Challenges for innovation in the maritime industry

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CHALLENGES

for Innovation in Networks in the Maritime Industry

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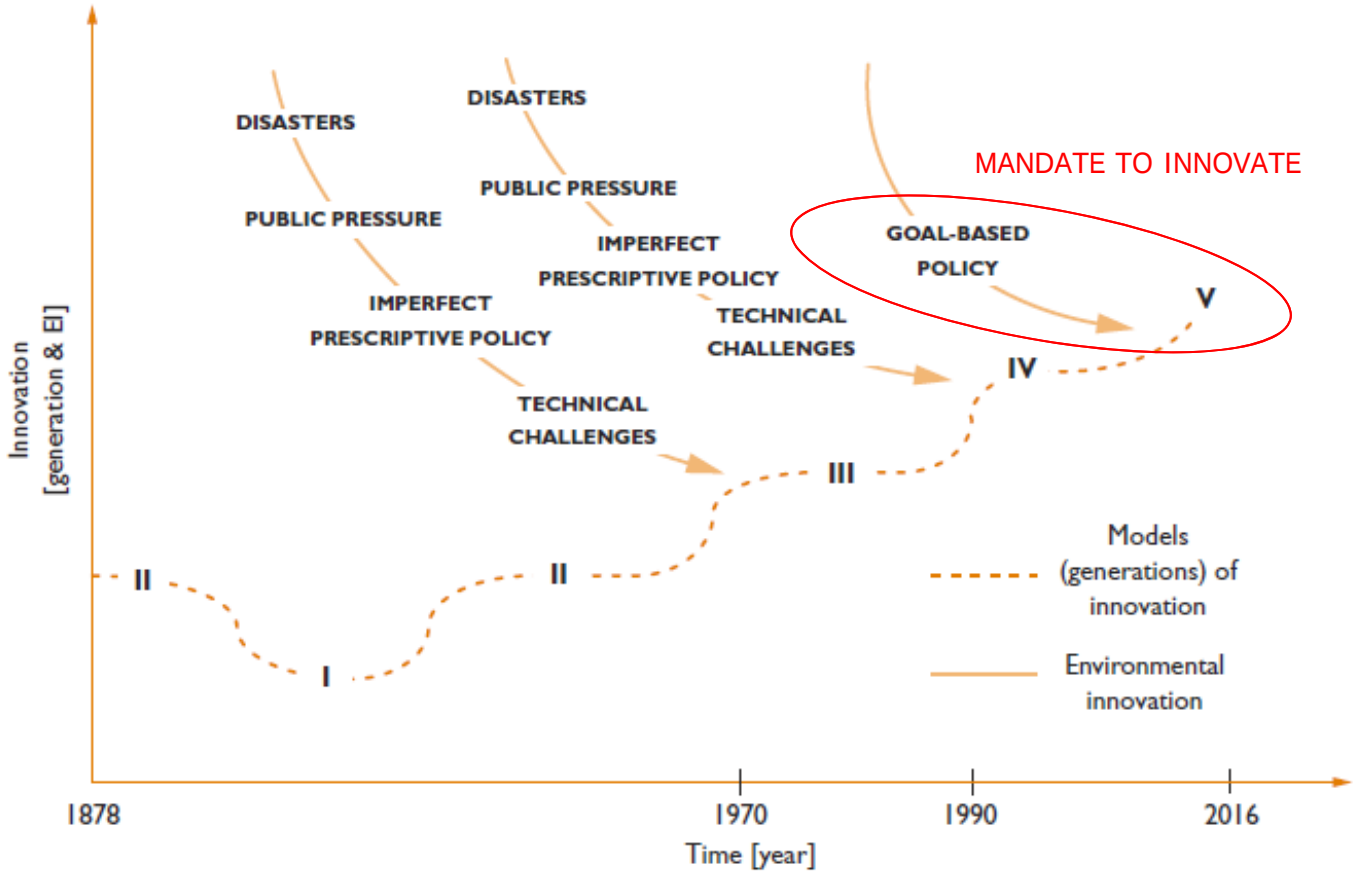
Innovation dynamics in the maritime industry



Perunovic and Vidic-Perunovic (2012)

Research sponsored by the Danish Maritime Fund

Research objectives

• Determine the **key enablers, barriers, and mechanisms** of "innovation in networks" in the maritime industry

• Identify the key **characteristics of collaborative innovation processes** applied in the maritime industry

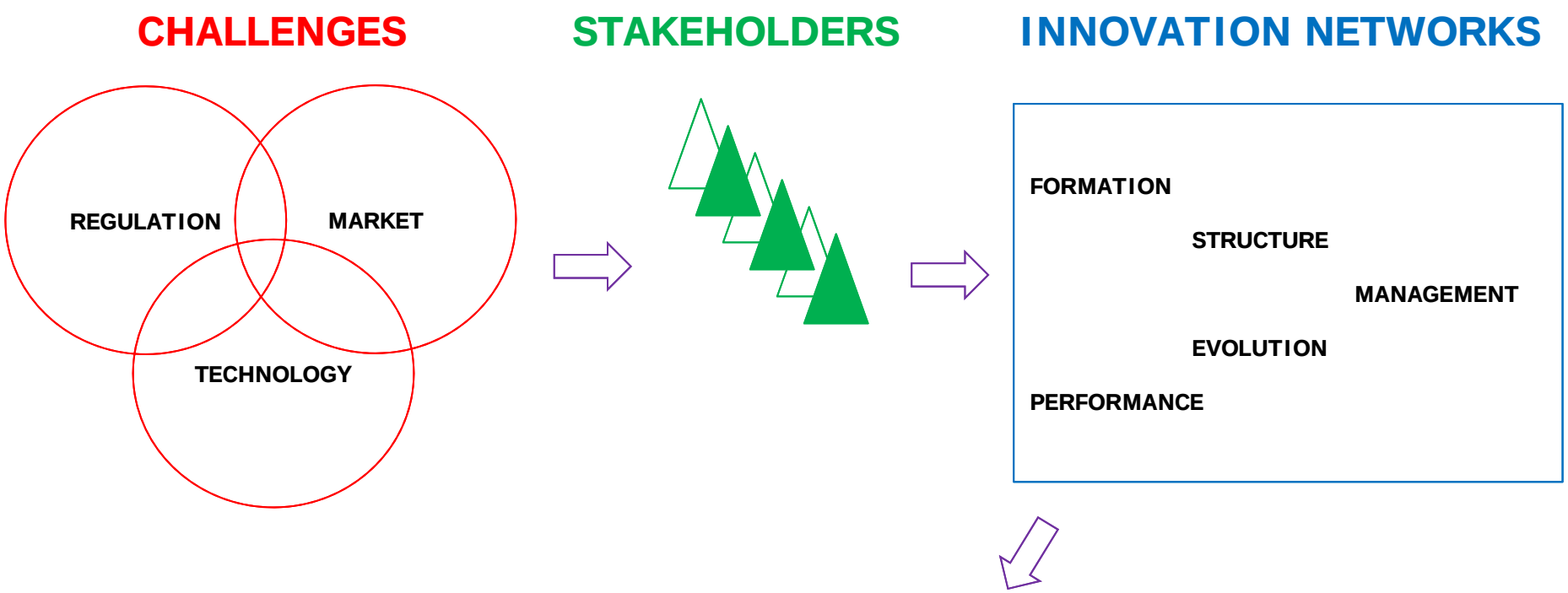
• Determine **managerial actions** to be undertaken to organize for successful innovation in networks

• **Asses the benefits** of innovation in networks

Research strategy

• Multiple-case research strategy

Research design



Explanation of how "innovation in networks" creates value for participants in the maritime industry

Regulatory requirements

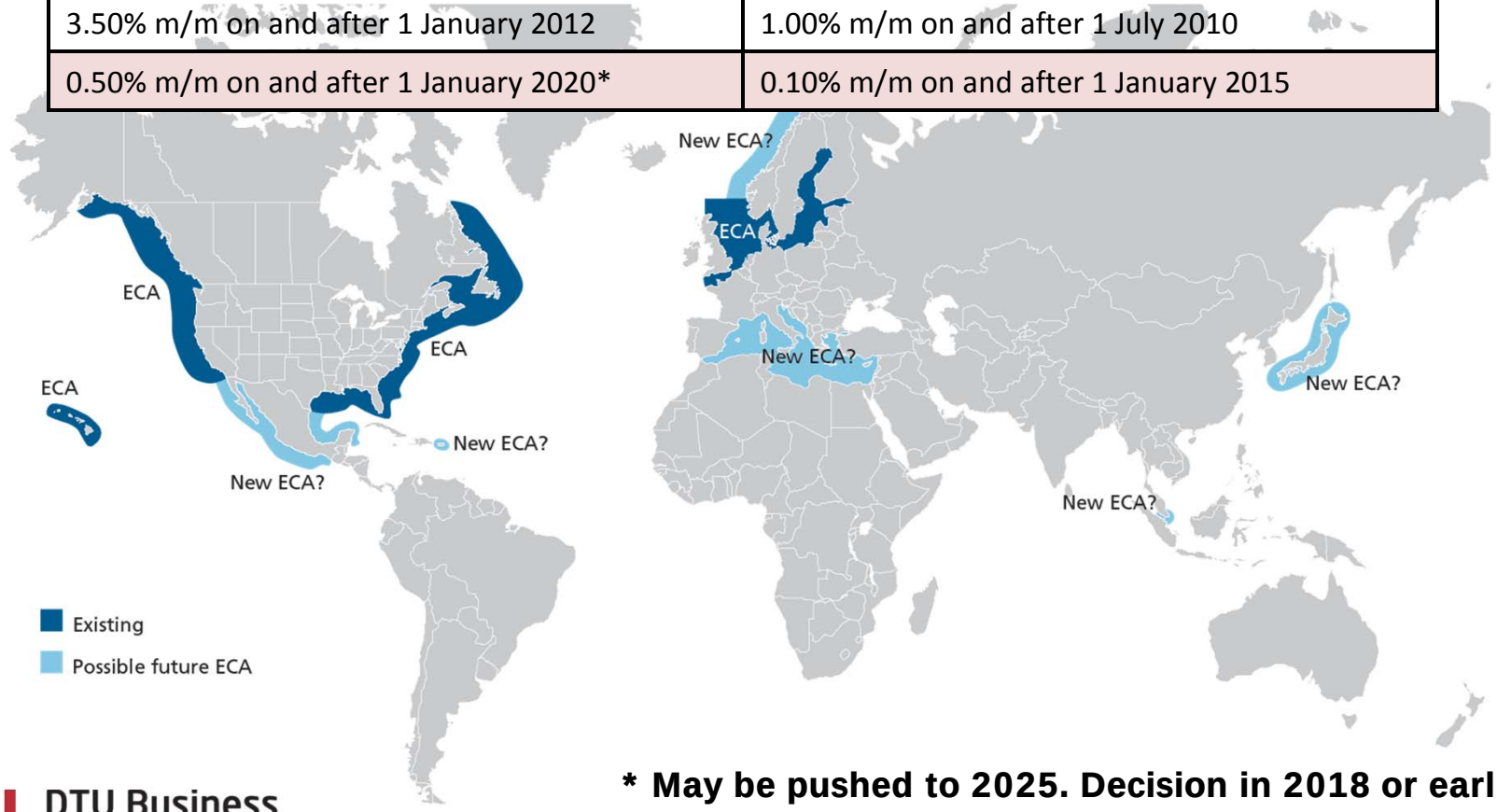
Air pollution reduction
SOx, NOx, PM, CO_2

Ballast Water Treatment

Regulatory requirements

SOx reduction

Outside an ECA established to limit SOx and particulate matter emissions	Inside an ECA established to limit SOx and particulate matter emissions
4.50% m/m prior to 1 January 2012	1.50% m/m prior to 1 July 2010
3.50% m/m on and after 1 January 2012	1.00% m/m on and after 1 July 2010
0.50% m/m on and after 1 January 2020*	0.10% m/m on and after 1 January 2015



*** May be pushed to 2025. Decision in 2018 or earlier.**

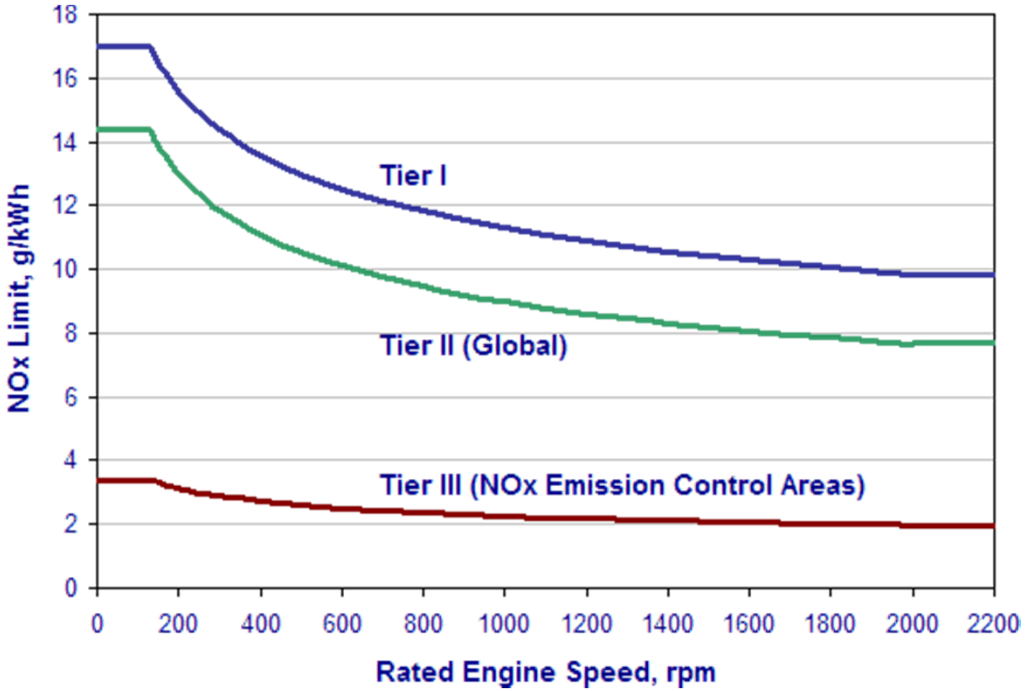
Regulatory requirements

NOx reduction

Tier	Ship construction date on or after	Total weighted cycle emission limit (g/kWh) n = engine's rated speed (rpm)		
		n < 130	n = 130 – 1999	n ≥ 2000
I	1 January 2000	17.0	45.n-0.2 e.g., 720 rpm – 12.1	9.8
II	1 January 2011	14.4	44.n-0.23 e.g., 720 rpm – 9.7	7.7
III	1 January 2016	3.4	9.n-0.2 e.g., 720 rpm – 2.4	2.0

Tier III enforcement date (January 2016) is being debated. US and Canada will implement 2016. Other and new ECA still uncertain.

Major engine conversion could shift compliance from Tier I to Tier II



Regulatory requirements

Greenhouse gasses

Vessel type	Size	Phase 0 2013 – 2014	Phase 1 2015 - 2019	Phase 2 2020 - 2024	Phase 3 2025 -
Bulk carriers	>20,000 dwt 10-20,000 dwt	0% n/a	10% 0-10%	20% 0-20%	30% 0-30%
Gas tankers	>10,000 dwt 2-10,000 dwt	0% n/a	10% 0-10%	20% 0-20%	30% 0-30%
Tanker and combination carriers	>20,000 dwt 4-20,000 dwt	0% n/a	10% 0-10%	20% 0-20%	30% 0-30%
Container ships	>15,000 dwt 10-15,000 dwt	0% n/a	10% 0-10%	20% 0-20%	30% 0-30%
General cargo	>15,000 dwt 3-15,000 dwt	0% n/a	10% 0-10%	15% 0-15%	30% 0-30%
Refrigerated cargo	>5,000 dwt 3-5,000 dwt	0% n/a	10% 0-10%	15% 0-15%	30% 0-30%

Market-based, operational, and technical measures proposed

Energy Efficiency Design Index (EEDI)

$$EEDI = \frac{CO_2\ emission}{transport\ work}$$

Ship Energy Efficiency Management Plan (SEEMP)

Energy Efficiency Operational Indicator (EEOI)

Regulatory requirements

Ballast water treatment

Year constructed	BW Capacity (m^3)	Applicability of standards	New schedule
Before 2009	1,500 - 5,000	D-1 or D-2 before end of 2014. D-2 from 2015	1st renewal survey after entry into force of the Convention
Before 2009	Less than 1,500 or greater than 5,000	D-1 and D-2 before end of 2016. D-2 from 2017	1st renewal survey after the anniversary date of delivery of ship in 2016
In 2009 or after	Less than 5,000	D-2	1st renewal survey after entry into force of the Convention
Between 2009 and 2012	5,000 or more	D-1 and D-2 before end of 2016. D-2 from 2017	1st renewal survey after the anniversary date of delivery of ship in 2016
In 2012 or after	5,000 or more	D-2	1st renewal survey after entry into force of the Convention

← IMO

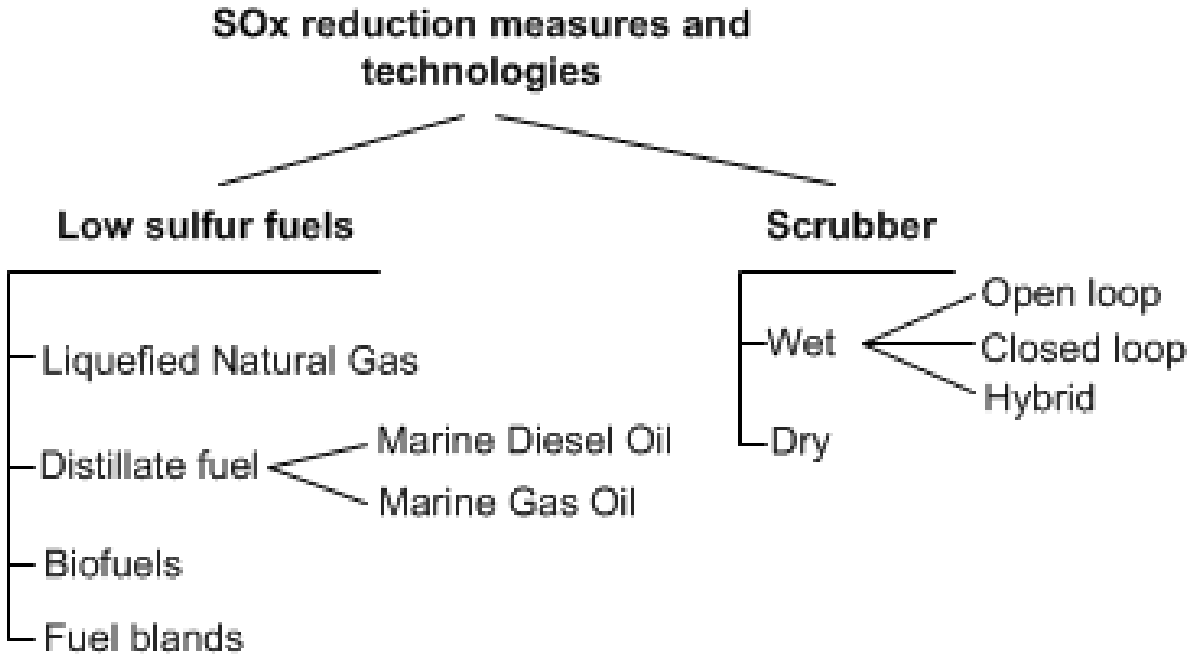
Vessel type	BW capacity	Date constructed	Vessel's compliance date
New	All	On or after 1 December 2013	On delivery
Existing	Less than 1500 m^3	Before 1 December 2013	First scheduled drydocking after 1 January 2016
Existing	1500 - 5000 m^3	Before 1 December 2013	First scheduled drydocking after 1 January 2014
Existing	Greater than 5000 m^3	Before 1 December 2013	First scheduled drydocking after 1 January 2016

← US

IMO postponed – US will start
Different requirements for approval of systems
50+ different systems

Technologies

SOx reduction



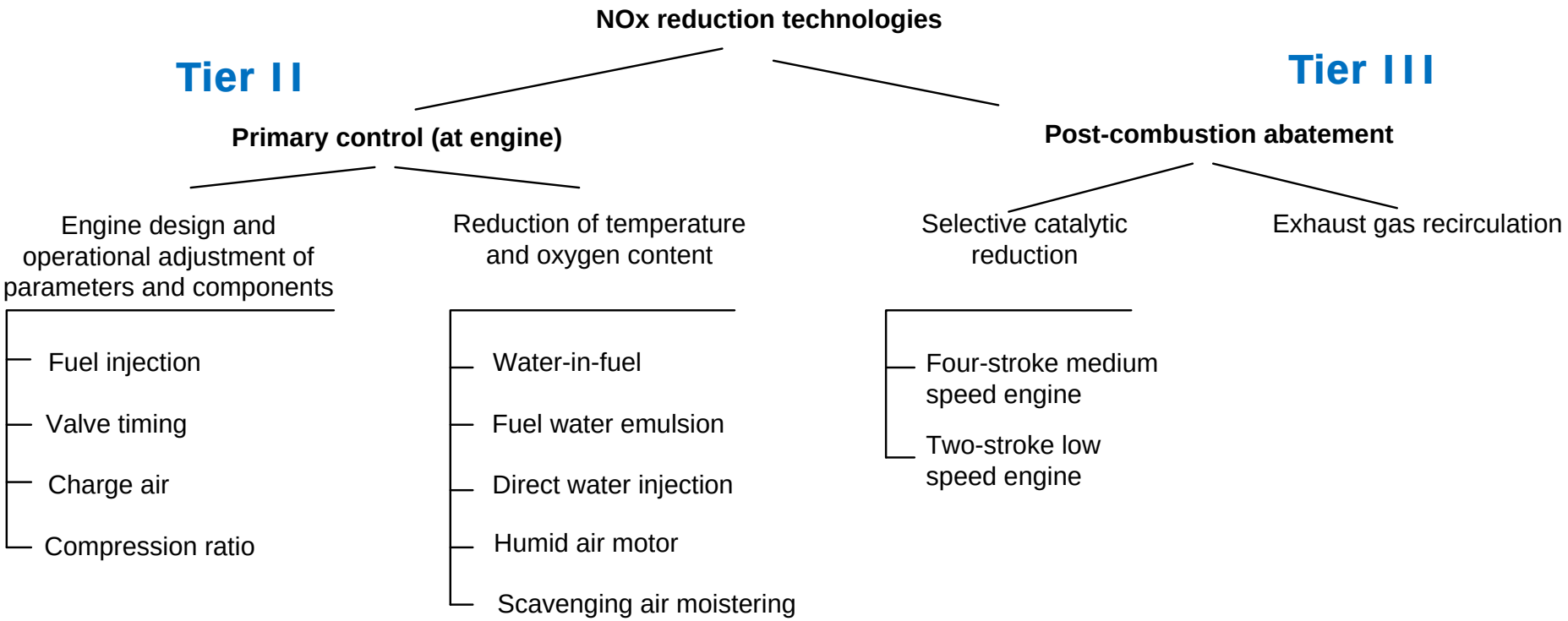
Engine modifications required

Lengthy installation process

LNG not effective for retrofitting

Technologies

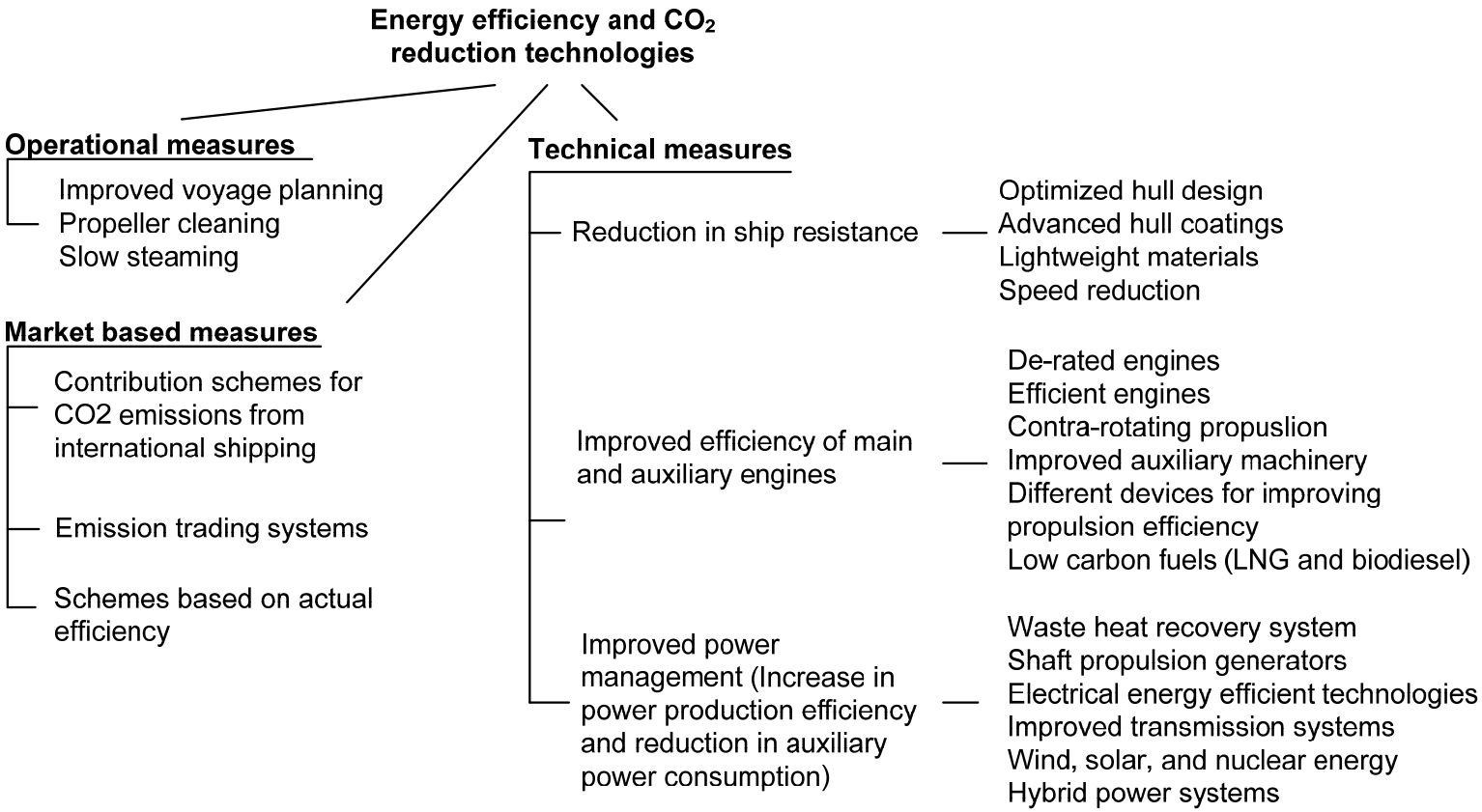
NOx reduction



Negative correlation between fuel combustion efficiency and NOx emission

Technologies

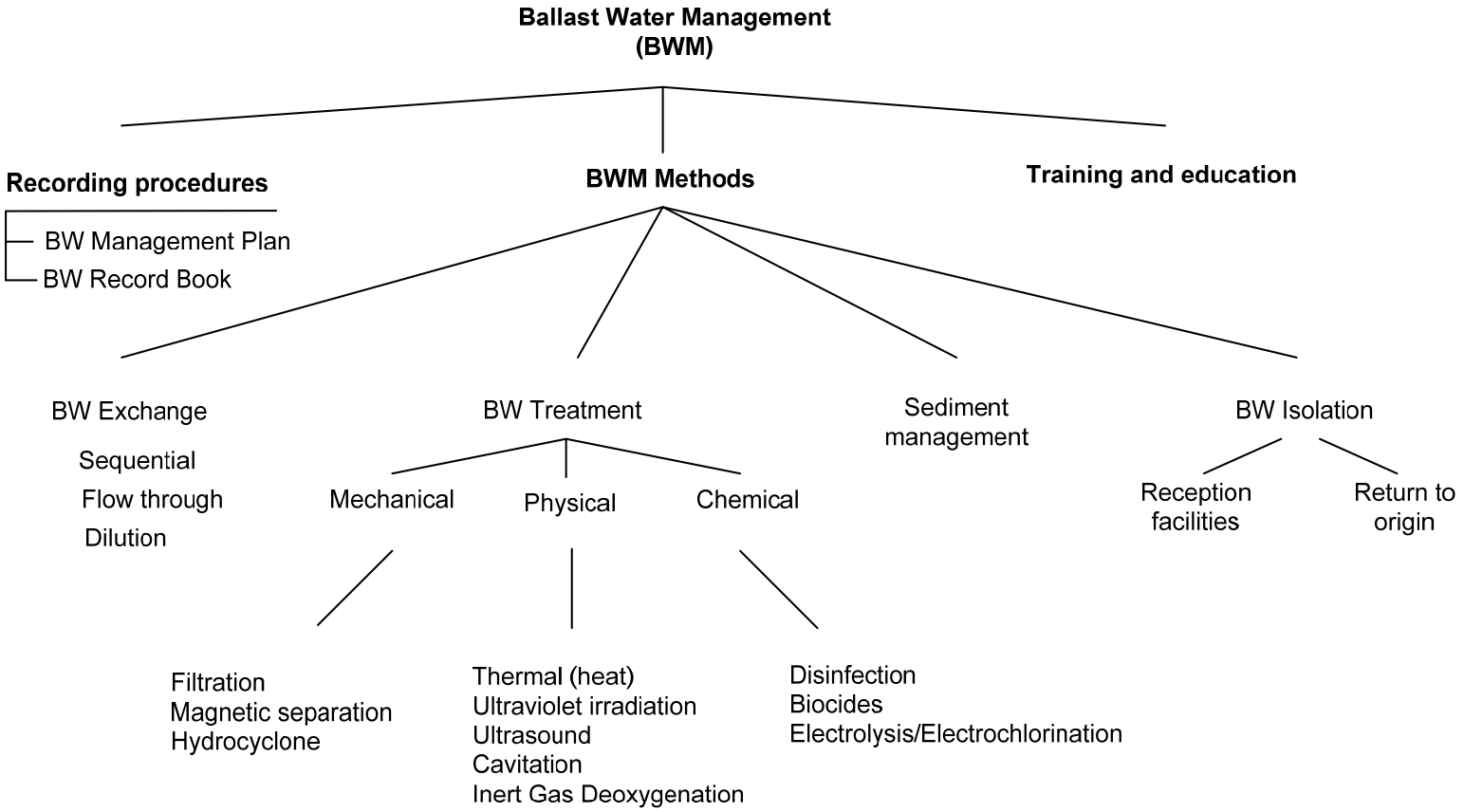
Energy efficiency and CO2 reduction



Retrofit vs Newbuild

Technologies

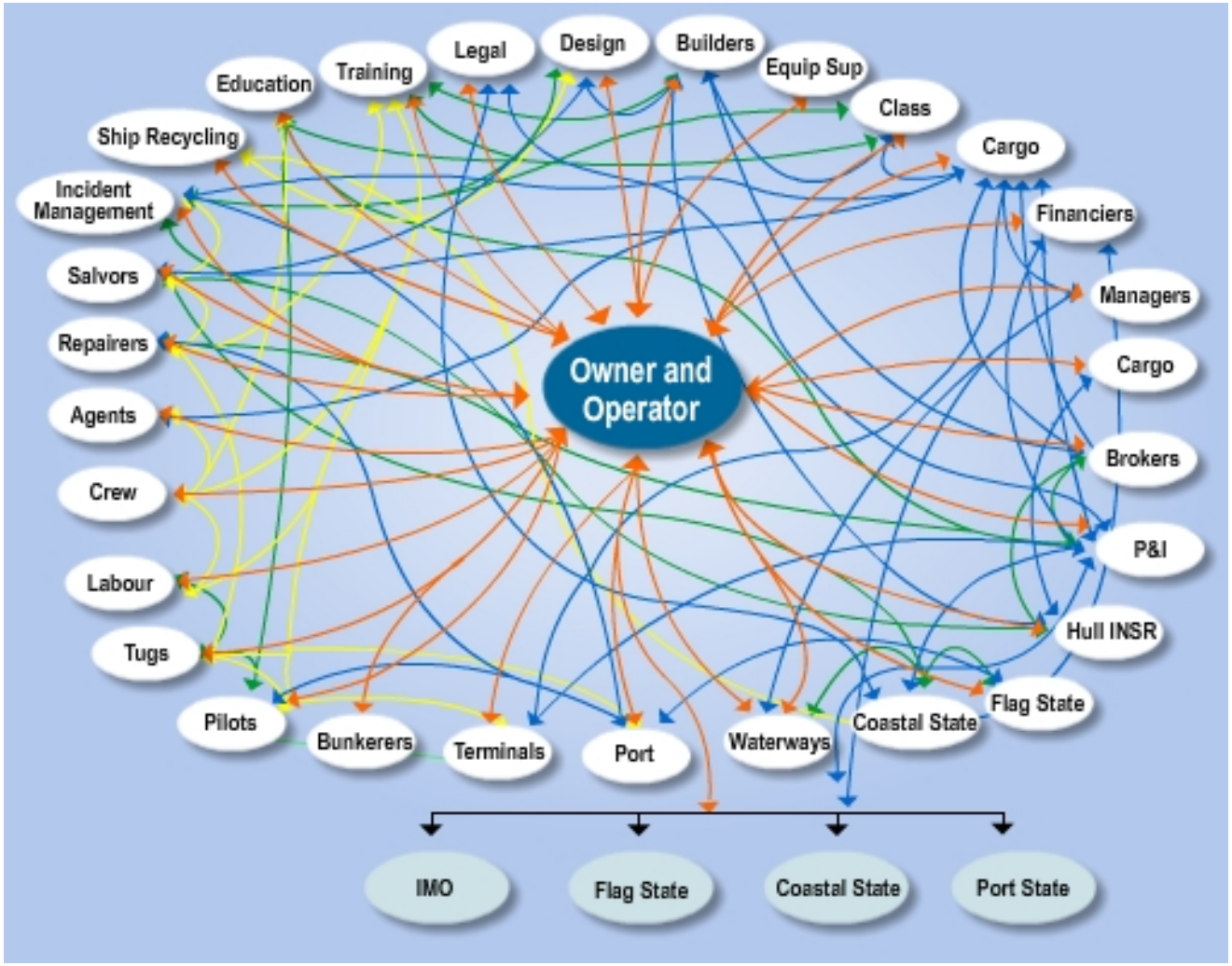
Ballast water treatment



Market challenges

- Fleet over-capacity creates low freight rates and aggressive competition
- Price development of HFO vs. other fuel options such as LNG, is very difficult to predict, and the outcome will have tremendous effect on the business case for the different options
- Market is growing North-South rather than East-West, with different trade of goods, and thus different types of ships. Hence, obsolete vessels on e.g. Asia-Europe trade cannot easily be transferred to Europe-South America
- Ships being built today have an expected life-time of 25 years. Regulatory landscape will look different by then, but many solutions are irreversible – hence placing the bet on LNG is not something you can go and change

Stakeholders



In general

Enforcement dates

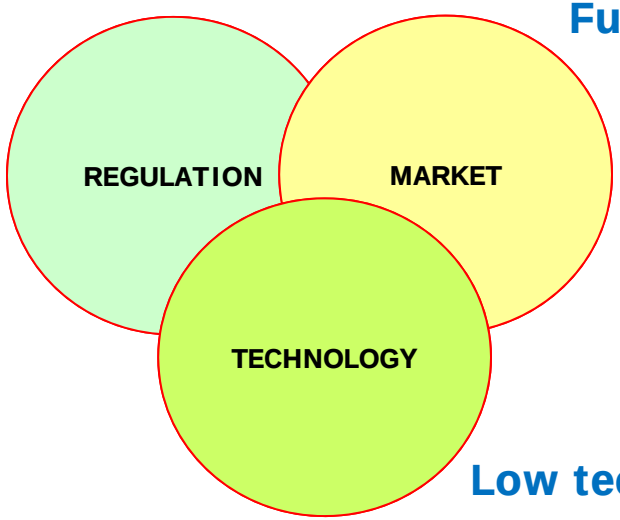
Lack of compliance control

Variation in different regions and countries

Oversaturated market

Fuel cost and availability

Route dependency



Low technology readiness

Myriad of unproven technologies and suppliers

Retrofit or new build

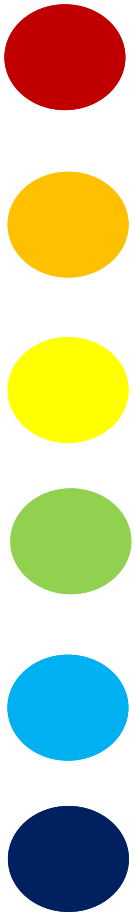
Stakeholders are not used to innovation dynamics created by deployment of goal-based policies

Reactive behavior on innovation

Innovation paradigms

Conflicting interest of different stakeholders

Innovation networks



Owner driven

Vertical engine maker-driven

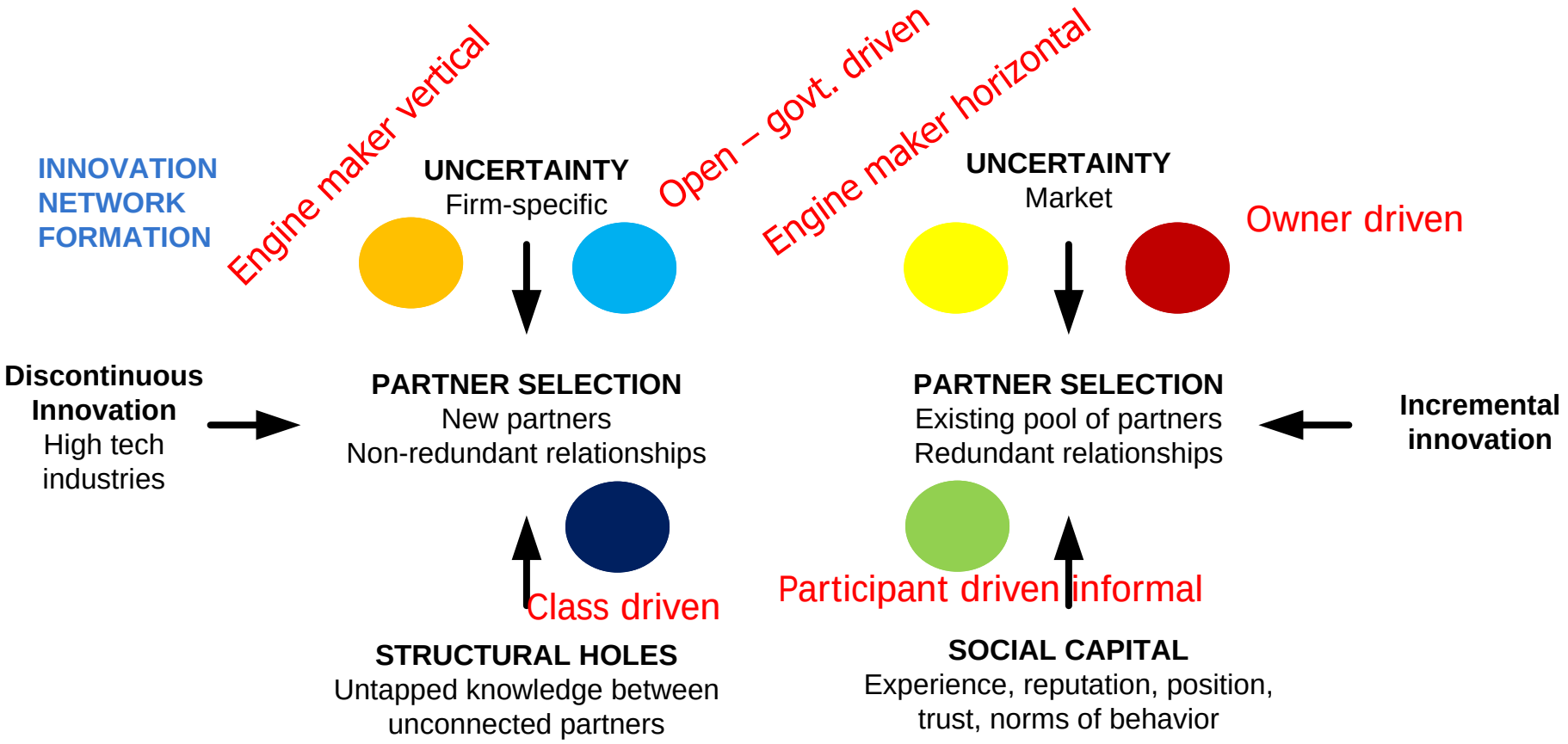
Horizontal engine maker-driven

Participant driven informal

Open networks (government driven)

Classification society driven decentralized networks

Formation


INNOVATION NETWORK FORMATION
Engine maker vertical
UNCERTAINTY
Firm-specific
Open – govt. driven
Engine maker horizontal
UNCERTAINTY
Market
Owner driven
Discontinuous Innovation
High tech industries
PARTNER SELECTION
New partners
Non-redundant relationships
PARTNER SELECTION
Existing pool of partners
Redundant relationships
Incremental innovation
Class driven
Participant driven informal
STRUCTURAL HOLES
Untapped knowledge between unconnected partners
SOCIAL CAPITAL
Experience, reputation, position, trust, norms of behavior

Key enablers

Good network management
Absorptive capacity

Key barriers

Social capital mind set
Lack of innovation stimulating organizational culture
Use of innovative products and solutions in operations

Opportunity

Structural holes between technology suppliers
Horizontal networks among owners and technology suppliers