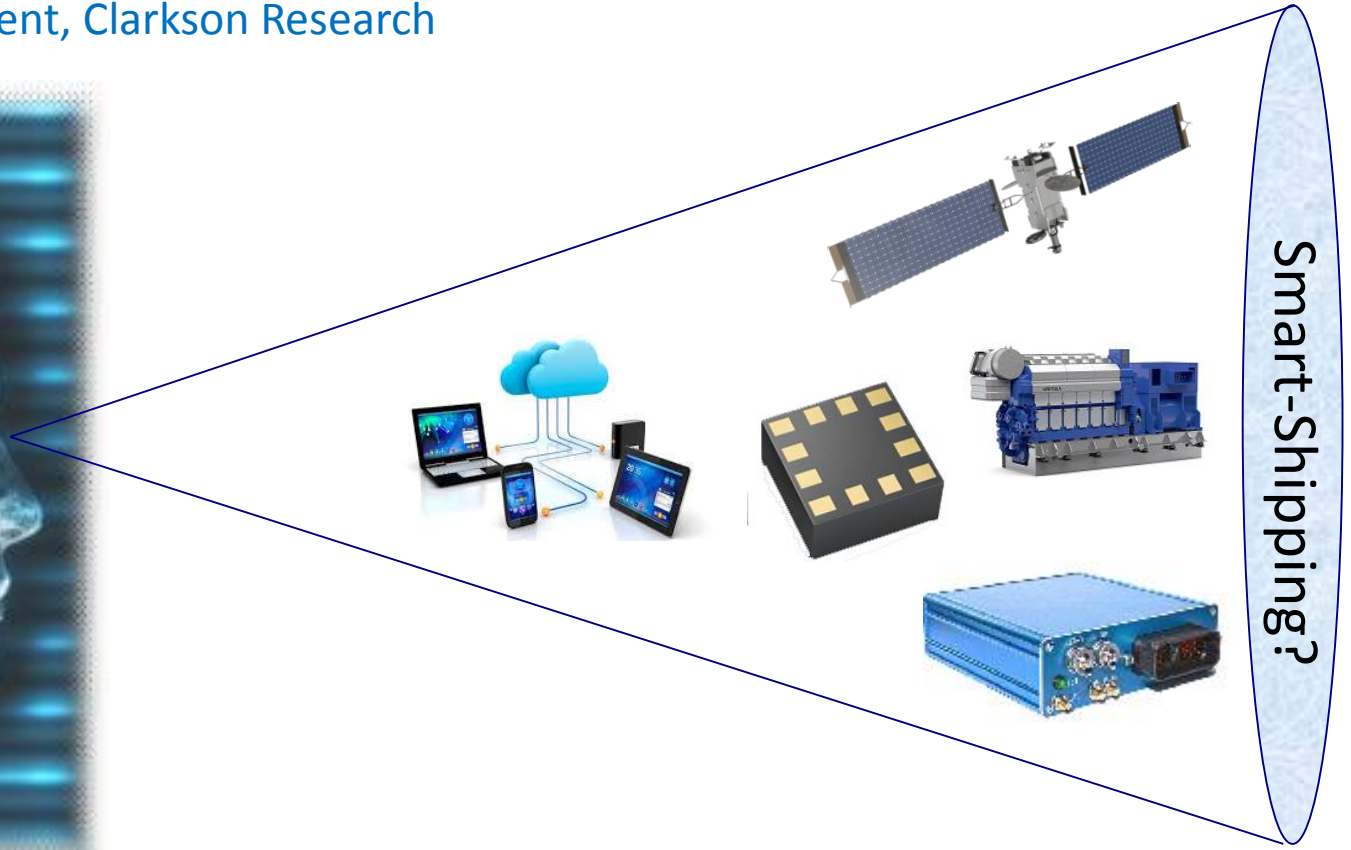
Shipping's Next Techno-Economic Great Wave

Martin Stopford President, Clarkson Research



Maritime Forum, Tokyo, 7 December 2015

How should we approach economic analysis?

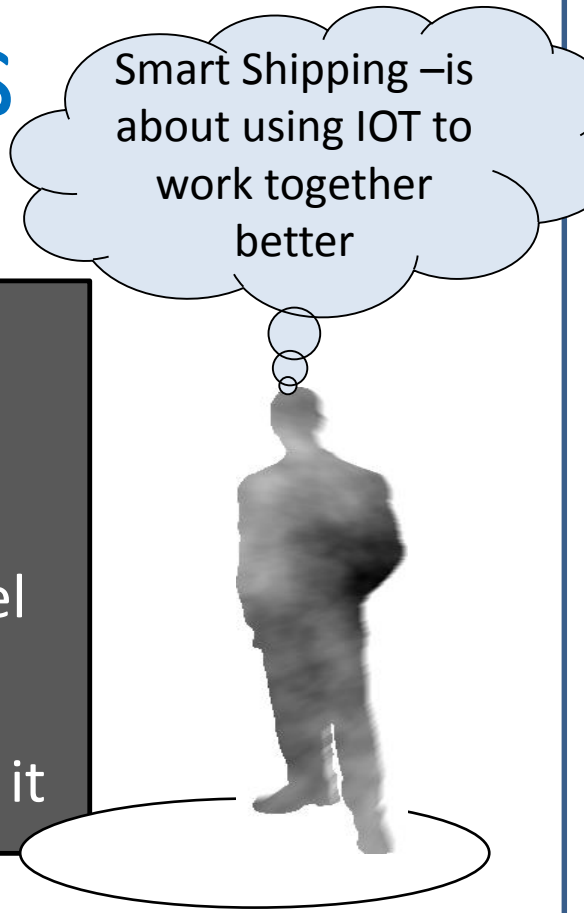
Joseph Schumpeter thought that “what distinguishes the scientific economist from other people who think, talk and write about economic topics is a command of techniques that we class under three heads: history, statistics and theory” .

1. Economic history gives perspective and an understanding of how economic and non-economic (“institutional”) facts are related .
2. We need economic statistics “to explain things and to know what there is to explain” . Also statistics provide numerical continuity, framework and a base for thinking through relationships.
3. Finally “economic theory is a box of tools for the analysis of specific problems” .

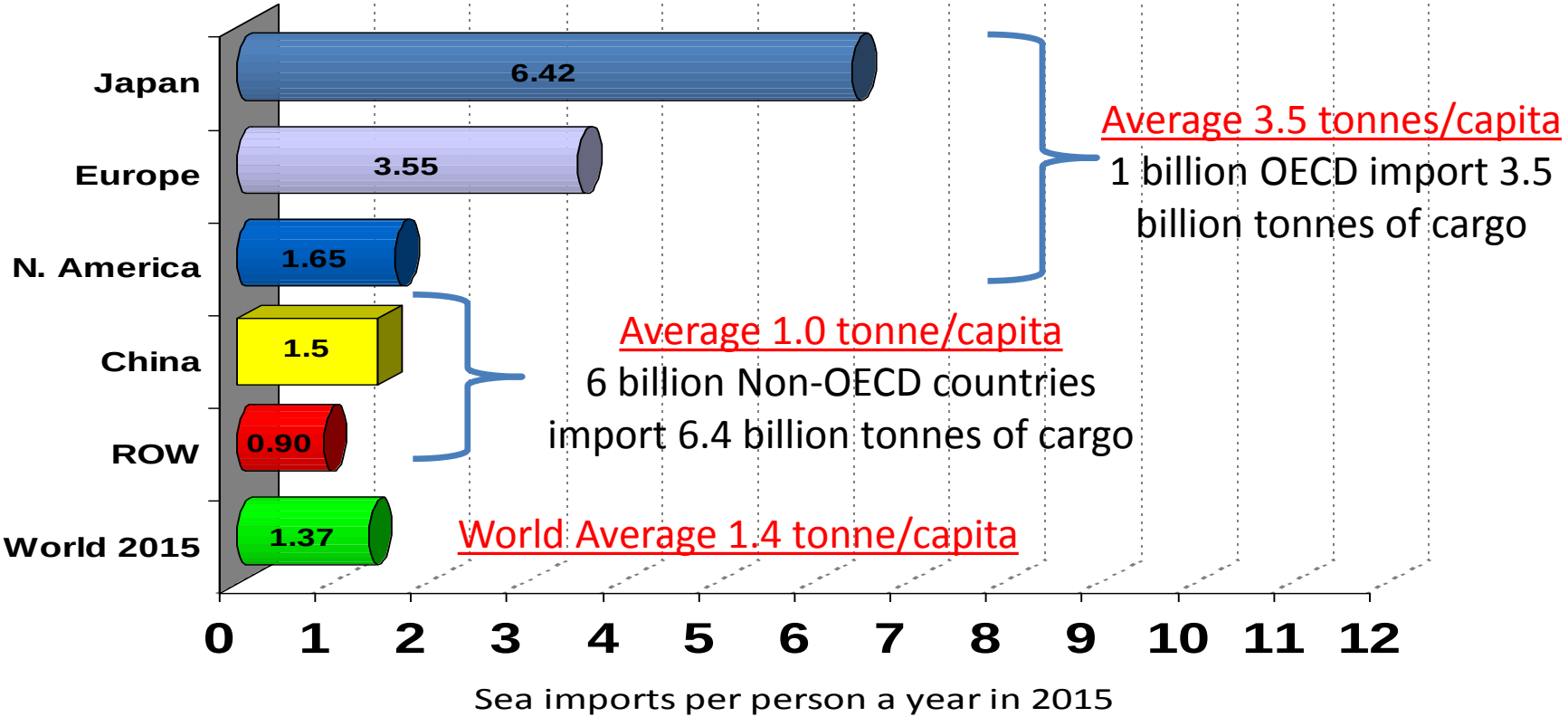
Joseph Schumpeter

Six Propositions To Discuss

1. Today sea transport faces special challenges
2. The maritime business model changes
3. Ship technology is running out of solutions
4. Smart –Shipping offers a new business model
5. A new management system will be possible
6. Other transport industries are already doing it

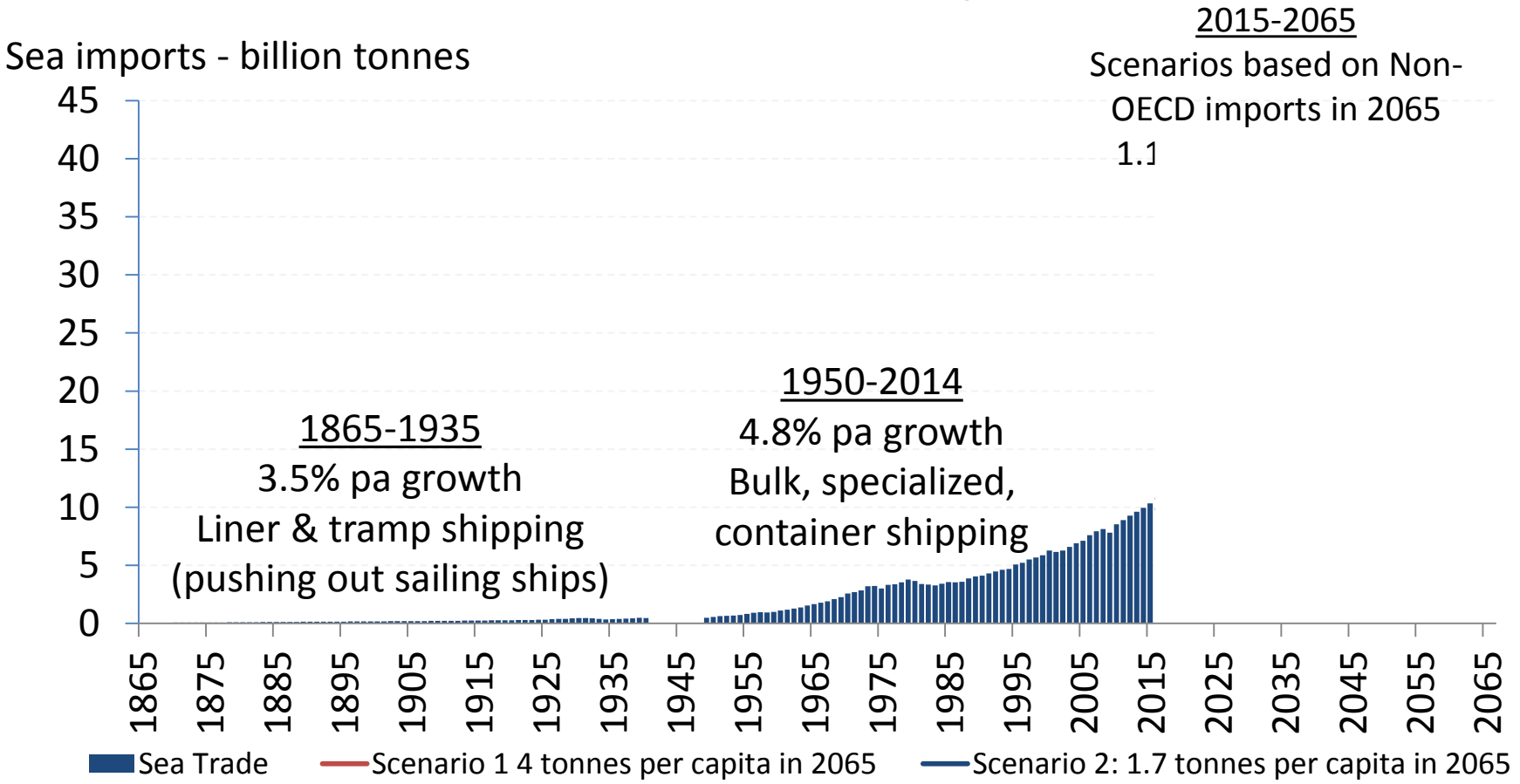


1. Sea transport faces special challenges today



Martin Stopford, President Clarkson Research

More trade, smaller carbon footprint?



Can information solve our problems?

In managing global trade it has massive potential…..

1. Production	2. Sea Transport	3. Processing	4. Sea Transport	5. End users
RAW MATERIALS **ENERGY** •Oil, Gas, coal, bio fuel **MINING** •Iron ore, •Scrap steel •Manganese ore •Bauxite, Alumina •NFM Ores **AGRICULTURE** Grain, Oilseeds Rubber, Skins **Refrigerated** •Fruit & vegetables •Oils, Wine, Fruit juices •Molasses **FORESTRY** •Logs, Lumber	**Liquid Bulk** crude oil & Gas **Dry Bulk** Metal ores, metal scrap, coal, fertilizers, salt PROCESSING **Dry Bulk** Agricultural materials and forest products shipped to consuming markets **Liquid** Vegetable oils & fats **Unit load** Logs, lumber, paper, pulp MANUFACTURING	OIL REFINING CHEMICALS STEEL MOTOR VEHICLES LIGHT ENGINEERING FOOD PROCESSING TEXTILES & CLOTHING WOOD & PAPER	**Bulks** Liquid products of oil refining, chemicals, steel etc. Many parcel sizes  **General Cargo** Manufactured products of all types shipped to companies and private end users	**POWER GENERATION** Power stations are major users of oil, coal and gas, often dealing direct with the primary suppliers **TRANSPORT** Major user of energy (Cars, rail & air travel, ships) **CONSTRUCTION** Uses steel, timber products, NFMs Residential, Commercial etc. **COMPANIES** energy, buildings, capital goods and consumables **CONSUMERS** final market, but shipping industry has little direct contact today

The new digital technology - Internet of Things (IOT)

McKinsey Global Institute believes it has great potential

1. We must “look beyond the hype to see how the internet of things can create real economic value”.
2. The hype may understate the full potential value of the IOT
3. Capturing that value will be very difficult, requiring an understanding of where real value can be created and…
4. successfully addressing a set of systems issues.

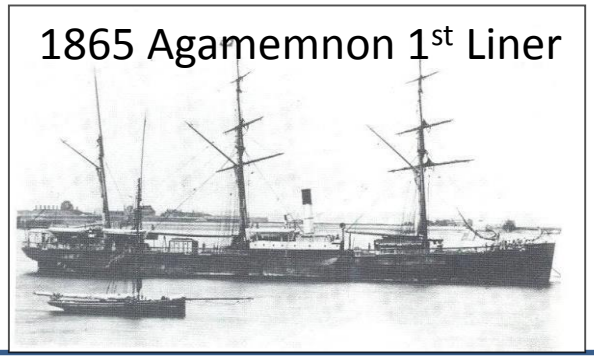
IOT is only a tool –we have to make it work!

“Unlocking the Potential of the Internet of Things” McKinsey Quarterly June 2015


Helicopters
bicycles
cars
Ships
planes
Trains
INTERNET of
THINGS
WHAT'S MISSING?
planes
Trucks

Proposition 2: Maritime business models change

- Model 1: 1490-1790: Merchant Traders – voyages of discovery & maps of the world created a business model based on global trade
- Model 2: 1790-1950 – Liners & Tramps - steam engines, iron hulls, propellers, cables etc. made this imperial business model possible
- Model 3: 1950-2015 – Bulk shipping – multinationals used oil, diesel engines & welded steel hulls to build a new low cost model

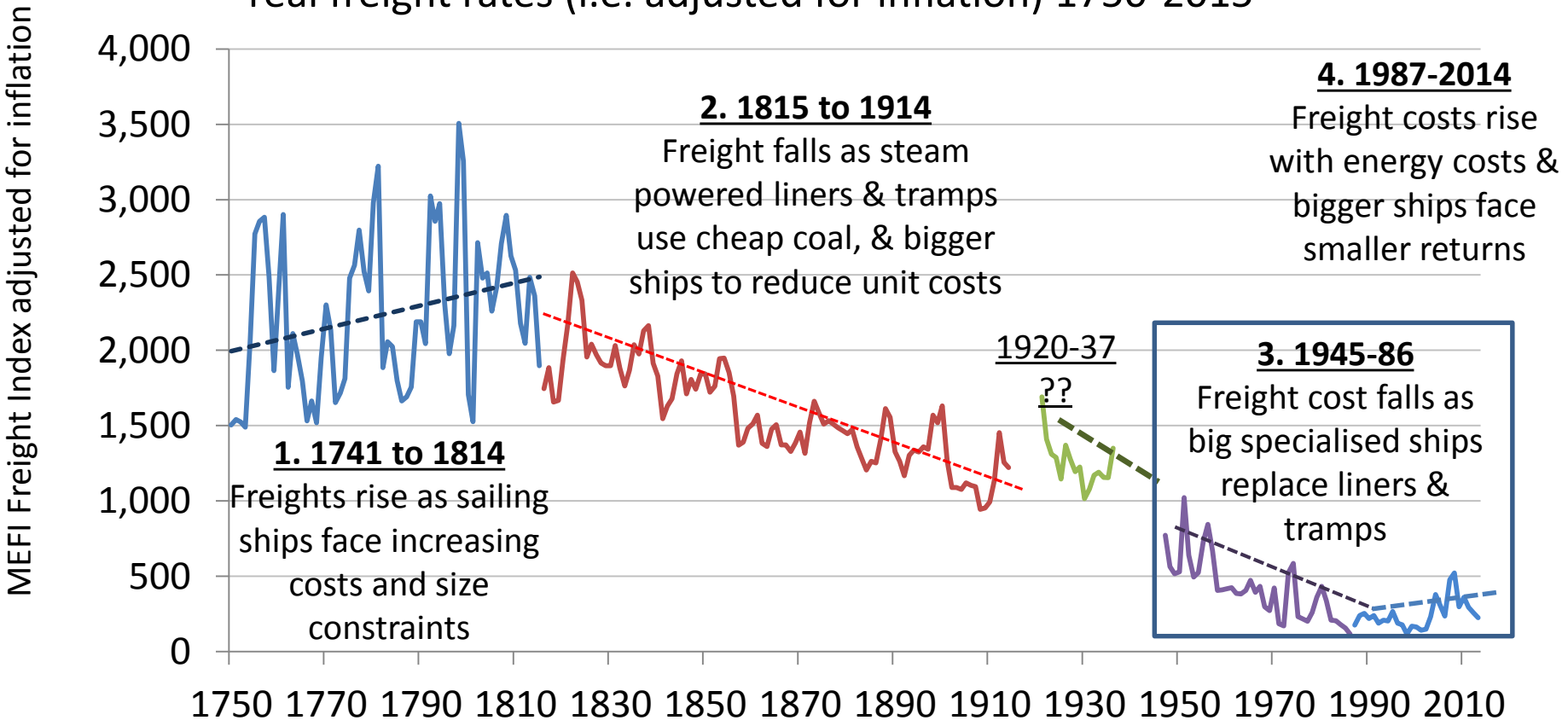


Model 3 - started in 1950 and its key principles were – 1) bigger ships 2) better engines 3)better terminals

- As the global free trade economy evolved cargo owners needed better sea transport. Small tramp ships were too expensive and ports got clogged up with the escalating volume of “break bulk” cargo revolution
- Lead by the cargo owners they built much bigger ships, mechanized cargo handling and developed specialized ships for “difficult” cargo to improve efficiency

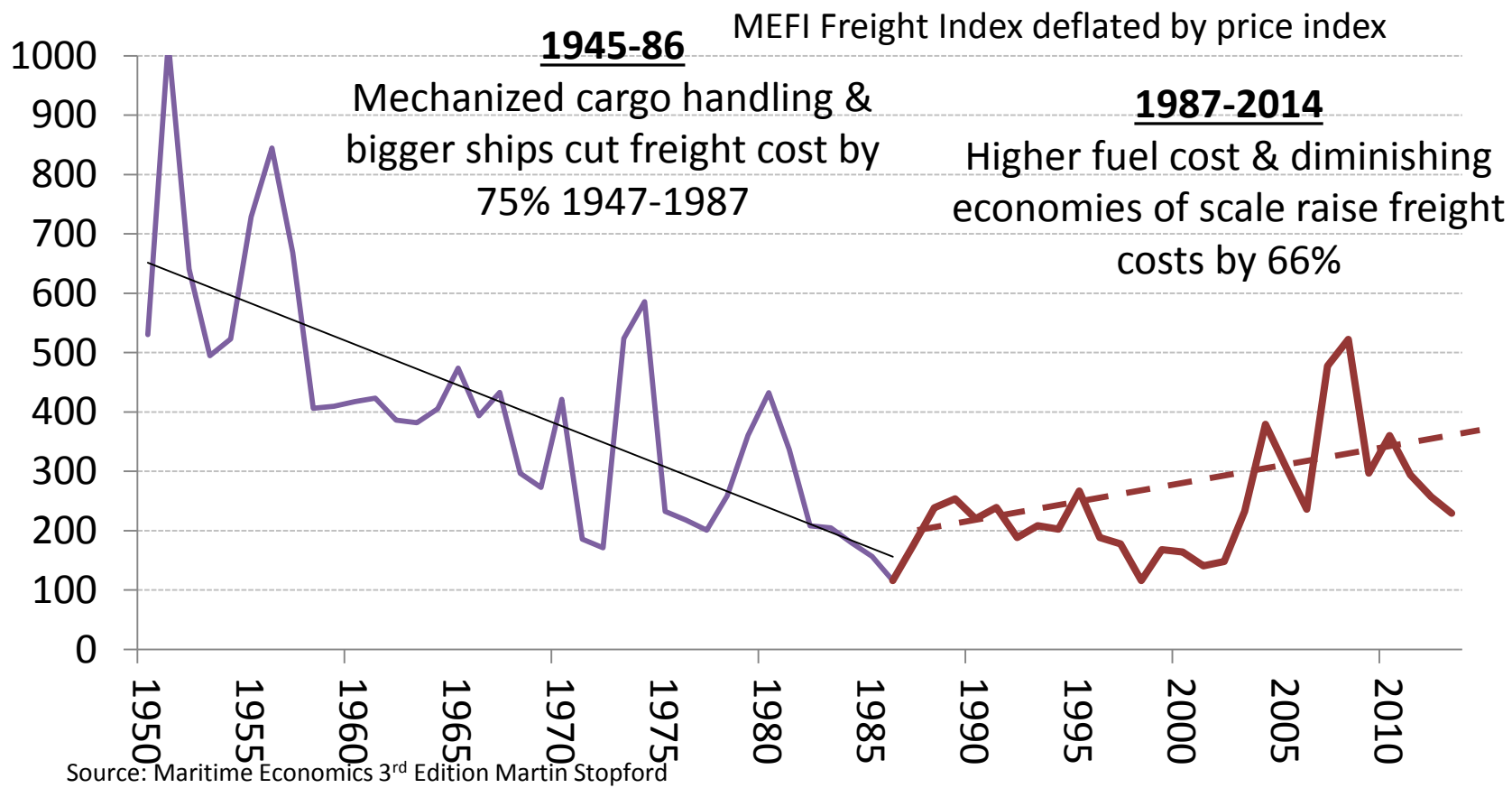
Proposition 3: Ship technology short of solutions

real freight rates (i.e. adjusted for inflation) 1750-2015



Source: Maritime Economics 3rd Edition Martin Stopford

A closer look at real freight costs since 1950



Source: Maritime Economics 3rd Edition Martin Stopford

150 years of improving liner fuel efficiency…

From 1865 to 1975 ships made massive technical advances. First the move to diesel engines and then Liners and tramps were replaced by much bigger and more specialised ships.

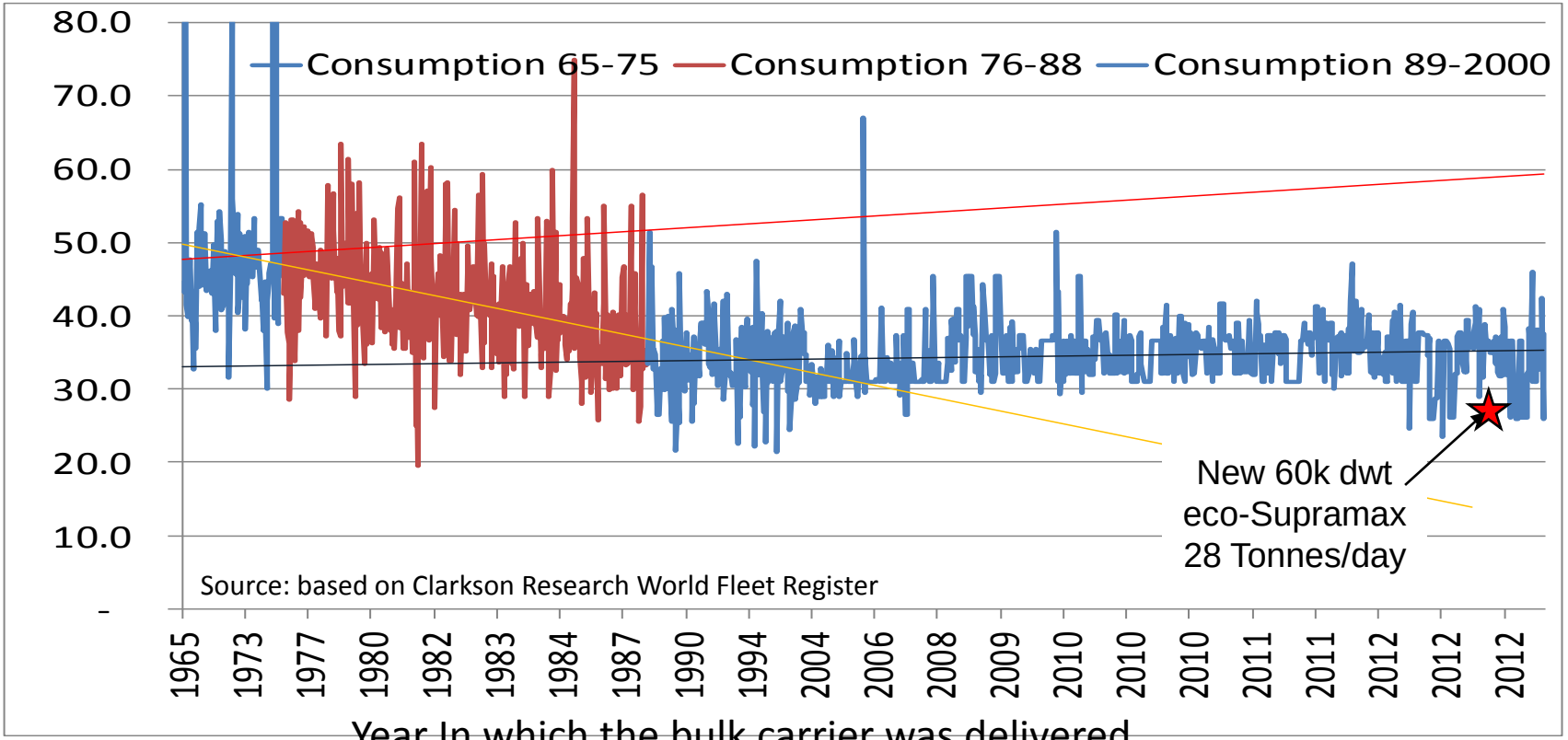
Table1 Fuel consumption of typical small to medium sized cargo vessels

1	2	3	4	5	6	7	8	9	10	11	12	13
Year built	Type	GRT	DWT	Cargo tons	Speed knots	Engine type	Horse-power	Fuel type	Tons per day	Cargo /tonne	Kg fuel/ 000 ton cargo	% fuel
1855	Liner	700	900	750	7.5	Steam 1	400 ihp	coal	12.0	63	88.9	
1866	Liner	2,270	3,065	2,911	10	Steam 2	945 ihp	coal	20	146	28.6	-68%
1895	Liner	3,600	5,500	4,900	9.5	Steam 3	1800 ihp	coal	25.0	196	22.4	-22%
1915	Liner	5,300	8,500	7,500	11	Steam 3	2800 ihp	coal	35.0	214	17.7	-21%
1935	Liner	6,000	10,000	9,000	12.5	Steam 3	4000 ihp	oil	33.0	273	12.2	-31%
1955	Liner	7,500	11,000	10,000	14	Diesel	6000	oil	25.0	400	7.4	-39%
2014	Liner	176,490	186,649	177,317	23	Diesel	85705	oil	255.0	695	2.6	-65%
Notes												

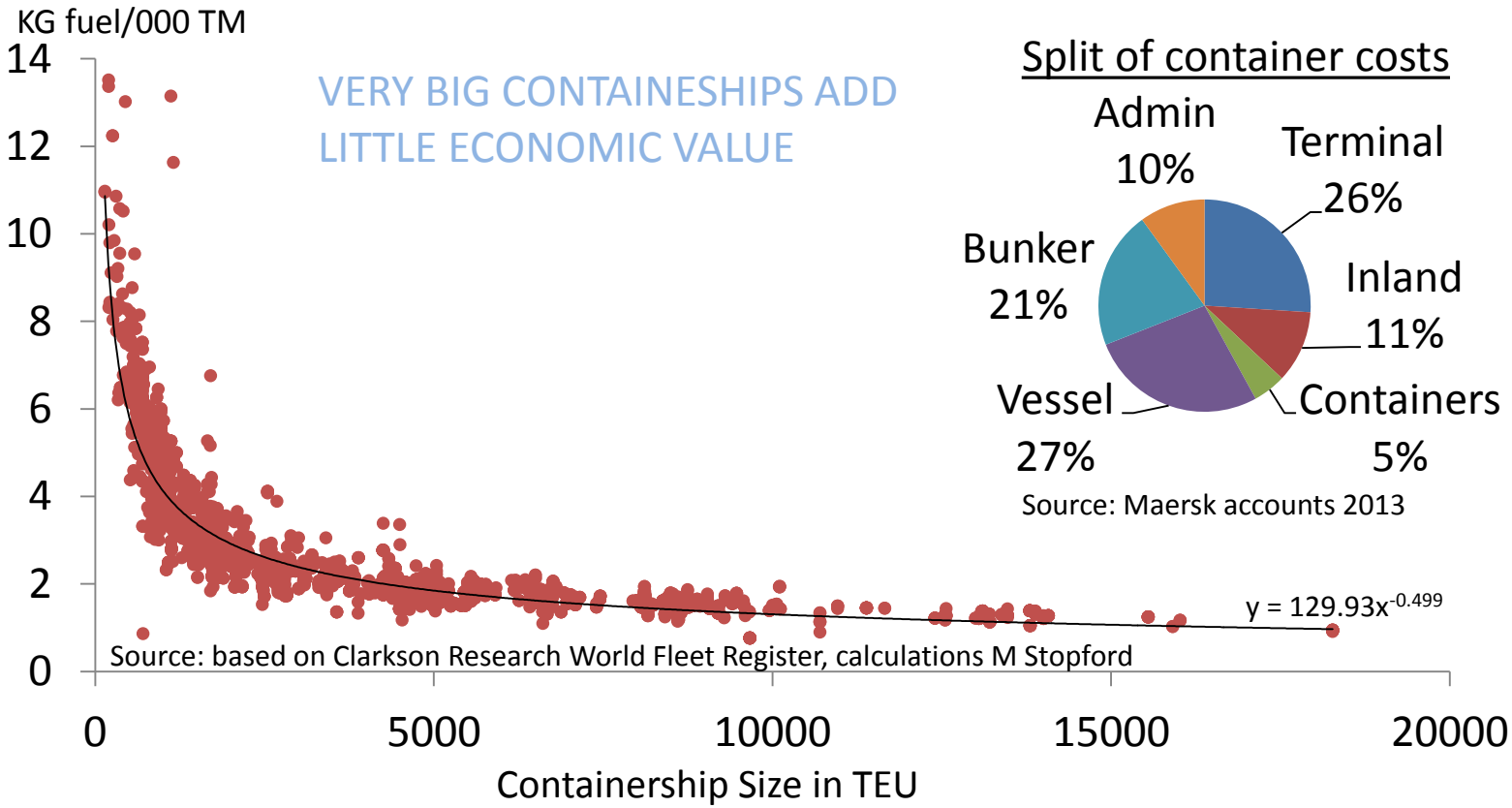
FOR 150 YEARS WE HAVE SQUEEZED THE TECHNOLOGY & MARGINAL RETURNS DIMINISHING

Fuel Consumption not improving much since the 1980s

Fuel consumption 60,000 dwt bulk carriers TPD at 14.5 knots in tonnes per day



Big containership Fuel Performance not much better



Source: Maersk accounts 2013

Business model issues after 65 years of evolution

- Enormous change in sea transport over the last 65 years
- Business model - small companies, big balance sheet, volatile income, tight costs, few technical resources
- Environmental pressures increasing (EEDI & carbon footprint)
- Few ways to improve performance (except slowing down)

Liner business 2015

Proposition 4: Smart-Shipping offers a new business model

Three things Smart -Shipping might do (if we really get organized):-

1. Use assets more efficiently
    1. Automate & de-skill ship operations & navigation
    2. Manage ship/shore personnel into a single more productive team
    3. Integrate fleet systems (like BMW factory) to improve asset performance
    4. Use big data to find ways to improve performance & reduce accidents
    5. Inform management on how the business is performing
2. Produce regulatory information digitally (no more manual reports)
3. Develop global through transport system (Amazon, UBER, UPS)

The Smart-Shipping “Toolbox”

1. **Telematics**: "sensors" generate digital information about equipment & ship - cheaper and better than ever.
2. **Satellite communication**: new INMARSAT Ka band global systems (99% reliable) broad band data to be collected, processed & beamed ashore. Telephone too.
3. **Data Storage**: The cloud provides storage for data generated by sensors. Analyse “Big Data” to improve performance.
4. **Smart phone-style apps** : to do specific jobs without big computer systems & management information
5. **Information systems**: management know exactly what’s going on and performance levels.
6. **Automation:** feedback loops allow automation of many tasks (navigation, maintenance, operations etc)

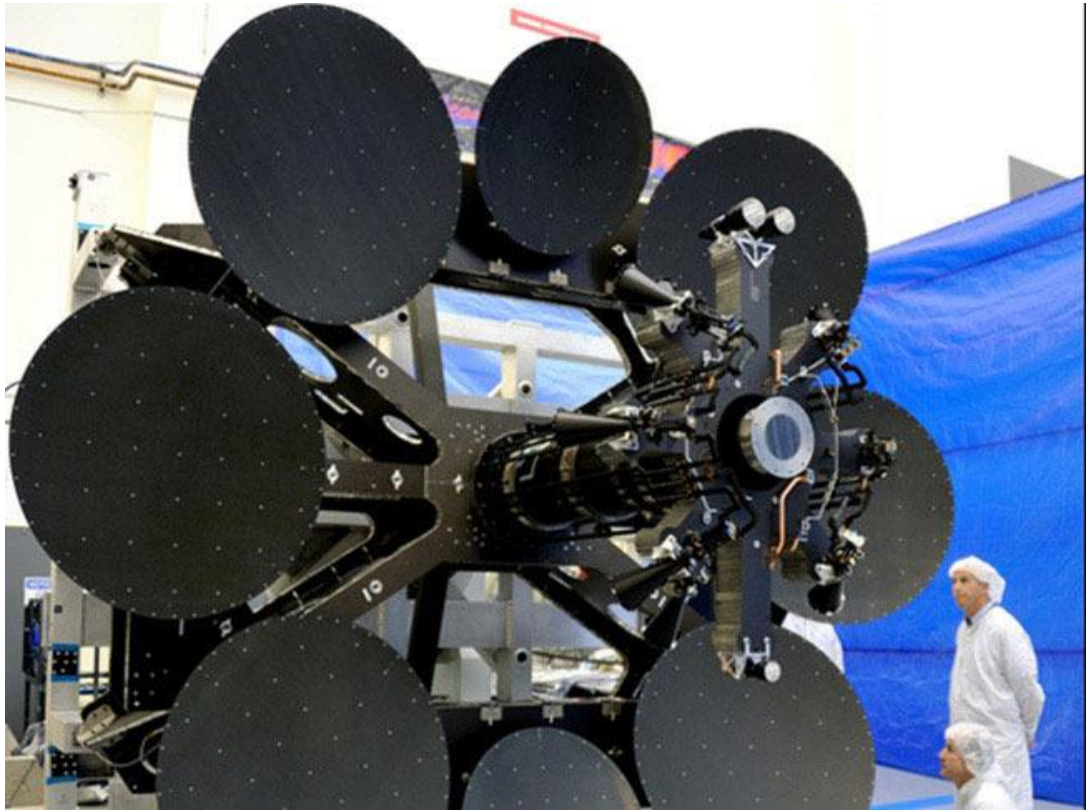
Young engineer with degree

Auxiliary sealed & monitored

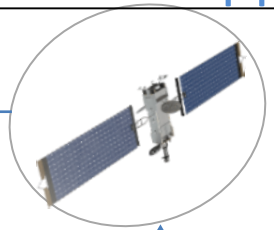
Railnova information system

INMARSAT Fleet Xpress..In March 2016

- Seamless global coverage
- Reliability through L-band and Ka-band
- Guaranteed data rates
- Separate voice channels
- Simplicity and scalability
- During next year: third party apps e.g. engine manufacturers - can embed bandwidth into their services



How a Smart-Shipping company might be organized:-



Warehouse (on cloud?)

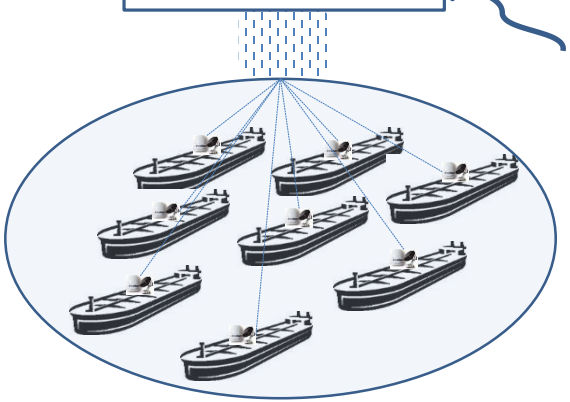
Company Systems:-
- Host Server
- Ship network
- Fleet Intranet
- Phone services
- Messaging
- Systems & apps

Information system

MANAGEMENT

Equipment supplier monitoring products

Server system on each ship



A. Statistical Quality Control (SQC)

B. Fleet Accounting Systems

C. Cluster Process Management

D. Systems Design

Feedback to fleet

System management

TECHNICAL

- Advisory
- Regulatory reports
- Systems design & improvement

Source: Martin Stopford 2015

Browser-based software gives total visibility on your fleet.

1. **Track: Locate money leaks and service failures.** Sensors capture important data (idle time, route history, speed, consumption, emissions, component failure and distance), providing accurate picture for ship costs & crew performance. Ship based server & shore database.
2. **Manage: Fleet Dashboard to stay in control.** Give management on ship and shore comprehensive view of overall fleet trends and detailed data on a specific ships, to manage your fleet in real-time, any time.
3. **Review: Analyse performance with stored data.** Historical data supports data-driven decisions about a range of fleet operations including ship performance, routes, crew scheduling and safety. Customised reports automatically emailed to key staff.
4. **Plan: Use data to plan for a more profitable future.** Big Data analysis of fleet performance and costs supports decisions about preventive maintenance, workload balancing, operational procedures; cargo handling; route planning; ballast management etc

Proposition 5: a new management system possible

Four management building blocks for the future

A. Statistical Quality Control (SQC) which uses data to measure performance against expected benchmarks for the process.

B. Fleet Accounting Systems: which provide management with the information to make operating decisions based on economic as well as operational criteria (e.g. value added, carbon etc).

C. Fleet Cluster Management Process: matrix management combines standardisation & flexibility in managing fleet deployment.

D. Systems Design: views the physical operations of ships as one part of the business process of creating value. The system is designed to achieve customer related business goals, not production targets.

A. Statistical Quality Control (SQC)

Sensors & data management software allow sophisticated monitoring of transport processes:-

1. Establish benchmarks for the process
2. Establish quality monitoring and correction by operators
3. Predict the impact of a deviation on the entire process
4. Identify how the quality of the whole process can be continuously improved

W. Edwards Deming with Managing Director of JUSE, Mr. Kenichi Koyanagi, to his immediate right.

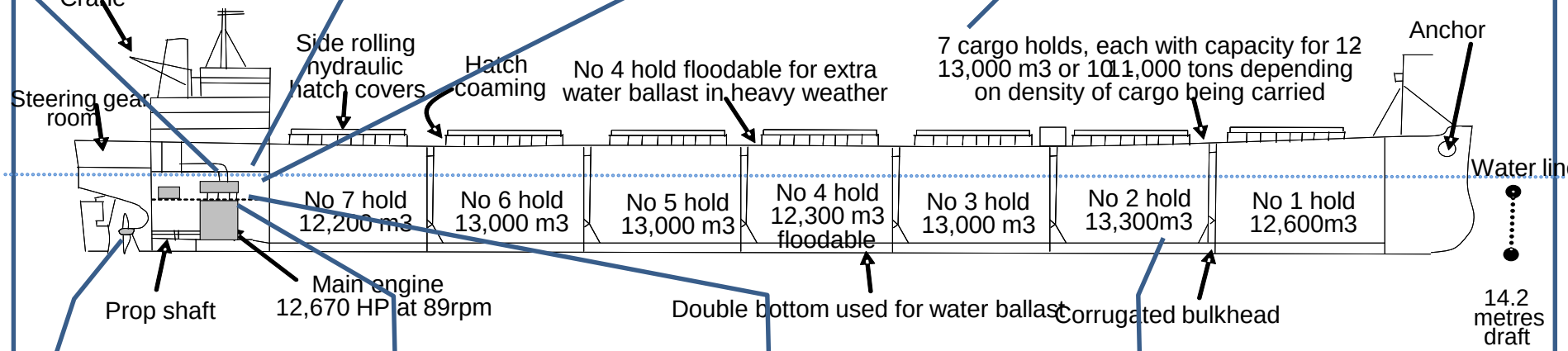
Eight areas where the process can be monitored by SQC

1. Machinery management

2 Navigation & route planning

3. Alarm management

7. Improved trim management



4. Manoeuvering

5. Power management

6. Ballast management

8. Cargo management.

225 m LOA, 77,000 dwt

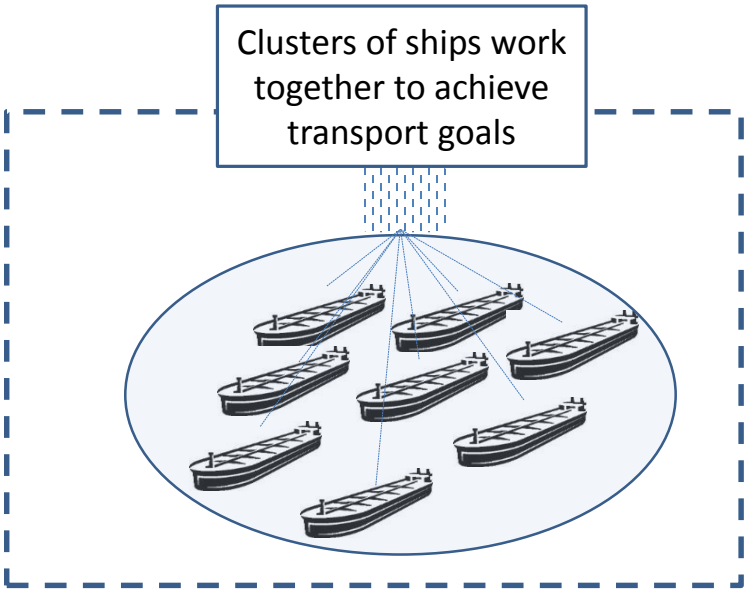
B. Transport accounting systems

- The accounting system must consider all costs
- The OPEX issue: only a small part of cost is considered by current accounting systems. More direct charging possible.
- The non-producing cost – management need to consider total performance of the transport operation
- The external cost issues: e.g. what are the implications of very big containerships for port and road transport?

Taking the cost of time into account is vital

C. Fleet Management Process

- Ships can working closely in clusters to carry out related sea transport operations.
- This organization gives each cluster the benefits of standardization and at the same time the whole process has greater flexibility.



For example VLCCs working together

D. Systems Design

- the whole transport operation is seen as an integrated process that adds value to cargo transported
- In theory, at least, the fleet should not be designed or built, until the entire process of sea transport to the customer – and its many problems –are understood.

Are these ships developed as part of a system?

Proposition 6: Others are using smart technology

1. UPS fleet using it on 48,000 trucks
2. Boeing Airplane Health management (AHM) System offered pre-installed on some planes
3. Google car automates navigation (up to a point)
4. Rolls Royce monitoring all engines in the air, real time, with follow up

Telemetric monitoring on the road!

The truck Industry: big data saves money

Example of truck fleet cost savings with telematics				
	Current Process	Re-sequenced routes	Re-assigned deliveries	Reduced routes
Number of Jobs	124	124	124	124
Total distance (miles)	1300	990	750	740
Total drive time (hrs)	36.5	27	21.9	21.5
Vehicles	12	12	12	11
Total cost	$61,456	$50,056	$44,400	$42,800
Cost saving		18%	28%	30%
Source: GE CapitalSolutions Fleet Services				

From eco-ships to the smart-shipping vision

Four Challenges

1. Another 10-20 bn tonnes cargo?
2. Energy cost ($50 oil won't last)
3. Climate change
4. Low financial returns

Three Issues/Problems

1. Slim Technical capability
2. Future crew shortages
3. Weak customer relationship

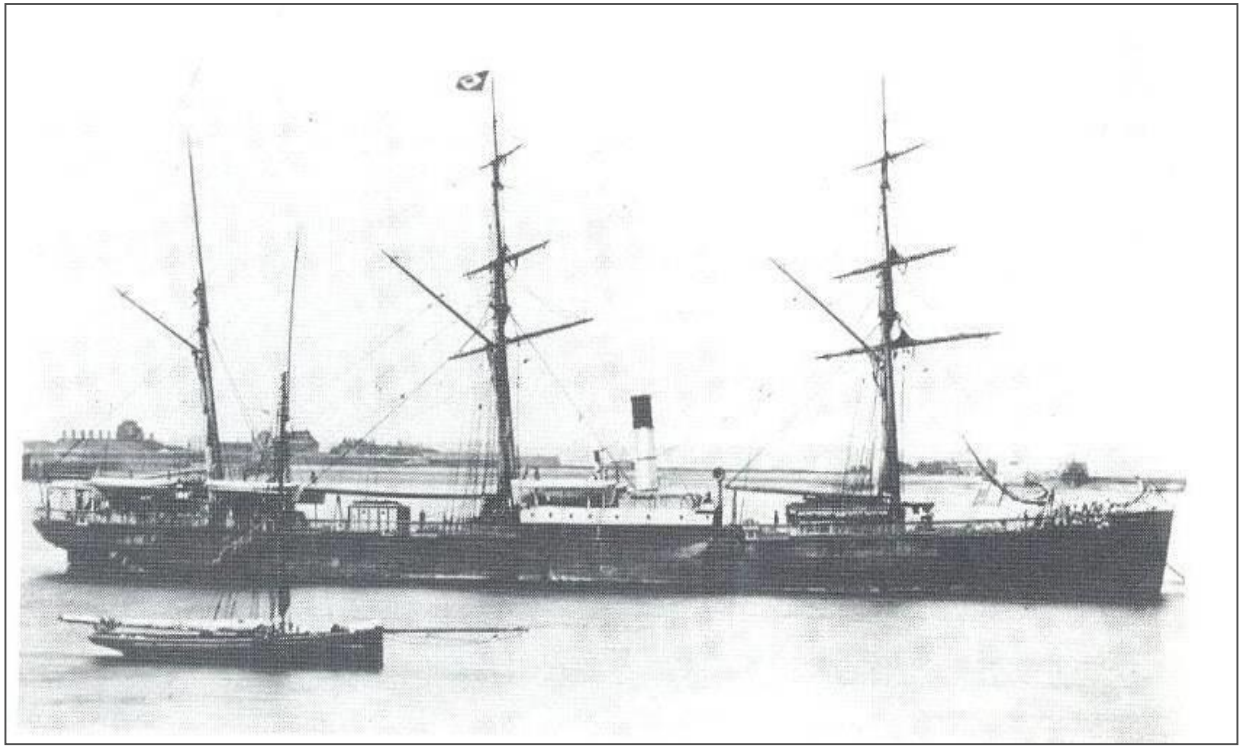
Smart Shipping toolbox

1. Telematics
2. Satellite communications
3. Data storage & analysis
4. Smart phone style apps
5. Information systems
6. Automation

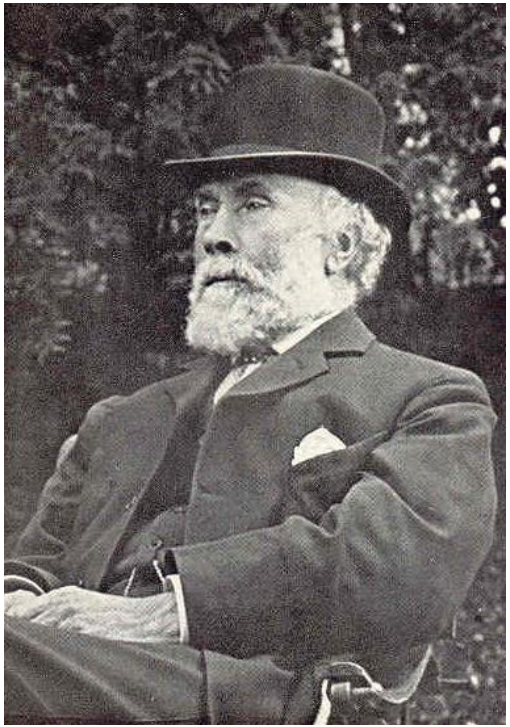
The Vision

1. Smart-Shipping can handle this, no problem !

Revolutions have to be created



The Agamemnon launched October 1865 – for the Asia Trade



Alfred Holt 1829-1911

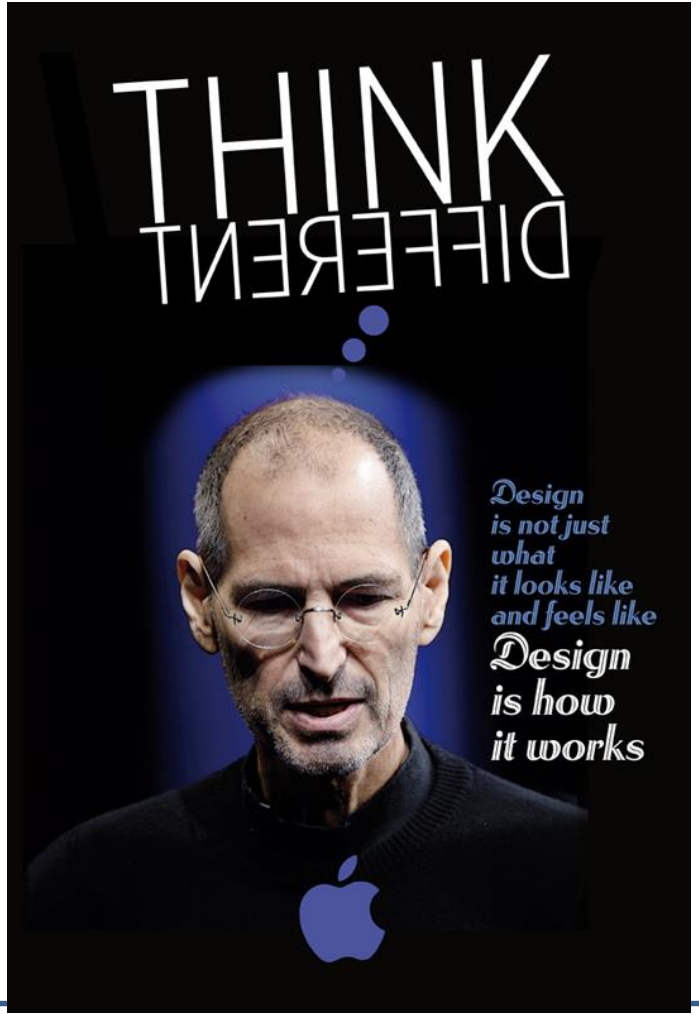
Revolutions have to be created

Fairlane discharging Rotterdam 1966

Malcolm McLean

Back to McKinsey

1. The *Great Information Wave* can help to transform sea transport
2. “Capturing that value will be very difficult, requiring an understanding of where real value can be created and…
3. successfully addressing a set of systems issues, is vital.
4. This is a management challenge at industry level as well as company level.
5. Many companies will find it difficult to adapt.



THE END…OF THE BEGINNING