	106.10	0.00	0.00	1382.46	979.77	1351.27
	5288.99	75.00	145.49	0.00	101.09	2856.87	979.77	1351.27
type: STACK								
OC05	8686.52	134.00	72.29	6389.49	211.14	2345.89	0.00	0.00
OC06	10241.89	134.00	76.43	6403.87	721.42	3116.77	0.00	0.00
OC04	12130.99	200.00	60.65	6688.25	0.00	0.00	1491.24	4951.11
OC01	13378.12	200.00	66.89	6829.40	0.00	0.00	1509.40	5182.25
OC02	13260.79	200.00	66.75	6829.49	0.00	0.00	1514.67	5146.41
OC03	13632.94	200.00	68.16	6834.28	0.00	0.00	1492.55	5444.91
	73418.75	1068.00	69.18	29513.99	1072.56	6062.64	6497.97	20722.98
	90994.72	1401.00	65.20	29513.99	1072.56	13043.27	6997.74	20993.78

total costs

costs/box

costs/device type

- 
- ASEAN Terminales, Philippines
BLG/Eurogate, Bremerhaven
Contship, La Spezia
EVAG, Emden
Eurokai/Eurogate, Hamburg
FH Oldenburg
Gerd Buss, Hamburg
HHLA, Hamburg
HIT, Hong Kong
Jade Weser Port, Wilhelmshaven
Maersk Lige
MCT, Gioia Tauro
MTL, Hong Kong
Noell Crane Systems, Würzburg
NTB, Bremerhaven
Port of Odessa
P&O Ports, Antwerp
P&O Ports, Australia
P&O Ports, Canada
P&O Ports, India
P&O Ports, London
P&O Ports, North America
Port of Tacoma, USA
SCT, Southampton
TRP, Buenos Aires
VTE, Genoa
WMU, Malmö

Thank you for your attention

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