Maritime Innovation Networks

Perunovic, Zoran; Christoffersen, Mads; Fürstenberg, Sofia

Publication date:
2015

Document Version
Publisher’s PDF, also known as Version of record

Citation (APA):
Maritime Innovation Networks

Zoran Perunović
Mads Christoffersen
Sofia Fürstenberg

Need for collaboration for innovation

About the study

Grant
• Danish Maritime Foundation

Team
• DTU Executive School of Business
• Maersk Maritime Technology

Duration
• Two years

Method
• Exploratory qualitative multiple-case study

Data
• Interviews with more than 100 key informants at 40 maritime organizations
• Analysis of numerous internal company materials, industry reports, publicly available reports about more than 30 innovation networks
• Articles from newspapers and magazines
• Extensive literature review of more than 50 academic journal articles

Turbulent environment for innovation

Market
• Discrepancy between the dynamics of the global trade and the shipping industry
• Trade specialization of ships
• Unpredictable fuel prices
• Efficiency of the existing fleet (Buy or retrofit decision)

Regulations
• Enforcement dates
• Variations in regulations in different regions and countries
• Lack of compliance control

Technology
• Customized solutions for retrofit projects due to the fleet variety
• Myriad of unproven technologies and suppliers
• Contradictory solutions
• Incompatible and uncomplementary technologies
• Scalability of technologies for large capacities
## Stakeholders and innovation

| Regulators | Drive innovation  
National could hinder innovation | Financiers | Focused on profit and vessel’s liquidity  
Indifferent towards innovation |
|------------|---------------------------------|------------|-------------------------------------------|
| Classification societies | Repository of knowledge  
Promote innovation  
Initiate and moderate innovation networks | Insurers | Novelty accepted if coming from respectful owner and shipyard with good historical operational record  
New instruments to calculate risk of novel technologies |
| Owners, charterers, and operators | Drive innovation  
Large – internal R&D capability  
Small – open for innovation networks  
Other should innovate  
Equipment testing  
First mover concern  
Performance Improvement | Ports | Service providers embrace process and technological innovations to improve efficiency  
Port authorities embrace innovation to create attractive conditions for users and service providers  
Hinder innovation if do not monitor compliance with environmental regulations |
| Designers | Design to satisfy multiple physical, regulatory, and economical requirements | Universities and institutes | Cradle of knowledge and creativity  
Strong influence on innovation in industry  
Present in every innovation network |
| Equipment and technology suppliers | Strong R&D, innovation, and networking capabilities | Industry associations | Promote and finance collaborative innovation activities |
| Shipyards | Contemporary model – design, engineer, and build vessels  
Technology push, but opening for networked innovation strategies with early involvement of owners | | |

### Six innovation networks

- **Centralized**
- **Triad**
- **Horizontal**

**PUBLICLY FUNDED**

- Designed centralized
- Designed decentralized
- Emergent
- Experts’ forum
- Informal
### Centralized

<table>
<thead>
<tr>
<th>Formation</th>
<th>Management and organization</th>
<th>Evolution</th>
<th>Performance</th>
</tr>
</thead>
</table>
| Owner driven | - Fast and affordable access to knowledge and technologies  
- Formed when needed | - Formal agreements in exploration at engine maker and shipyard driven networks  
- Informal agreements for scouting and testing and formal agreements for new builds in exploitation at owner driven network | - Indirect measurement of success  
- Objectives met in most cases | |
| Engine maker and shipyard driven | - Access new knowledge technologies, and market segments  
- Suppliers: Tool technology, understand user's needs, get sales with large customer | - Strong ties between central organization and individual partners: Little or none formal relationships between the partners (structural holes)  
- Ideas and needs shared with partners who are expected to come up with solutions  
- R&D unit/entity is coordinator  
- Engine maker and shipyard protects IPR through patenting, Owner protects IPR by being first on the market | - Suppliers may delay the process because of lack of resources and uncertain sales  
- Untapped potential of structural holes  
- Networking capabilities not regarded as KPI | |

### Triad

<table>
<thead>
<tr>
<th>Formation</th>
<th>Management and organization</th>
<th>Evolution</th>
<th>Performance</th>
</tr>
</thead>
</table>
| Emergent, Formal, Exploit structural holes | - Exploration with fit for exploitation  
- Easy to manage  
- Governance based on openness, flat structure, and good relationship management  
- Trust driven by network size, previous experiences, and personal relations  
- Equal distribution of knowledge and information | - Time limited  
- Allow flexibility for partners to establish new triads  
- Can initiate new networks to add more competences | - Successful in achieving objectives  
- Acknowledge learning as success criteria | |

---

**Diagram:**

[Centralized Network Diagram]

[Triad Network Diagram]
Publicly funded Formation Management and organization Evolution Performance

Stakeholders
Access public funding

Public funds
Support development of solutions and industry’s innovation and networking capabilities.

Top-down and bottom-up generation of topics
Relevance of topics depends on individuals

Rules for formation in top-down could negatively affect enthusiasm

Negative effect of imposed collaboration

Three variants

- Designed centralized, designed decentralized, and emergent
- Designed types for exploration. Emergent types for development (more open)
- Work-package driven
- Complex and bureaucratic organization hinders innovation. Heavy management apparatus

Natural stability is very sensitive to quality of governance and operational management

Designed are time limited
Emergent will continue if positive experience with results and management

Partners from work packages may establish new exploitative networks

Predominantly incremental improvements or conceptual studies with occasional validation through testing

Successful commercialization of network results is not captured and disseminated

Universities benefit from academic publications

No established measures to capture and follow improvement of members’ innovation and networking competencies and capabilities and commercialization of solutions

Formation
Very rare and found in the development phase of innovation process
Reasons
- Pulling joint experience, effort, and resources to make business case for everyone, to build networking capability, and inability to develop environmental solutions alone. Primarily focused on shared learning about operational experience.
- Prevention of opportunistic behavior
Classification society initiates formation and manages the network
Members with different market specializations

Fully committed top management

Decentralized with formal agreements
Simple and flat management structure due to small size
Each member involved in project management, participation in projects, and decision making

Top management and work groups jointly make decisions about strategic development of network
Efficient knowledge flow due to short distances between the nodes and teams

Positive experience spurs new projects and admission of new members.
Small incremental steps increase trust and improve networking capabilities

Small improvements
Main achievement is that competitors learn to work with each other

Horizontal
Experts’ forum

<table>
<thead>
<tr>
<th>Formation</th>
<th>Management and organization</th>
<th>Evolution</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Founder</td>
<td>Closed, designed, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>decentralized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expert</td>
<td>Experts are organized within</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>working groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Governing body sets topics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge sharing intensive</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>within groups. Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>sharing in joint meetings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Little or no formal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>relationships between</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>working groups (structural</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>holes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power of single member</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>rooted in technical</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>competency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participating organization</td>
<td>Permanent network with</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>temporary groups and members</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to knowledge and influence on regulators</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Informal

<table>
<thead>
<tr>
<th>Formation</th>
<th>Management and organization</th>
<th>Evolution</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on initiatives developed from personal relationships</td>
<td>Decentralized</td>
<td>Successful to get to formal collaboration in exploitation</td>
<td>Result in commercial projects</td>
</tr>
<tr>
<td>Partners chosen on technical competences, prestige, expected quality of contribution and added value</td>
<td>Different stakeholders</td>
<td></td>
<td>Deep insight in short time frames</td>
</tr>
<tr>
<td>No contract involved. Trust is guarded and publicly funded behavior prohibited by personal relationships and accepted norms of behavior</td>
<td>Informal because too much bureaucracy can hinder innovation</td>
<td>Light management and strong governance</td>
<td></td>
</tr>
<tr>
<td>Mutual benefit for all members is expected</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Utilization of maritime innovation networks

Uncertainty

<table>
<thead>
<tr>
<th>Low</th>
<th>TECHNOLOGICAL UNCERTAINTY</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>MARKET UNCERTAINTY</td>
<td>High</td>
</tr>
<tr>
<td>High</td>
<td>REGULATORY UNCERTAINTY</td>
<td>Low</td>
</tr>
</tbody>
</table>

Networking activity

Utilization of maritime innovation networks

Innovativeness

<table>
<thead>
<tr>
<th>Incremental</th>
<th>Breakthrough</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect for breakthroughs</td>
<td>Triad</td>
</tr>
<tr>
<td>Centralized</td>
<td>Incremental</td>
</tr>
<tr>
<td>Publicly funded</td>
<td>Rejuvenate for breakthrough</td>
</tr>
<tr>
<td></td>
<td>Triad</td>
</tr>
<tr>
<td></td>
<td>Horizontal</td>
</tr>
<tr>
<td></td>
<td>Informal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OLD Partners</th>
<th>NEW Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental</td>
<td>Incremental</td>
</tr>
<tr>
<td>Experts' forum</td>
<td>Rejuvenate for breakthrough</td>
</tr>
<tr>
<td>YES YES YES</td>
<td>YES YES YES</td>
</tr>
<tr>
<td>NO NO NO</td>
<td>NO NO NO</td>
</tr>
<tr>
<td>Structural holes</td>
<td>Structural holes</td>
</tr>
</tbody>
</table>
Utilization of maritime innovation networks

Innovation process

Connectivity between different types of maritime innovation networks

- Centralized (Engine maker)
- Centralized (Shipyard)
- Centralized (Owner)
- Triad

EXPLORATION

- Closed and controlled environments
- Partner selection relies on existing ties and the social capital's mechanisms

DEVELOPMENT

- Advanced collaborative and final-user driven forms emerge to qualify promising technology

EXPLOITATION

- Advanced collaborative networks disband
- Industry closes up again

Utilization of maritime innovation networks

Stakeholder participation

<table>
<thead>
<tr>
<th></th>
<th>Centralized</th>
<th>Triad</th>
<th>Publicly funded</th>
<th>Horizontal</th>
<th>Expert forum</th>
<th>Informal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification society</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owners, charterers, operators</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Designers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment and technology suppliers</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shipyards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financiers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Universities and institutes</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Industry associations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>
Utilization of maritime innovation networks

Result

Innovation networks are relatively new concepts to the industry

Significant innovation-related networking activity despite perceptions about the industry

Formed predominantly as reaction to regulations
Pursuit of incremental innovation
Dominance of closed networks
Abundance of structural holes in networks and work packages
Underrepresented stakeholders
Lack of understanding of values and risks of different types innovation networks
Different facets of performance of are undermined
Underdeveloped innovation capability on organizational level

Utilization of maritime innovation networks

Performance

• Performance = Network dynamics + Member dynamics

• Network dynamics = f[design (social capital, structural holes, knowledge flow) + management (leverage, appropriability, coherence)]

• Member dynamics = f(top management governance, open organizational culture, networking capabilities, innovation capability, absorptive capacity)
Unleashing the potential or maritime innovation networks (1/3)

- **Understand benefits and risks of innovation in networks**
- **Use networks to create standards and influence regulations**
  - Create early
  - Use horizontal, experts’ forums, and emergent publicly funded
- **More breakthroughs**
  - Open and decentralized networks in exploration
  - New partners from maritime and other industries
  - Improved connectivity between members and work packages

Unleashing the potential or maritime innovation networks (2/3)

**Enhance holistic and life-cycle approaches**
- Activate broad set of stakeholders to capture the needs of the entire value chain
- Involve customers of centralized networks early in the process

**New measurement system for capturing value**
- At network level (Technology readiness maturation index, Number of patents, Objective achievement, Knowledge receiving/giving ratio, Commercialization probability, Actual commercialization (could be several years after disbanding of network), Number of successor and partnership networks created
- At organizational level (Technology readiness maturation index, Knowledge receiving/giving ratio, New ideas gained/internalized ratio, Number of patents, Commercialization probability, Number of new contacts established (customers, complementary stakeholders, competitors)
Unleashing the potential or maritime innovation networks (3/3)

Each network member

- **Governance**
  - Planning
  - Funding
  - Rating
  - Controlling/monitoring
  - Controlling patterns and activities
- **Networking competencies and capabilities**
  - Established within single organization
- **Operational management**
  - Incentivisation
  - Idea enrichment
  - Marketing
  - Transfer of results to mainstream
- **Activities**
  - Innovation
  - Knowledge flows
  - Network identity
  - Appropriability
- **Innovation leverage**
  - Lead organisation
  - Integration/Coordinator

Focus on:
- **Partner selection**
- **Enabling control position**
- **Top management**
  - Builds innovation and networking capabilities into culture of openness
- **Open innovation**
  - Attracting players
  - Flow of innovation

7/10/2015