A Webinar

An Analysis of Maritime Risks

Maritime Risk Management in the Future

Shuo Ma

September, 2020

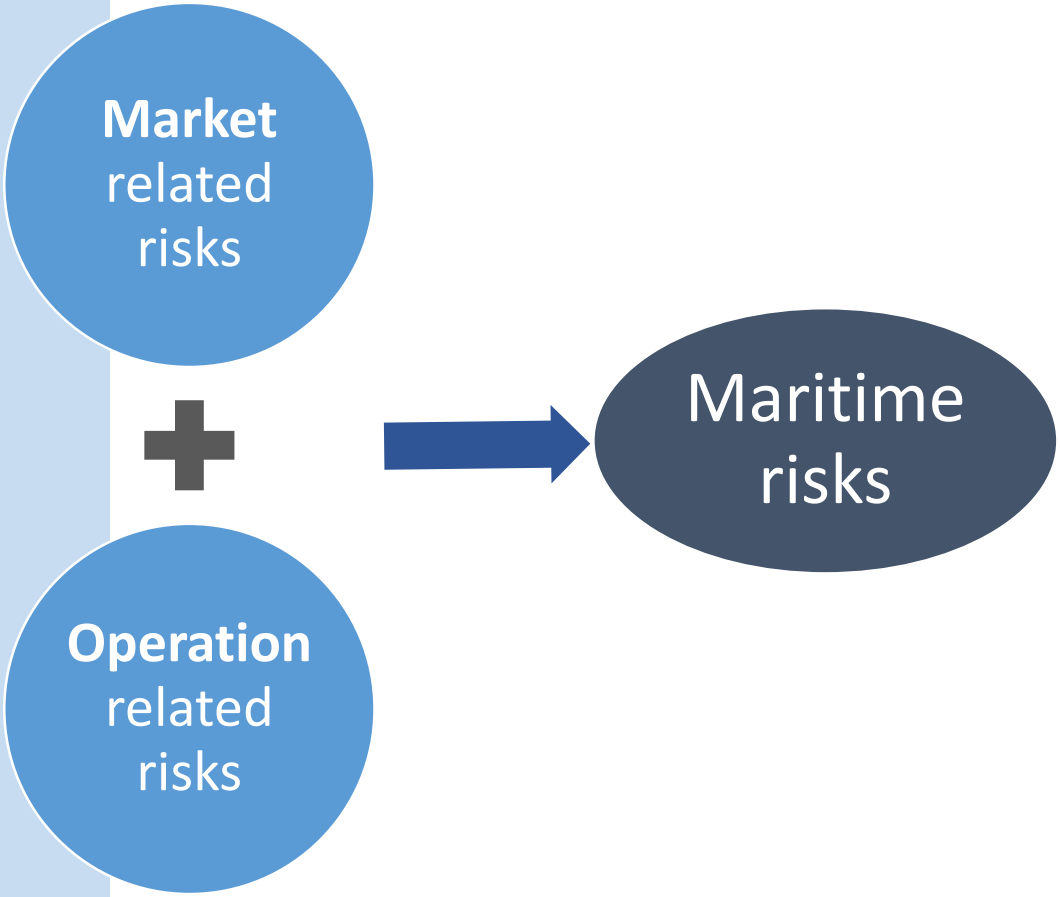
Definition of risk

What are maritime risks?

- Risk is measured by a hazard's consequence and its probability of occurrence
- Risk management is to manage and control the risks of hazards so that they are always at an acceptable or negligible level
- Risk is divided into individual risk and societal risk
- Risk equivalence concept means that a relationship exists between consequences of risk and probability of occurrence

Maritime Risks Defined

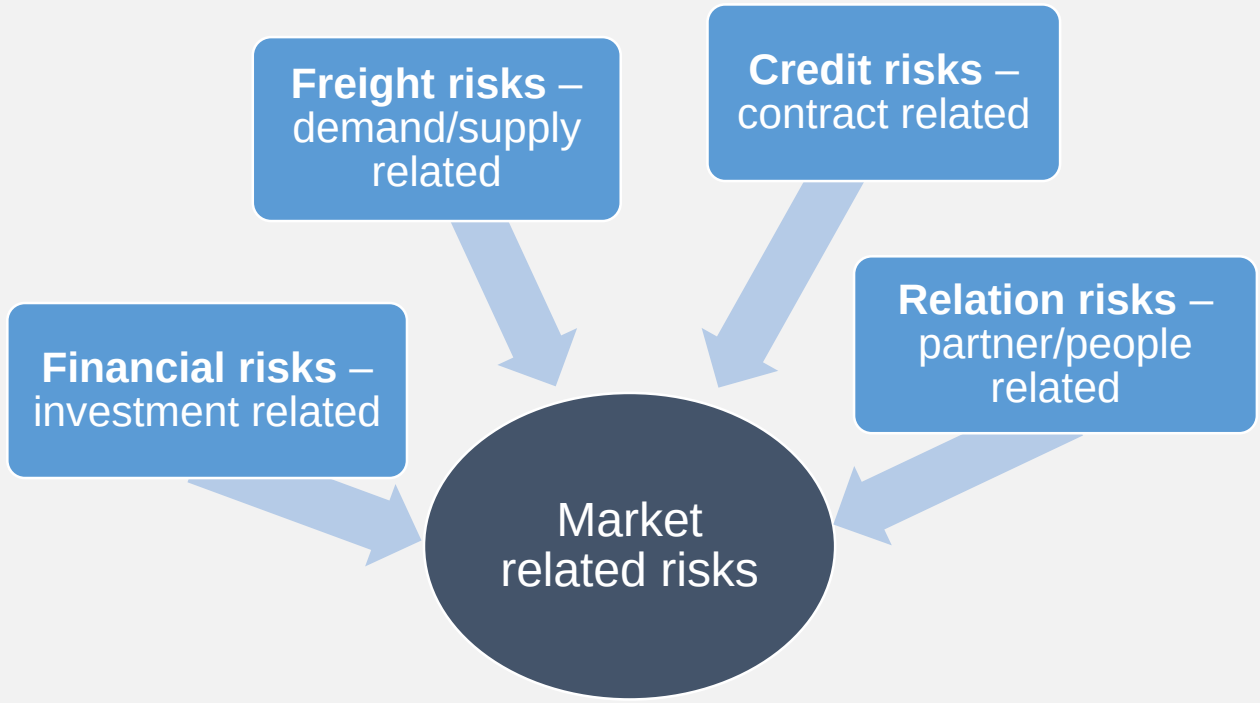
TWO main types of maritime risks



Maritime Risks Defined

What are maritime MARKET risks?

Market risks are associated with the uncertainties of trading conditions and transactions.



Maritime Risks Defined

What are maritime MARKET risks?

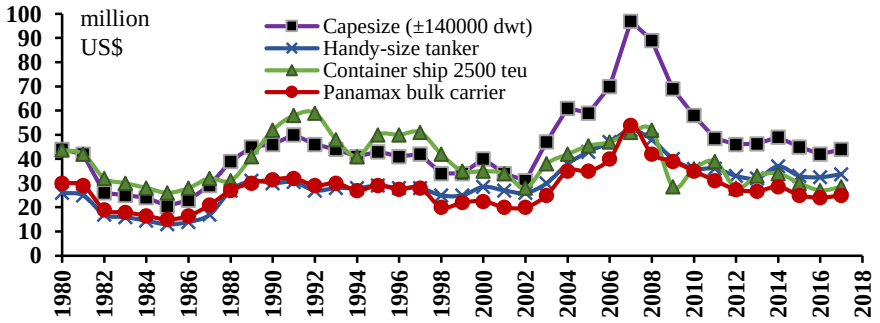
Financial risks

Freight risks

Credit risks

Partner risks

- Maritime transport is generally considered as a capital-intensive sector and it often involves a substantial sum of capital.
- Many factors would have an impact on the financial obligations of a shipping company, such as prices, interest rate, inflation, currency exchange rates, etc.
- All above influential factors are variable and difficult to predict.



Maritime Risks Defined

What are maritime MARKET risks?

Financial risks

Freight risks

Credit risks

Partner risks

Maritime freight level is affected by many factors related to demand and supply of ships

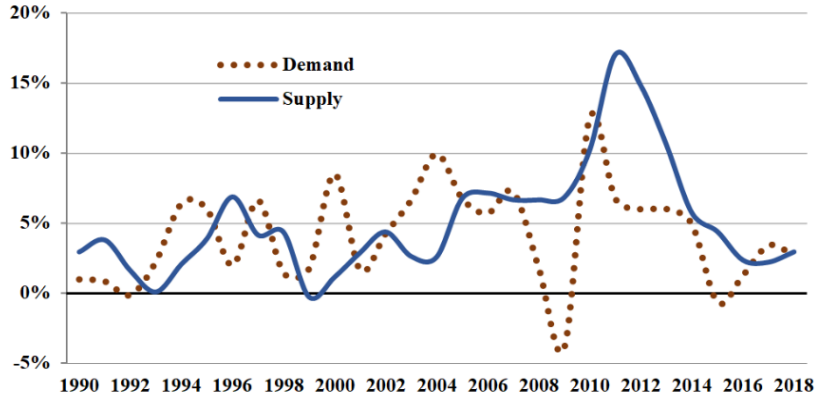


Figure 12.2. Annual changes (%) of demand and supply of dry bulk shipping, 1990 - 2018

Source: Compiled based on data from Clarksons

Note: The chart is about the annual percentage change of the World seaborne dry bulk trade (iron ore, coal, grain and other bulk trade) in tonnes and the World's bulk carrier fleet in DWT.

Maritime Risks Defined

What are maritime MARKET risks?

Financial risks

Freight risks

Credit risks

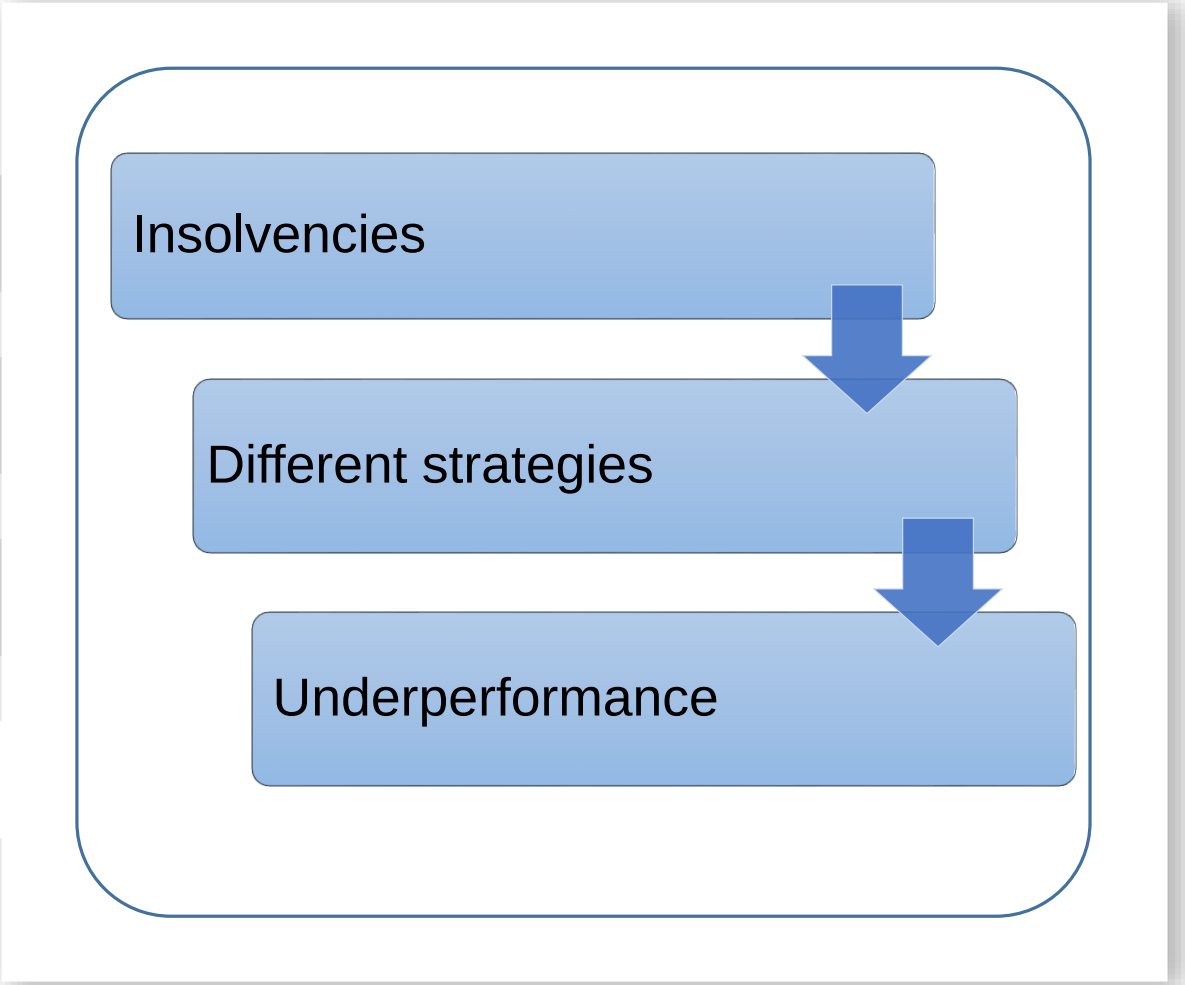
Partner risks

- Maritime fraud has been a big concern in the industry.
- Such fraud can be found in numerous situations for virtually all kinds of transactions and contracts when false documents are found.
- Other frauds are, e.g., bunker, chartering, cargo related.
- In recent year, maritime fraud has been on the rise

Maritime Risks Defined

What are maritime MARKET risks?

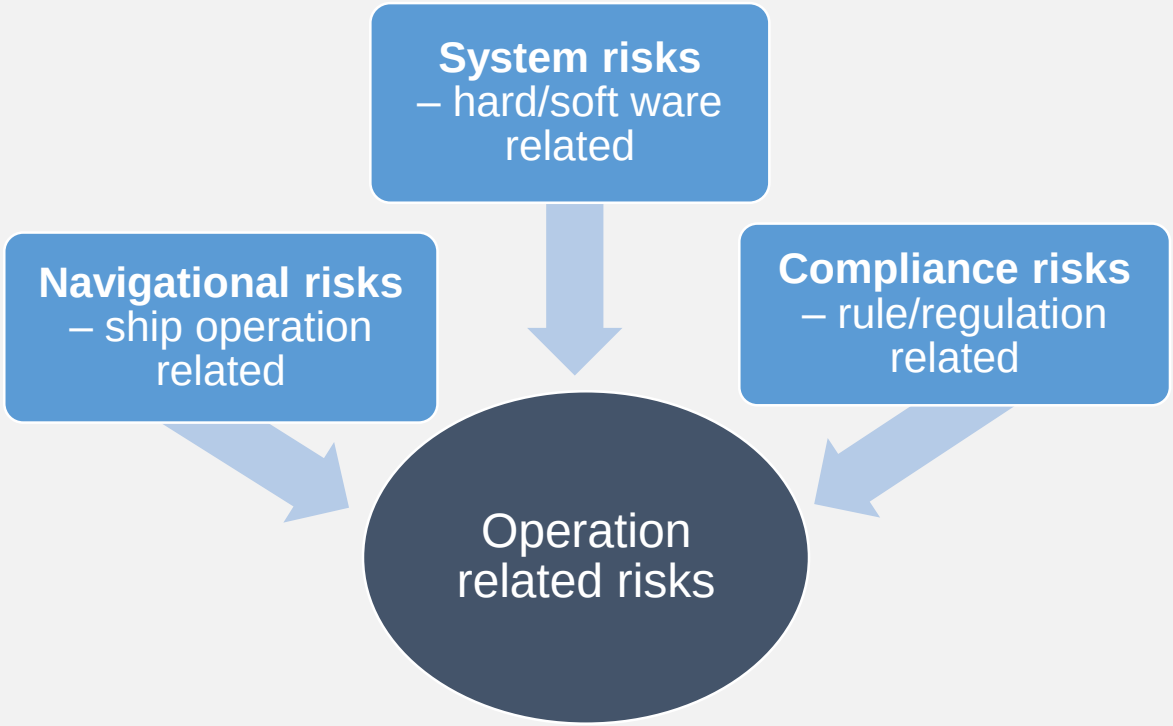
- Financial risks
- Freight risks
- Credit risks
- **Partner risks**



Maritime Risks Defined

What are maritime OPERATION risks?

Operation risks are associated with the uncertainties of ship operation and transport activities



Maritime Risks Defined

What are maritime OPERATION risks?

Navigational risks

System risks

Compliance risks

- Maritime transport is a risky activity despite tremendous improvements.
- Marine insurance which include cargo, ship and responsibility risks is about $30bn/year.
- About half of total losses are related to heavy weather (2005-2017)
- Collision and grounding are the most common types of accidents.
- Human error is the primary responsible factor of most cases.
- The most frequently cited direct causes include: inadequate risk management, failure in communication, poor judgement, and inadequate lookout …

Maritime Risks Defined

What are maritime OPERATION risks?

Navigational risks

System risks

Compliance risks

- Ship structural defects, machine failure, equipment breakdown … used to be the major causes of accidents
- Better technology and more preventive instead of corrective measures have led to remarkable improvements
- Still more than 10 percent of accidents attributable to technical failure
- Aging ships and inadequate maintenance have been among the main reasons for system risks
- Increased technological sophistication and automation have led to new system risks
- Data and internet related risks are a new threat

Maritime Risks Defined

What are maritime OPERATION risks?

Navigational risks

System risks

Compliance risks

- One of the most important elements for the reduction of operational risks is the setting and implementation of standards
- Many standards are in the form of national and international rules and regulations
- However, there are large differences between countries and firms regarding the compliance with rules and regulations
- The inadequate compliance may be due to lack of expertise or resources
- It may also be related to seeking cost advantages

Maritime Risks Management

What are root causes for maritime risks?

A. Risk = Uncertainty = Lack of information

B. Risk = Uncertainty = Unknown relations

C. Big data improves “lack of information”

D. AI improves “unknown relations”

Digital Technologies

Why is data acquisition a key factor?

- **Right decisions are always made on adequate information**
  - All activities should be digitized
  - Real time data and historical data
- **Technology in data collection**
  - Sensors
  - Voice and image recognition
- **Technology in data transfer**
  - Happening data
  - Mobile data
- **Technology in data storage**
  - Cloud
  - Data filtering and labelling

Maritime activities

Digitization and programmability

Information can be in two different forms: analogue or digital

The input of many shipping activities are or can be in digital format. This has been happening rapidly

The same is true for the outcomes of many shipping activities which can also be in digital format

The input and outcomes follow a certain structure with rules, logic and sequence

If such structure is known, the activities can be programmed

Many shipping activities are programmable

Digital Technologies

Why is computing power an enabler?

- **The complexity of decision making process**
  - The meaning of experience
  - The limit of human capability

- **The size of data – or big data**
  - Most decisions are made with a fraction of data
  - Lack of computing power to make sense of big data

- **Technology to boost computing power**
  - GPU, 3-D computing
  - Quantum computing

Digital Technologies

Why can AI derive value from data?

- **Right decisions are always made on the logic of things**
  - Processing large and complex data sets
  - Discover rules and relations

- **AI and expert system**
  - “Expert system”
  - Simulations
  - Finding the best practices

- **AI and deep learning**
  - Neural network
  - Uncover unknown patterns

Maritime Risks Defined

What are maritime risks?

	Big data–AI	IoT–AI	Blockchain
Shipping market risks	major		
Credit risks	minor		major
Navigational safety risks	major	minor	
System reliability risks	minor	major	
Rule compliance risks	minor	major	minor

Table 16.4. Effects of digital technology on maritime risks major minor

Source: Ma

Note: Digital technologies can mitigate maritime risks. The table shows the major and supplement effects on the common maritime risks between the 3 digital technologies.

Maritime Risks Management

Market Risk – Example – Financing a ship

- Some leading banks are introducing AI system that monitor details of all communications with a perspective client, pick up tones and choice of expression/words and other patterns.
- Based on big-data, the machine learning model adapts quickly when people change behaviour.
- With the input of many other relevant information about the client, the AI system differentiate between higher and lower risk alerts.
- The system provides the banks with much refined views of the risks associated with the investment.

Maritime Risks Management

Market Risk – Example – Documentation accuracy

- About 25% of serious incidents on containerships were attributable to mis-declaration on, in particular, dangerous goods and cargo's weight.
- A shipping company uses AI and natural language to analyse full sets of documentation.
- Abnormality could be detected at early stage and alert the carrier in good time.
- The implementation of the system has showed very positive result. The longer and broadly the system is used, the better and more accurate the outcomes will be.

Maritime Risks Management

Operation Risk – Example – Navigational safety

- Over 50% of total losses are related to heavy weather.
- By permanently monitoring data on weather, sea conditions, vessel location, speed, ENC data, past data on incident in same and similar situation, etc. best routes and timing can be calculated.
- Digitalization can drastically reduce human errors such ignorance of risk rules, wrong judgement, failure in communication, inadequate lookout, etc.
- Such navigational system can give early alert when unusual manoeuvring or deviation from suggested route or potential collision/grounding are detected.

Maritime Risks Management

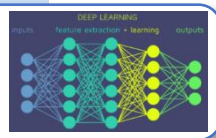
Operation Risk – Example – System Reliability

- About 11% of maritime accidents are attributable to technical deficiencies and failures.
- The traditional remedy is to intensify checking, by various surveys: flag state, port state, class ... Yet, extra efforts only bringing diminishing effects.
- Digital technologies, such as big data and IoT have started to change the situation. Real time data is collected by many sensors, cameras and processed by AI to identify unknown patterns.
- Consequently, early signs of technical failure can be detected or anticipated. And preventive measures can be undertaken in good time.

Maritime risk re-defined

Why will the future of maritime risk management be different? – an example of marine insurance

3. AI based



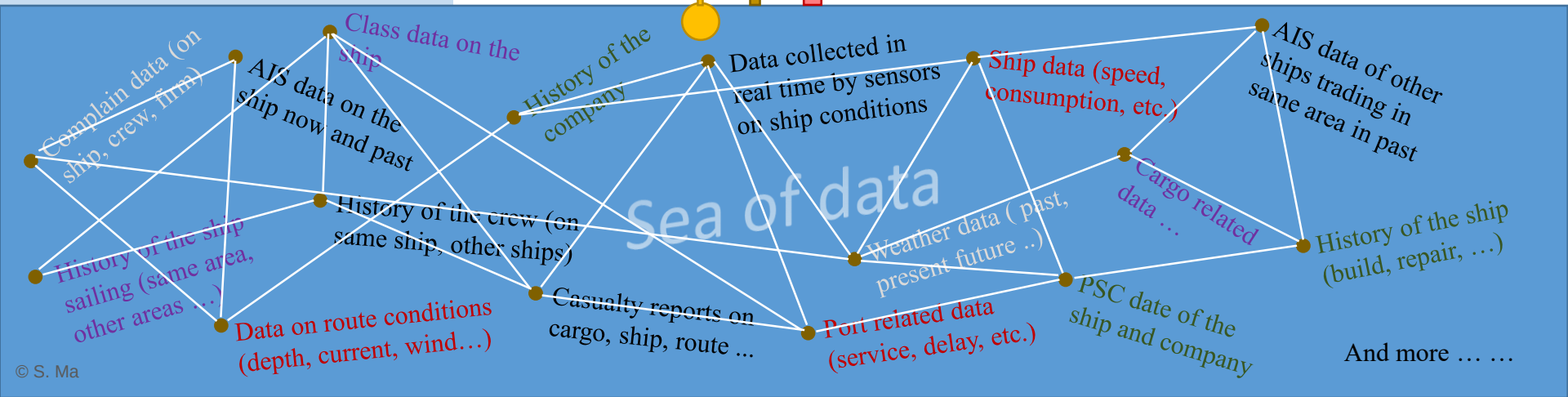
- Collect, store and process huge data
- Process using deep-learning algorithm
- Uncover best incl. unknown solutions

2. Big-data based

- Collect, store and process huge data
- Using models developed by experts
- Find best solutions models can provide

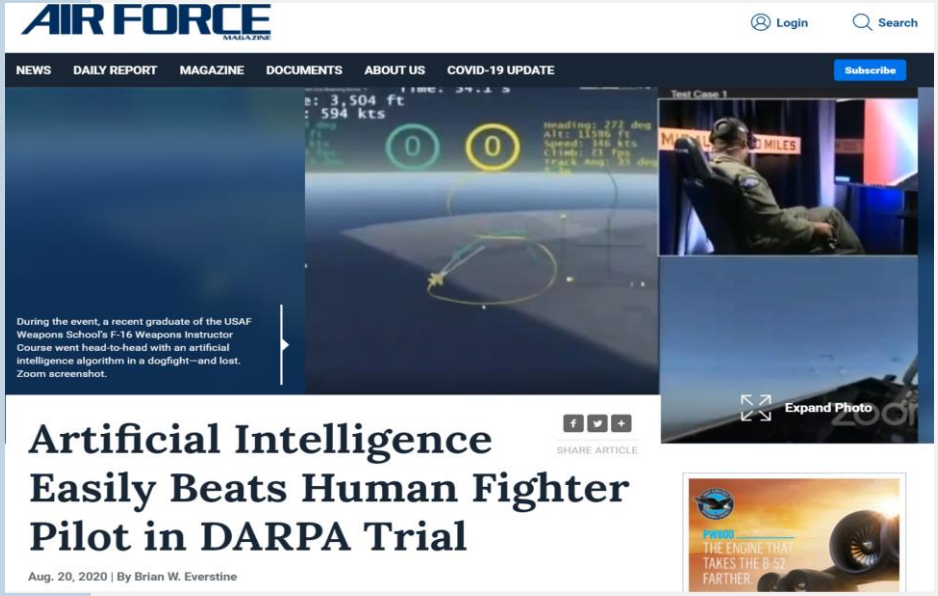
1. Expert based

- Get a fraction from the sea of data
- Remember a few hundred past cases
- Process the data with human brain



Maritime Risks Management

Operation Risk – Example – System Reliability



The artificial intelligence algorithm, developed by Heron Systems, swept a human F-16 pilot in a simulated dogfight 5-0 in the Defense Advanced Research Projects Agency's AlphaDogfight Trials on Aug. 20. The company beat out seven other companies before going head to head with "Banger," a pilot from the District of Columbia Air National Guard and a recent graduate of the Air Force Weapons School's F-16 Weapons Instructor Course. The pilot, whose full name was not provided, is an operational fighter pilot with more than 2,000 hours in the F-16.

Maritime Risks

Future of maritime risk management

The Main Features of Future Maritime Risks

A Data, digitalization and AI based

B Some traditional risks … not any more …

C New types of risks emerge …

D Different kinds of “uncertainty” remain

End

This presentation is based on a new publication

Q & A

Published in July 2020 by Routledge, Taylor & Francis, London and New York. ISBN: 978-1-138-99964-0

450 pages with sixteen chapters divided in 4 parts dealing with “demand”, “Supply”, “Market” and “Strategy”

The book consists of in-depth discussions on more than 250 specific questions. The analysis are illustrated by more than 160 graphs