

Technological Development Innovation in Ports of the Future

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1. Introduction

- One of the advantages of working at the university is the ample availability of students (MSc and PhD) to investigate new ideas and concepts
- This research was often initiated by practice (port authorities, terminal operators and consultants) and based on a good understanding of long-term trends in ports and shipping
- I will start with these trends and then show you some results of research in my group and by others.

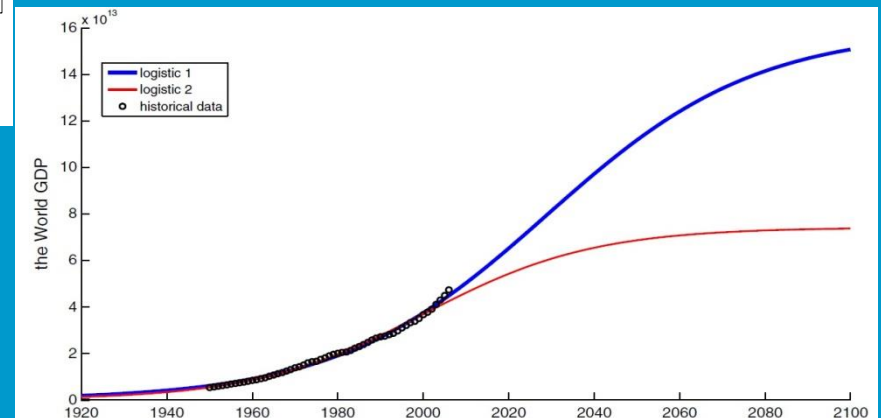
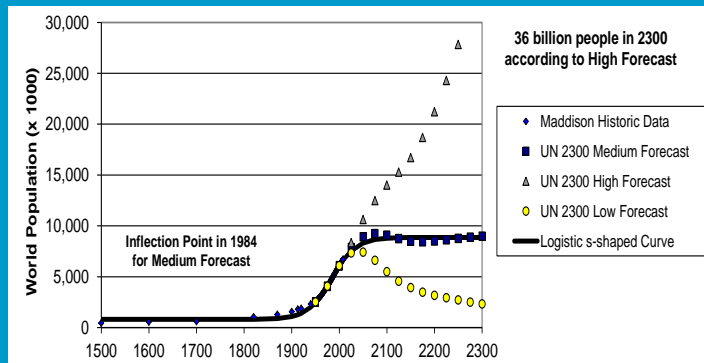
2. Long-term trends

(i) Transition from Industrial to Post-Industrial Age

	Production mode	Production factors
Industrial age (1800 - 2000)	Manufacturing	Capital, labour
Post-Industr. Age (2000 - ?)	Services and networking	Knowledge, skills, and IT

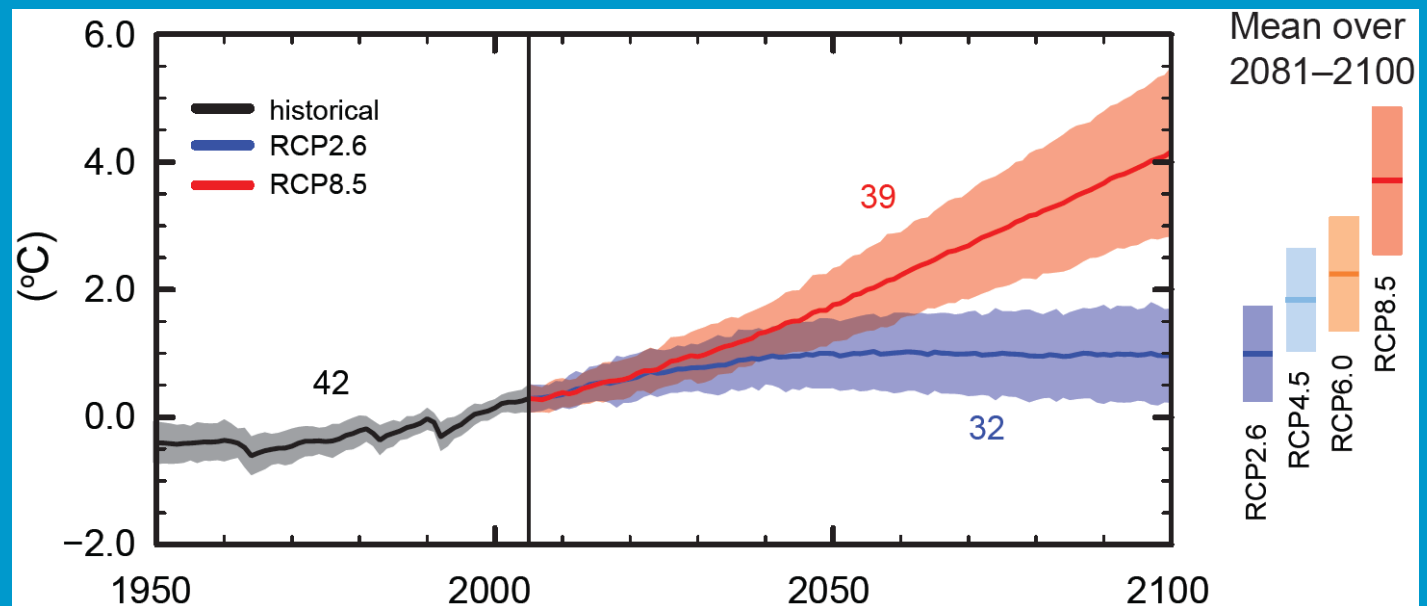
(ii) Economic growth

Forecasts of the growth of the world population and GDP show a levelling off in the course of the century



(iii) Environmental and Societal trends

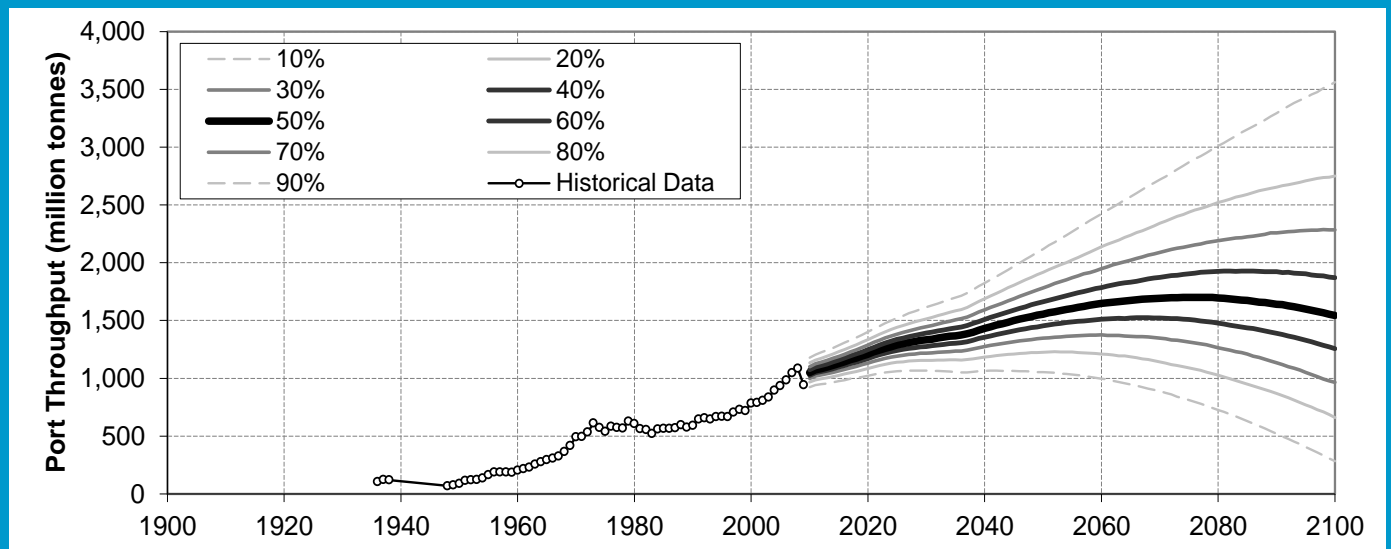
Two of the most important trends are Climate Change and the shift of production location back to the consumers (de-globalisation)



3. Implications for ports

(i) Port throughput is likely not to grow forever

Port throughput Hamburg-LeHavre range



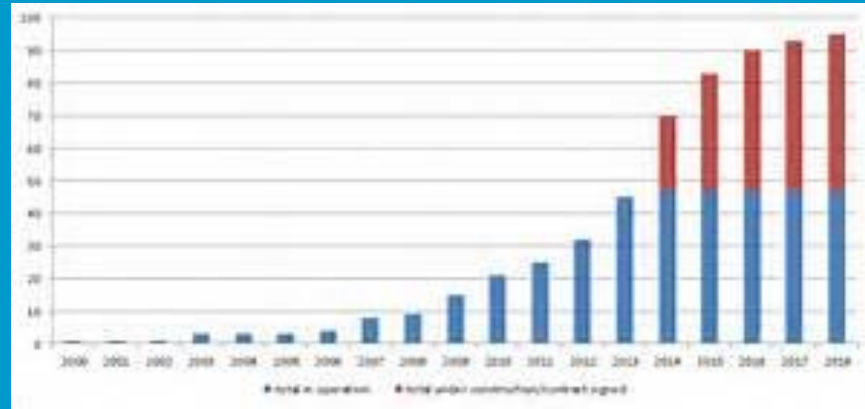
Source: Van Dorsser, 2013

(ii) Shift of cargo types and shipping patterns

- coal/oil → LNG and bio-fuels
- long distance → short sea shipping

(iii) Changes in shipping

- cleaner fuels



- automation



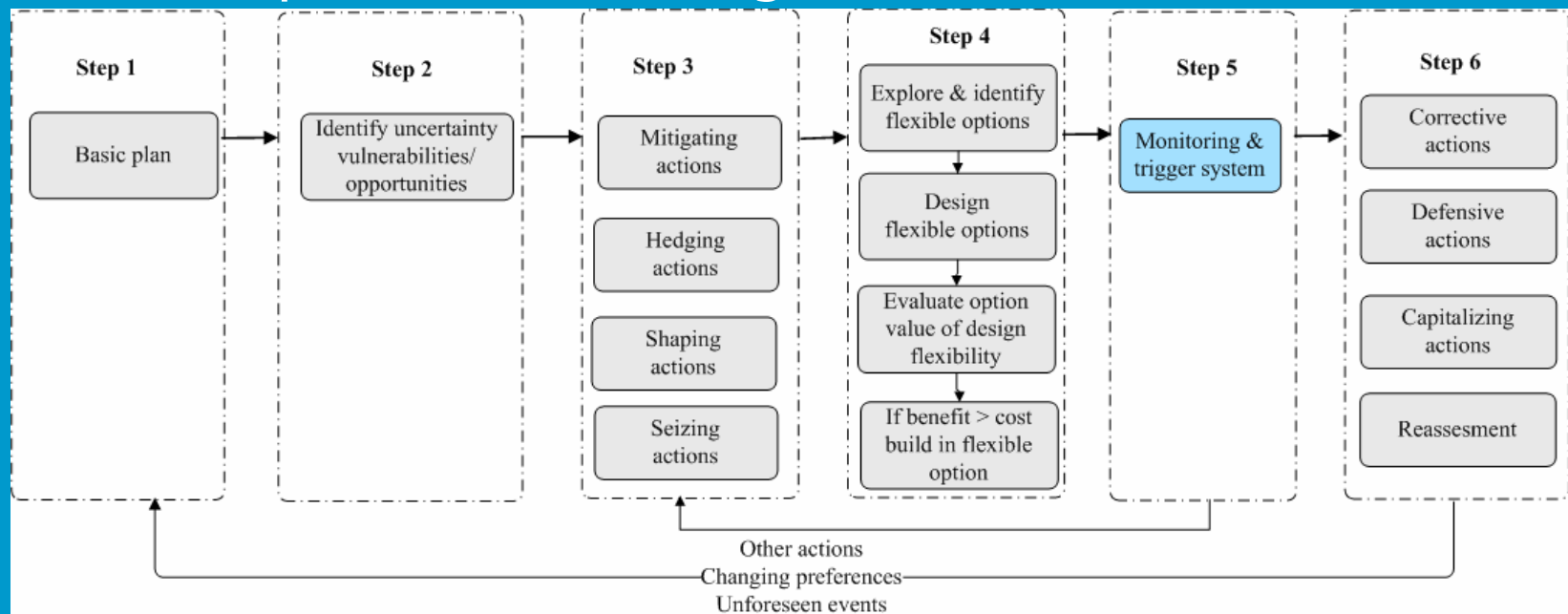
(iv) Changes in seaports

- cleaner ports (World Ports Climate Initiative/ESI)
 - Target Port of Rotterdam: CO₂ reduction of 95% by 2050! Agreement with refineries and electricity producers signed on 26 October 2016
- further automation (terminals, ship traffic)

4. Research areas

(i) Flexibility and adaptability

- Adaptive Port Planning

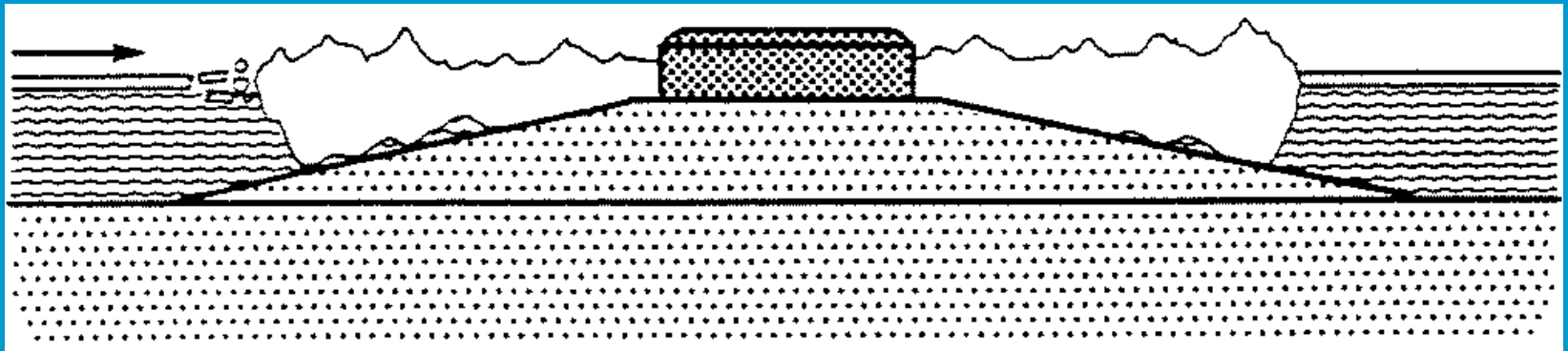


Ref. The Flexible Port, P.Taneja, 2013

- Modulair lay-outs and designs

Examples:

1. standardisation of quay-walls in large ports
2. jetty-design (OCIMF Guidelines)
3. breakwater protection of LNG-jetties in Arctic regions



- Floating terminals

Examples:

1. Kamigoto Floating Storage Base, Japan



2. Container terminals

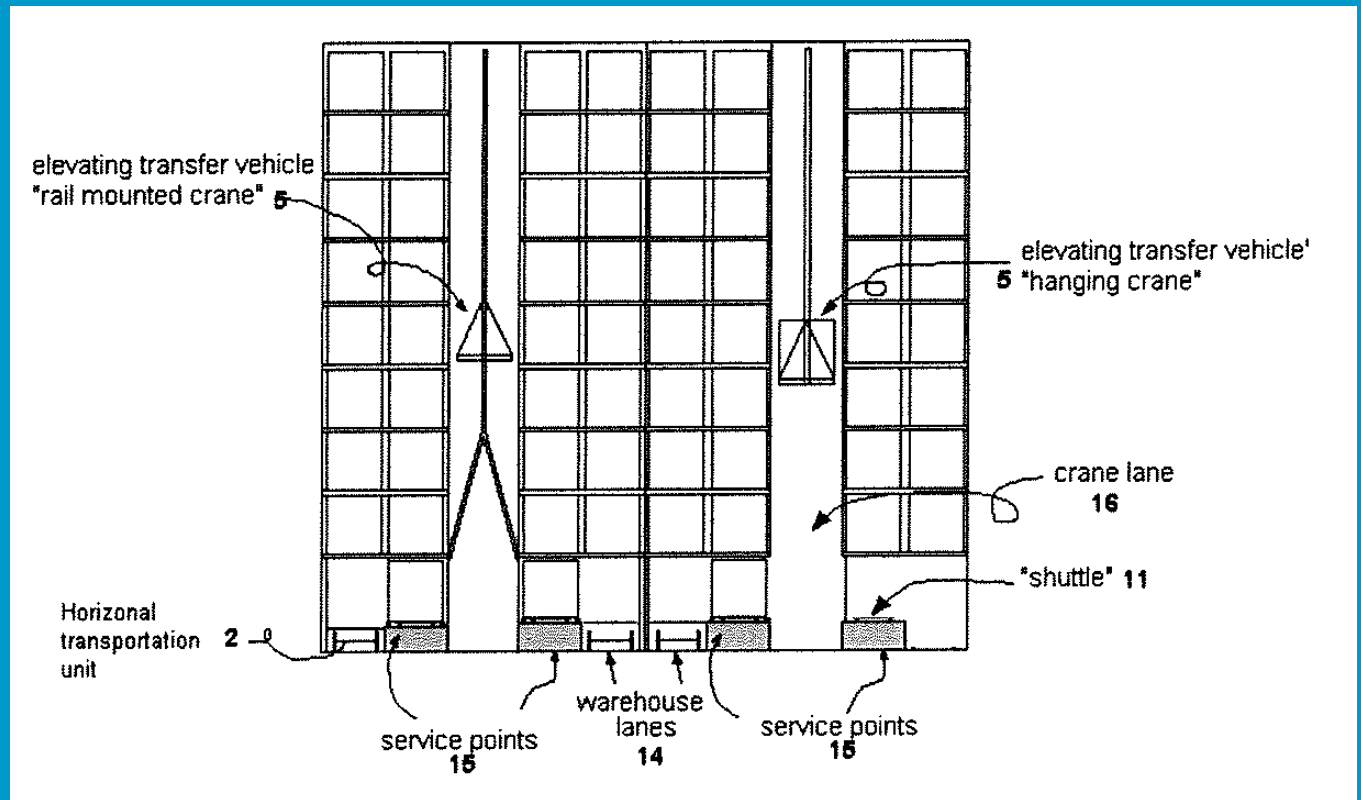


3. Liquid bulk terminals

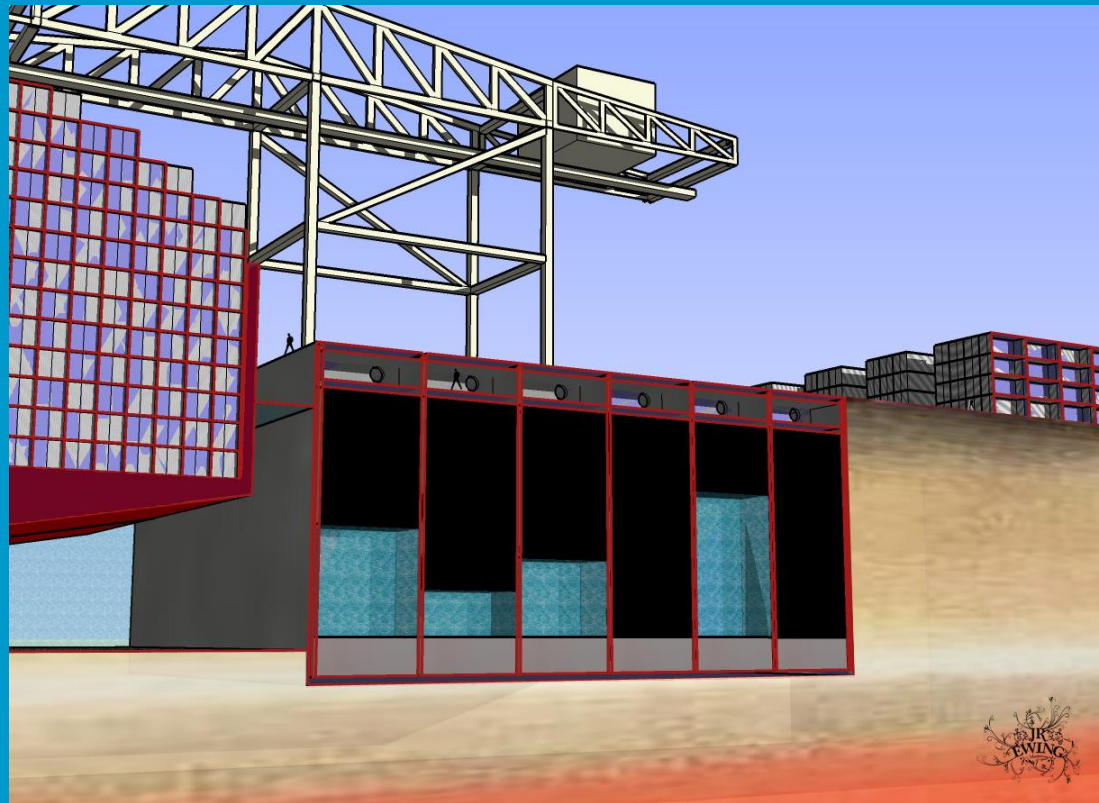


(ii) Spatial optimisation

- High-capacity container terminals



- underground storage of crude oil in combination with a container terminal



- Use of old containers to make temporary land

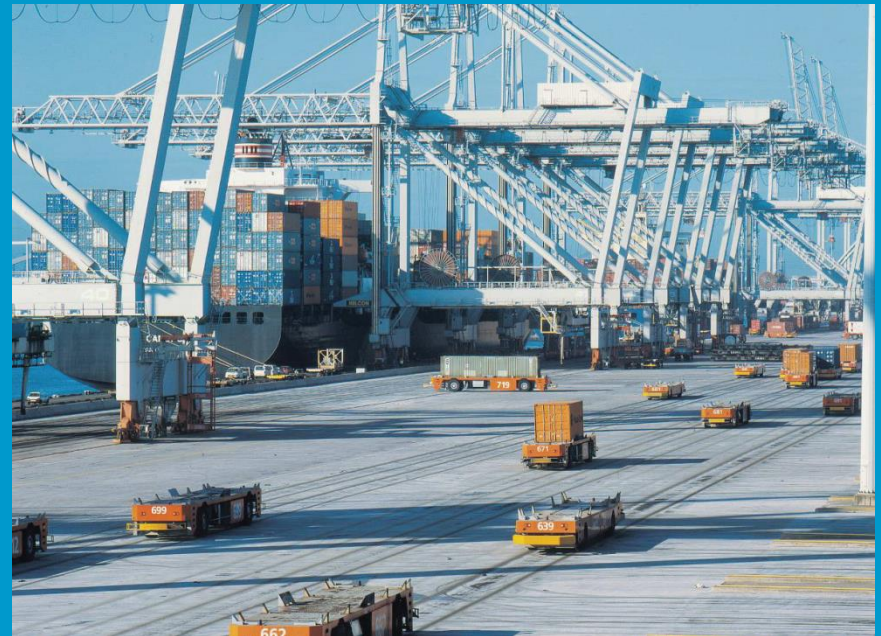
Container Land



(iii) Automation

- automation mid-size container terminals

Example:
Risavika Havn, Norway



5. Conclusions

1. **Long term** trends show a shift from labour to IT, a slowing down of growth and a change of cargo types and shipping patterns
2. The changes in ports will be more rapid, but they are uncertain. In response Adaptive Port Planning is required and the infrastructure has to become more flexible
3. Ports will become nodes of high-tech logistics, industry and services

Thank you for your attention