



**“MARITIME CLUSTERS
SUPPORTING RESEARCH &
INNOVATION TO ENHANCE
BLUE ECONOMY
ENTREPRENEURSHIP”**

Priority 1: Maritime Innovation and economic development

Topic 2: Innovation in new economic sectors

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**“Mapping of the successful
maritime clusters in international
level”**

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**Phase 2.1: Definition of the project analysis methodology and
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Responsible partner: University of the Aegean

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1. Introduction

Maritime clusters have been defined as networks of connected businesses, suppliers, and associates in the maritime field that are located in the same geographical area, operating and influenced by related relationships and institutions. A feature that distinguishes clusters from other types of networks is their mutual relatedness and interdependence. There are both economic and social ties that relate cluster members around their economic specialization interests. Clusters are seen as means of providing improved efficiency and productivity so that businesses can be competitive on a national, regional and global scale. Further socio-economic factors, such as employment and sustainability are also seen as positively influenced by cluster dynamics.

Cluster theory has been identified and adopted over the past two decades as a tool for better understanding the economic activities in service and knowledge-based regional economies. Clustering is primarily viewed to enhance the advantage of competitiveness, generate productivity, foster innovation abilities and embody the transfer of new knowledge and business information, with different development functions.



A Traditional Maritime Cluster Configuration



Maritime clusters have emphasized, so far, shipping, port, also shipbuilding and associated services, namely financial or technology research and development maritime services as the principal services of the cluster. In other words, “traditional” maritime services have been the strategic pillars within successful international clusters, with varying emphasis and distinguishing configuration features. As maritime clusters evolve over time in terms of the composition of maritime services provided and actors represented, also overall strategic re-orientation and positioning of established and emerging stakeholders of the maritime sector, we witness an evolution of new or changing cluster services and functions, reflecting quite different stages of economic and social developments, such as the growth of blue economy sectors (i.e. aquaculture, maritime tourism), environmental sustainability strategies, the growing recognition of embedding and formally including related technical research and innovation mechanisms and actors in a cluster’s governance and functions, and further modernization in the maritime clusters governance along with a revival in its overall attractiveness.

In more detail, the theoretical definition and the actual operation of a maritime cluster, based on available literature and professional reality reviewed, is not uniform.

The scope or focus and driving forces of a maritime cluster can be very wide and diverse. As regards the structure of maritime clusters, three main groups of actors have been identified, namely shipping, shipping and maritime services and ship industry, supported and cooperating with facilitating associations, educational and research institutions and political bodies. As to the linkages and relationship within a maritime cluster, these also vary significantly with a profound impact on the clusters functions and institutional form and enabling governance mechanisms.

According to literature reviewed and also largely validated in practice, businesses cluster because of the access to a large employment infrastructure inside the cluster, which reduces search costs and allows for the existence of



training and education programmes, which in turn enhance the quality of the human capital. Also, businesses cluster together because of the existence of suppliers and customers in a cluster, in the proximity of both offering low transport costs. Proximity also enables closer and more efficient interactions and monitoring. Lastly, businesses cluster together because of the occurrence of “knowledge spillovers”, because of frequent and creative interaction and because of more proficient identification opportunities and challenges, locally (agglomeration economies).

Cluster complementarities account to the benefits (scale economies) arising from the use of common resources. Infrastructure, such as maritime education and ports are examples of such scale-dependent resources. Attaining and maintaining the aforementioned benefits of clustering requires that there are sufficiently strong linkages between the various constituent parts of a cluster.

The performance of the cluster is measured in value added: a good performance is shown by a rise in the value added generated in the cluster; namely more start-ups and entrants than bankruptcies and exits, also the growth of established firms, along with pertinent, topical indicators of interest i.e. employment growth.

Strong industrial clusters are characterized by inherent, self-reinforcing upgrading mechanisms, specifically (a) pressure for innovation, (b) complementary resources, and (c) knowledge dissemination.

Innovation is dependent on demanding customers, on rich and open communication between the actors in the sector, and on some level of competition between present firms as well as among suppliers.

According to the literature reviewed, an established framework to analyze *cluster performance* considers factors related to the *cluster structure* and factors related to the *cluster governance*.

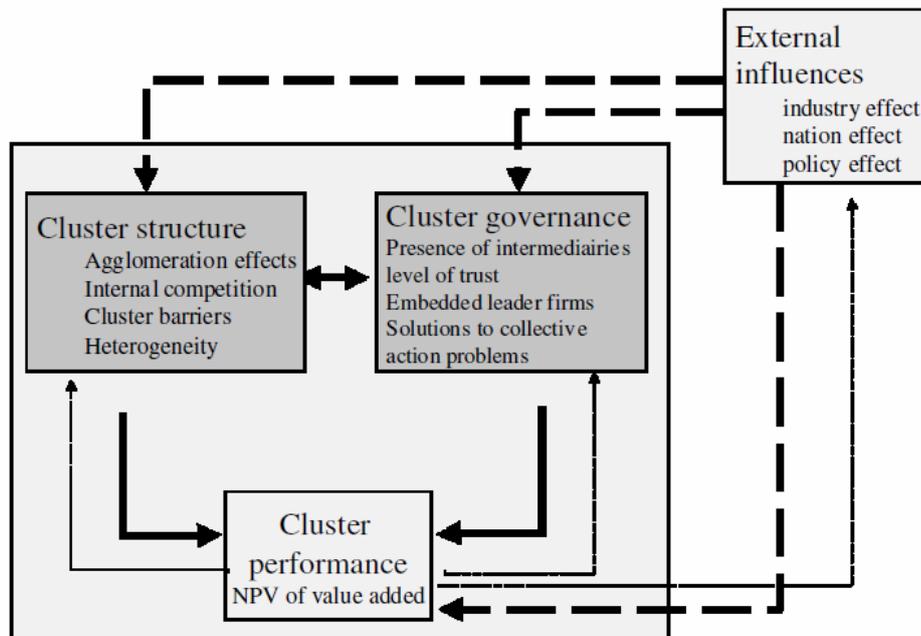
As regards the structural factors, cluster performance should be cited as regards a positive influence of *heterogeneity*; the cluster population is rather heterogeneous with regard to the economic activities included in the cluster

and includes a substantial number of large firms, internationally active firms and innovative firms.

Internal *competition* adds to the cluster performance as it fosters specialization and, therefore, enhances, from a cluster perspective, the service to specific market segments. In many cases a balanced form of competition and co-operation is apparent.

As regards cluster governance, defined as “the mix of and relations between different modes

of governance, i.e. mechanisms to co-ordinate interaction in a cluster”, the following pertinent factors are examined: the presence of *trust* which is viewed to reduce transaction costs in the cluster; the presence of *intermediaries* such as associations, the value of which is predominantly their role as intermediary between firms and governments. An opportunity could be to expand the economic functions of associations (such as diffusion of innovations, financing, consulting, marketing etc); the presence of “*leader firm behavior*”, which is viewed to increase the performance of a cluster, since such firms actively further the interests of the cluster as a whole, with “multiplier effects” and “knowledge spillovers”; also quality solutions to collective action problems.



A Cluster Analysis Framework (DeLangen)



As informed by studying the performance and configuration of evolving, successful maritime clusters, such as those analyzed in reviewed maritime clusters studies, we approach CoRINTHos clusters as being comprised of both traditional maritime and blue economy sector activities, in the west and east Mediterranean geopolitical and socio-economic defining context. Thus, CoRINTHos framework for analyzing and supporting contemporary maritime cluster policy, structure and governance, in the Mediterranean, is based on the premise of a very dynamic economic, technological and with a strong global and innovation orientation cluster environment, that consequently determines cluster (trans)formation and sustainability. Against this background, it is interesting, necessary and not straightforward to predict and determine clusters evolutionary paths and appropriate enabling policy measures. Towards this end, we overview major international maritime clusters. In the following, we review the prevailing features of five important international maritime clusters, as regards their actors, structure and governance, in other words their performance, correlated with enabling factors, and their future orientation. We cite these features and pertinent cluster configuration, evolution and performance attributes as possible reference models or best practices pillars towards advising the pilot CoRINTHos clusters formation, towards formulating appropriate policies for maintaining and further developing the institutional, relational, technological, and educational infrastructure of the co-evolving maritime and blue economy sector.

Furthermore, as informed by latest developments in innovation management and technology policy studies, it is considered that successful maritime clusters development entails a combination of parallel complementing management processes, addressing cluster services “customer”. Using ecosystems to coordinate maritime stakeholders’ efforts towards meeting specific challenges is becoming more prevalent in the twenty-first century economy. Understanding and maximizing effective use of ecosystems is the strategy that maritime actors may also adopt in order to operate sustainably.



Coordination of the emerging maritime ecosystem activities, stakeholder group coordination, and change management is thus considered. Also, refined “orchestration” efforts should be emphasized that create the necessary synergy between different sectoral activities, which are traditionally carried out in separate projects and incompatible working cultures. This process includes the clear identification of the players and what their business models are but foremost the goals that unites all the players; also the ecosystem roles, such as resources owners, problem solvers and facilitators and process orchestrators. Also the rules of the ecosystem and formal also informal relationships and the challenges and opportunities that render the ecosystem or cluster approach appropriate.



2. Key Clusters in the Global Maritime Sector

Norwegian maritime cluster

The Norwegian maritime cluster is on a global scale successful and sustainable. According to latest findings, out of the four main sectors within the Norwegian maritime industry, namely shipping companies, yards, equipment suppliers and service suppliers, the biggest sector has traditionally been shipping, with the fifth largest fleet in the world., followed by the equipment and service supplier sectors and thirdly the shipyards sector. Port and logistics provider companies in Norway have also a very active business profile.

The deep sea shipping (including general cargo and bulk, container, cruise, chemicals and car ferries) is decreasing whereas the offshore sector (including service, underwater entrepreneurs and seismic companies) is growing.

Shipping companies are often privately owned, and usually there are at least two companies competing in the same category and geographical region, fostering development and competitiveness in the sector.

Although the ship owners' power in the maritime sector and traditional shipping no longer play the most central role, Norwegian shipping sector still remains significant and is expected to grow.

In particular, innovation, research and development of new technologies is a top priority along with collaborative business practices and efficient knowledge management in this area. In this context, with a proven environment friendly technology orientation, Norwegian shipping companies have recently agreed on a zero emission plan for Norwegian shipping.

As regards the Norwegian shipbuilding sector, in total, 75 yards operate in Norway, focusing mainly on construction, repair and maintenance work, on a wide variety of specialized ships such as offshore vessels, advanced fishing vessels, passenger/car ferries and specialized coastal. Around 25 yards focus on newbuilds, with the largest



concentrating on offshore and special vessels, such as LNG ships and specialized tankers.

Ship design is also an important area of business, even though it nowadays is mostly carried out in foreign-owned international companies such as Wärtsilä Ship Design, Rolls-Royce Marine and STX Norway Offshore Design.

As regards the Norwegian equipment suppliers, primarily these focus on special technologies and provide products and services for demanding conditions not only in offshore but also in fishing sector.

Various associations also play a strong role in the Norwegian maritime sector (i.e. Maritimt Forum). The sector strongly benefits from having well established industry associations, such as the Norwegian Ship Owners' Association and the Federation of Norwegian Manufacturing Industries (TBL) and even a cluster organization called 'Maritime Forum', that ease communication (also trust) within and across the various parts of the maritime sector. Finally, a particular strength of the Norwegian maritime sector is the diversity and number of firms operating there, which in turn ensures a degree of competition in basically all parts of the value chain.

Norwegian companies perform very successfully international business networking and marketing of their own expertise, and have gained strong presence in the key markets like Brazil, Western Africa and Australia, in particular related to the offshore.

The Norwegian cluster's success partly stems from beneficial and proactive state actions.

As an example, a free trade agreement with South Korea already in 2006, EU signed such an agreement only in 2011.

A knowledge hub around the maritime activities is built with triple helix level support. The state, local universities and the industry are closely cooperating and supporting each other through this approach which is continuously being developed. The success of the Norwegian maritime cluster largely depends on the unique expertise in maritime sector, stemming the long tradition in developing the related technologies and knowhow.



To support the sector's competitiveness through continuous production of cutting-edge knowhow and skilled workforce, Norwegian universities are closely involved in the maritime sector's development (an exemplar institute being the Marintek research and development organization). Overall, knowledge creation and education are among the top priorities, in which both the state and the industry need to continue investing.

Furthermore, Norwegian maritime cluster is well networked internally and relatively broad in its operations. The interaction between seafarers, shipowners, shipbuilders, equipment manufacturers and service providers has strongly supported the sector's development and created synergies.

At the same time, the cluster's advancement is supported by a global outlook and wide business and cooperation networks around the world, i.e. with the Singapore maritime cluster.

Finally, strong political support for the sector's development (infrastructure, public financing, and national development strategy) is key in the cluster's sustainability.

As regards its future orientation, five focus areas are emphasized, namely: (1) environmental technology, (2) deep sea activities, (3) Arctic area activities and technology, (4) renewable energy and services and (5) concerted action in research and development in universities, research institutes and in the industry.

The vision of the maritime industry's future in Norway is ambitious, as it is not only aiming at strong presence at global markets but also a position as a knowledge hub – as the most attractive location for global, knowledge based and environmentally robust maritime business.

Expertise in the offshore sector and shipping of oil and gas, particularly LNG is strength of the cluster. Furthermore, active involvement in developing new international regulations for maritime safety, environment, and labour, for instance with the International Maritime Organization (IMO), the (International Labour Organisation) ILO and the EU, manifests a visionary, holistic and strategic approach, at a global level, towards the successful performance, and associated institutional, relational and governance mechanisms of the sectors' cluster.



Danish maritime cluster

Denmark is a seafarer nation with a long tradition in shipping and strong worldwide presence of eminent shipowners. The five biggest shipping companies, namely Maersk Group, DFDS, Lauritzen, Torm and Norden account for 95 % of Danish shipping, approximately 100 shipping companies.

AP Möller-Maersk A/S, is the biggest shipping company worldwide in terms of operated tonnage, and the fourth biggest in terms of owned tonnage. Maersk Group also offers a wide variety of services for the logistics and offshore segments.

Danish merchant fleet is the 18th largest in the world and comparatively young, with an average age of vessels of 8 years. 64% is liner trade, 30% tanker trade and 6% tramp.

Furthermore, some strong marine industry suppliers operate in Denmark, whereas the shipbuilding industry has almost been phased out. Denmark has a number of small ports and a few larger ones, namely Aalborg (feeder port) and Esbjerg port, important for offshore activities.

The strong focus on shipping, at the government level, is a strength of the Danish maritime cluster, as well as the developments made in the area of renewing the educational system, accounting to stable framework conditions and efficient administrative and management structures.

The Danish cluster prioritizes growth as based on quality shipping, related with high standards of safety and social and wellbeing conditions, as well as protecting the environment.

Denmark regards itself as a pioneer in the Arctic field, and is strategically positioned to operate in the offshore sector. Furthermore, offshore wind power activities are an area where the Danish players have already gained considerable expertise.

Actually, a clear prioritization of nontraditional maritime growth markets, such as offshore and offshore wind, also green maritime technology, in conjunction with increased and focused R&D effects constitute the sustainability vision of the Danish maritime sector and cluster. A number of universities are actively involved in the cluster, namely the Danish Technical University Copenhagen Business School



University of Southern Denmark, research important, complementary technical and business maritime aspects.

The recent Danish maritime cluster project plays an important role in the cluster governance definition and implementation.

German maritime cluster

Germany is currently the largest shipbuilding country in Europe, with around 130 operating shipyards, with efficient diversification of activities accounting to a variety of ship types manufactured and also substantial repair work.

Approximately one fourth of the shipbuilding turnover comes from the naval sector. The offshore and wind power sectors are also of growing importance.

The shipping industry is substantial, especially the container vessel segment, with around 380 ship owners in Germany, of which the majority is small companies with less than 10 ships. It is noteworthy mentioning that the strength of the German flag has decreased from 100% to 15% of vessels. Germany holds the third largest merchant fleet globally. However, traditional shipping faces global challenges that are also expected to impact the German cluster, thus repositioning and diversification is evidently applied in the German case. Those pressures are reflected in financial actors positioning and overall financial management practices; for instance German shipping financiers such as Commerzbank have withdrawn from shipping altogether. Private investors, banks and ship owners are encouraged to come up with solutions and financing concepts (through issuing bonds and new financiers such as American hedge funds and Chinese banks). Also, mergers of small and middle-sized shipping companies are also seen.

The recent growth of the German ports is also a positive development; Hamburg is the largest of the German ports and the third largest European port.

The German cluster has also a strong presence of active supplier actors, namely electronics and automation, as well as marine diesel engine technology companies.



One of the strengths of the German maritime cluster is that all actors (shipping, shipbuilding, financing, equipment supply) are strongly represented and collaborate with each other, which helps the industry develop.

Political stability is a key factor in this sustainable development process.

The expected position of the cluster is seen to emphasize further on strong collaboration between shipyards and marine equipment suppliers, diversification of shipbuilding activities and development of the offshore sector, such as the offshore wind parks in the North Sea. Also, the development of services for integrated logistics chains and environmental-friendly solutions.

At the central administrative level, R&D and innovation is implemented with political support, in order to establish and strengthen networking, update and expand educational programs and strengthen knowledge dissemination, as coordinated by the Federal Ministry of Economics and Technology.

A central research program called the Next-Generation Maritime Technologies supports collaborative projects between the industry and universities and research institutes.

Dutch maritime cluster

Netherlands is a country with a long shipping and trade history, whereas the Dutch maritime cluster has successfully evolved through maritime-related activities to the primary European logistics cluster.

Dutch maritime cluster actors include shipping, shipbuilding, ports, inland shipping, dredging, offshore, equipment suppliers, the royal navy, maritime services, yachting industry and fishing companies, with an interesting heterogeneity observed. Netherlands has a diverse fleet of sea-going vessels, the largest inland navigation fleet and the highest port capacity in Europe.

Today, the port sector is the largest player, producing 29% of the value added, 19% of the employment generated, and followed by the shipping and shipbuilding sector.

Netherlands still has a strong position as a shipbuilder global player, even though it clearly faces the global challenges in the shipbuilding sector.



The equipment suppliers range from specialized niche companies to larger ship building groups, but mostly they are SME companies. (around 750 companies), with a vital presence in the cluster.

Dutch maritime cluster has developed into the main logistics cluster in Europe (ports of Rotterdam, Amsterdam). The environment is highly international with global companies operating in the Dutch cluster and a strong technological innovation orientation.

Dutch port infrastructure has been ranked number one in the world. The port of Rotterdam describes the way of investing and developing as *cooperation between all affected actors*, such as the industry, ministries and NGO's. Efficiency, sustainability, cooperation and flexibility are key guidelines in the development work of the port (Port Vision 2030).

The development covers the whole port area and businesses related to it, with the aim of creating a competitive and main industrial complex in Europe. The Port of Rotterdam is ranked the fourth biggest in the world, and the biggest in Europe.

Inland shipping is clearly an area with further development possibilities.

Furthermore, a number of equipment and service suppliers with a strong focus on developing the operations and technology for the off shore sector (oil and energy companies, yards and vessel building companies, and single components suppliers related also to the energy sectors of wind and tide). Also, technologies for electronics and transport equipment.

High technology innovations and extensive R&D activities support the development of the cluster and its various sectors.

Stimulation of the cooperation between knowledge infrastructure and industry in the fields of fundamental and applied research has been a central factor for the cluster's sustainability (Maritime Knowledge Center 2013).

Knowledge development is extensive through universities and research centers collaboration, i.e. Delft University, Erasmus University, TNO, Dutch Institute for Advanced Logistics.



The Dutch Maritime Network (NML), which was established in 1997 as a joint initiative of the Ministry of Transport, Public Works and Water Management and the Royal Association of Netherlands shipowners (Kvnr), in order to promote the maritime cluster presence.

Cooperation and networking, political interest to develop and support the cluster has been assessed as the prime factors of the successful evolution of the cluster. Also a global approach and strong collaborative culture with networking activities enabling significant technological development, fostering cross-sectoral, public and private partnerships for high technology joint ventures.

Maritime cluster of Japan

The maritime industry in Japan has had a significant influence on the country's history and economic development. 96% of the supplies entering and leaving the country are carried by maritime transport, as of 2011 data.

Japan has been a global leader in the shipbuilding industry, in specific.

The Japanese maritime cluster is internationally significant even though it is losing its market share to China and South-Korea.

It is composed of three major groups, namely shipping companies and ship owners, shipbuilding companies and shippers/manufacturers.

A large number of players in the related industries, and reliable relationships between them make the functioning of the cluster quite effective.

As regards the shipbuilding industry, as the most important entity of the maritime cluster it has greatly influenced the Japanese economy (world leader in shipbuilding industry for almost fifty years).

There are over 1000 shipyards in Japan, of which some are individual enterprises while others operate multiple shipyards. The most important Japanese shipbuilding companies are Imabari Shipbuilding, Tsuneishi Holdings and the Oshima Shipbuilding Company. The role of shipbuilding industry in overall Japanese economy is relatively



small, but actually significant because of the joint activities with other industries related to shipbuilding, e.g. steel and marine equipment. The Japanese shipbuilding companies are also characterized by the world renowned Japanese methods of production engineering and techniques of advanced automation and quality control.

Three major shipping companies, namely K Line, Nippon Yusen Kaisha and MOL mostly register their vessels in open registers and employ a lot of non-Japanese seafarers.

The maritime cluster has close cooperation with the country's banking system

Several different intermediaries contribute in the collaborative, increased performance of the cluster e.g. the Shipbuilders' Association of Japan (SAJ), Japan Ship Technology Research Association (JSTRA), and Japan Ship Machinery & Equipment Association (JSMEA).

Ports and port services is another part of the Japanese maritime cluster where the competitiveness has declined. In 2009 Tokyo, the most important Japanese port in terms of containerized cargo handling was only 26th in the world's ranking, with the top five ports being all Asian.

A major challenge for the Japanese maritime cluster is the decline in skilled workers during the next ten years, along with an overall ageing workforce.

The Japanese maritime industry plans to reposition itself towards more sustainable activities with concerted efforts to increase international cooperation, investments in research and development projects for green technology and also development of the port sector by fostering investments in country's port hubs.



3. Conclusions

We have presented a review of five international, successful maritime cluster, in terms of their configurations and pertinent features towards providing a frame of analysis in support of Mediterranean clusters (trans)formation based on international best practices.

We have selected to overview the configuration and future positioning of the Norwegian, Dutch, Danish, German, and Japanese clusters as each of these clusters present distinct evolution paths, with socio-economic, structural and governance characteristics partly relevant to the CoRINthos pilot clusters.

We aimed at identifying important, recurrent success/reference dimensions, relevant with the specific purpose/time of evaluation, namely new markets development, maritime sectors diversification, emphasis on technological and market/product/service innovation (green technology R&D), importance of financial institutions, governmental policies (taxation vs. ownership), education system reforms, service specialization, type of cluster orchestrator, hyper-local nature.