



STRENGTHENING TIES BETWEEN UNIVERSITY AND MARITIME SECTOR

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Abstract. The main functions of universities are to provide education, conduct research and interact with society. Rapidly developing technology enforces universities to provide quality and up-to-date education demanded by society and to conduct research to provide support for the sustainable economic development of industry. Humanity is now in the age of innovation and all kinds of activities to ensure the continuous development of the economy require research and development on related issues. The most important support provider in this regard will be universities conducting scientific research. Universities are also obliged to follow the developments in the sector they are interested in closely and to constantly adjust their programs and to respond to current and future requirements. Sector stakeholders, who will use the technology, need to cooperate with universities to find solutions to problems and benefit from better trained human resources. These needs constitute the basic requirement of university-sector co-operation. The aim of this study is to evaluate the effects of exponentially developing technology on both the maritime sector and maritime education and to determine what to be achieved to improve the cooperation between the university and the sector. Determining the new requirements and presenting suggestions that will improve mutual co-operation are also within the aim of this study. To achieve the aim of the study, scientific studies conducted to improve cooperation between universities and the maritime industry, and the structures established for these purposes will be examined and meta-synthesis will be performed. Existing practices and best practice examples will also be reviewed and proposed for future activities. This study will provide guidance on how to make cooperation more effective and how to maximize its contribution to the sector. This will lead to the following initiatives for the establishment of standing platforms and joint university-industry structures necessary for effective cooperation and the creation of units extending from incubator level to research centres for innovation.

Keywords: Maritime Education and Training; Maritime Management; Exponential Technologic Development; Maritime Sector; University and Industry Cooperation; Collaboration with Industry.

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1. INTRODUCTION

Today's global maritime sector is not only at the center of transportation and logistics activities but has also become one of the key components of economic development, technological transformation and environmental sustainability. The sustainability of this multi-layered structure is directly related to the need for qualified human resources, innovative technologies and an ever-evolving information infrastructure. In an era where global maritime trade, technological innovation, and environmental sustainability are rapidly transforming the shipping industry (Belabyd & Pyne, 2023), the need for stronger collaboration between universities and the maritime sector has become more critical than ever. Universities and research institutions play a critical role as strategic knowledge production centers in meeting these needs (Etzkowitz & Leydesdorff, 2000; Šekularac-Ivošević & Milošević, 2019) and it is increasingly recognized that Universities play a key role in the development process of countries (Keane and Allison, 1999; Chatterton and Goddard, 2000; Charles, 2006). The role of universities is specified as "the exchange of knowledge for technology transfer" (Šekularac – Ivošević, 2021) and seen as crucial to attaining economic growth in knowledge-based societies (Rauf et al., 2023). Collaboration between universities and industry is a necessity for innovation, exchange of knowledge and national economic development (Abramo et al., 2011; Demirel, 2015). Universities have a strategic role as having the capability to transfer technological knowledge to the industry, which then transforms it into economic value (Godin B. & Gingras Y., 2000; Terán-Bustamante et al., 2021).

The partnership between universities and the maritime sector is a strategic necessity for both academia and industry. There are several compelling reasons driving this collaboration. First, the maritime industry increasingly demands highly skilled professionals equipped with hands-on experience and updated knowledge in areas such as shipbuilding, logistics, and port operations. Universities play a vital role in preparing this workforce through internships, field training, and sector-integrated curricula. Second, research and development (R&D) are essential for fostering innovation in maritime technologies, especially in fields like green energy, digitalization, and autonomous navigation. Joint university-industry projects enable cost-effective and collaborative innovation, giving companies access to scientific expertise and advanced research infrastructure. Third, with the International Maritime Organization (IMO) and other global bodies setting ambitious environmental targets, there is growing pressure on the industry to adopt sustainable practices. Universities

contribute to this transition by developing eco-friendly technologies, emission reduction models, and energy-efficient systems. Fourth, knowledge and technology transfer between academia and industry facilitates the commercialization of innovations, such as marine data platforms, smart navigation software, and port optimization tools. This also enables universities to diversify their funding sources and strengthen their societal impact. Fifth, closer ties between the academic world and maritime enterprises improve employment pathways, allowing companies to recruit graduates with sector-specific competencies, while universities can better track alumni and measure their labour market success. Lastly, universities serve as independent research institutions capable of producing reliable data and policy insights through academic observations in ports, shipyards, and onboard operations. These insights support evidence-based decision-making and long-term strategic planning within the maritime domain. Considering these factors, establishing structured, institutionalized mechanisms for university-maritime industry collaboration has become essential for building a resilient, innovative, and globally competitive maritime sector. The conclusion of this study is that national efforts in the field of UIC (University Industry Cooperation) should be integrated with international efforts, at least to the extent of ensuring interoperability. It is assessed that participation in EU projects and regional studies will also strongly support national efforts.

This study puts forward the main initiatives required for the relations between the maritime industry and universities to attain a permanent, productive and innovative structure. In particular, the main focus of the study is on how to design and implement an ecosystem that can directly respond to the needs of the sector, such as joint structures, permanent cooperation platforms, maritime-focused technology transfer centres, and an ecosystem that expands from incubator level to innovation research centres. It is argued that cooperation should not only remain at the level of internships and projects, but should instead be strengthened by politically supported, institutionalized and sustainable mechanisms. In this context, based on good practice examples from around the world, strategic recommendations are presented on how maritime education institutions, particularly in Turkey, can build stronger and more structured relationships with sectoral stakeholders. The aim is to contribute to the development of an effective university-industry cooperation model in all areas from knowledge generation to employment, from innovation to regulatory contribution.

The aim of this study is to evaluate the effects of exponentially developing technology on both the

maritime sector and maritime education and to determine what to be achieved to improve the cooperation between the university and the sector. To achieve the aim of the study, the scientific studies conducted to develop cooperation between the university and the maritime sector were examined and meta synthesis will be performed.

Many studies have been conducted on university-industry cooperation. This study examines national and international efforts in this area, the new needs arising from rapidly developing technology, and best practices in countries that have done excellent work in this field. The conclusion of this study is that national efforts in the field of UIC (University Industry Cooperation) should be integrated with international efforts, at least to the extent of ensuring interoperability. It is assessed that participation in EU projects and regional studies will also strongly support national efforts.

The methodology for this study is described in the second section. The current situation is analysed, and gaps are identified in the third section. The structures and platforms that can be created to increase cooperation are explained and examples are given in the third section. The fifth section deals with transition from incubators to innovation stage centres and explains the supporting mechanisms and integration with the sector. The sixth section describes the strategic roadmap and policy recommendations, followed by the seventh section, which examines the role of the Maritime sector. The final chapter provides conclusions and recommendations.

2. METHODOLOGY

This study adopts a qualitative and strategic analysis approach to explore how stronger and more sustainable ties can be established between universities and the maritime sector. The methodology consists of four main stages:

In the first stage, literature review was conducted to identify key concepts related to university-industry collaboration, technology transfer, and innovation in maritime education.

The second stage involved a problem-focused analysis of the current status of the relationship between academia and the maritime industry. Existing deficiencies, such as curriculum mismatches, low R&D cooperation, and lack of structural coordination, were identified and categorized.

Examination of Best Practices draw up the third stage. A comparative assessment of successful international examples was carried out to provide evidence-based guidance for institutional model pro-

posals. Initiatives such as technology incubators, maritime innovation hubs, and joint university-industry centers were examined. Common characteristics and transferability conditions of these models were extracted to inform the recommendations.

Lastly, based on the findings of the previous stages, a set of structural proposals was developed, including university-based incubators, joint R&D platforms, advisory boards, and maritime knowledge networks. These proposals were then integrated into a strategic roadmap with practical implementation steps and policy suggestions. The roadmap aims to offer a scalable and adaptable framework that could be piloted by maritime education institutions in Turkey and further refined through stakeholder feedback.

The methodology prioritizes a systems-thinking approach, emphasizing the interconnectedness between educational quality, research relevance, sectoral engagement, and national innovation capacity. Throughout the process, emphasis was placed on designing mechanisms that are institutionalized, sustainable, and aligned with the real needs of both academia and the maritime industry.

3. ANALYSIS OF THE CURRENT SITUATION: DISCONNECT BETWEEN ACADEMIA AND THE MARITIME SECTOR

As the maritime industry's dependence on knowledge and technology increases with each passing year, universities stand out as one of the most important sources that can respond to this need. However, the relationship between the industry and universities remains limited in Turkey, as in most countries, and is usually limited to short-term internships, individual academic projects or semester seminars. This disconnect leads to curricula not keeping pace with the dynamic needs of the sector, university research having low commercialization potential, and graduates experiencing various difficulties in the process of integration into the sector.

Structural weaknesses are particularly noticeable in the following areas:

- **Curriculum Mismatch:** Maritime programs may fall short in meeting the evolving needs of the sector. Investigating the effects of maritime vocational training with a survey, Benayoune et al. (2024) found that training programs were very useful in preparing students for the profession but also emphasized that sector stakeholders should take an active role in adapting them to sector needs.
- **Limited Interaction with the Sector:** Insufficient integration of maritime companies, port

companies or classification societies into the education process causes students to lack practical experience.

- **Lack of Joint R&D and Innovation Infrastructure:** Most of the university research is far from producing practical outputs, while maritime companies see academic cooperation as inefficient in terms of time and cost. Drawing attention to the importance of innovation in maritime education, Ziarati et al. (2010) stated that technological developments in the maritime sector are advancing rapidly and that educational programs must keep pace with these developments. In addition, it is stated that the lack of joint R&D projects between universities and the sector makes it difficult to integrate technological innovations into educational programs. This deficiency limits technology transfer.
- **Uncertainty of Mutual Expectations:** Yalcintas et al. (2015) draws attention to the difficulties in transferring knowledge produced at universities directly to industry and the lack of communication in this process. He also emphasizes that the participation of academics in R&D projects should be encouraged and that these collaborations should be made more systematic. The difference in value perception between the academic world and the private sector, lack of communication and trust problems cause potential collaborations to end before they begin.

For all these reasons, the relationship between universities and the maritime sector is structurally weak, disorganized and temporary. The main need at this point is to create common institutional mechanisms, digital collaboration platforms and financially supported structures that will make this relationship permanent. The next section will detail the initiatives to be proposed to meet these needs.

4. INSTITUTIONAL STRUCTURES AND PLATFORMS TO ENABLE COOPERATION

The dynamic nature of the maritime industry necessitates a sustainable and multi-layered relationship with universities. This cooperation should be supported not only by individual academician-company relationships, but also by structured, inter-institutional and permanent mechanisms. Permanent structures to be established in this context will make it possible both to respond more quickly and effectively to the needs of the sector and to transform the knowledge production potential of universities into economic value. Below are the main institutional structures and platform proposals that will serve this purpose.

4.1. University-Industry Joint Application and Development Centers

These centers are established within the university and operate with the direct participation of sector representatives. In particular, it fulfills the following functions:

- Conducting applied R&D projects for the sector,
- Providing simulation, design and analysis laboratories for students and graduates,
- Bringing sector consultants and academicians together in the same project,
- To prepare the ground for joint graduate thesis and research topics.

Structures such as “University-Industry Joint Application and Development Centers” offer a model for continuous and practical cooperation between universities and industry. The Fraunhofer Institutes are among the successful examples of this model.

The Fraunhofer Institutes represent one of the most successful models of university-industry cooperation in the world, especially in the field of applied research; they comprise more than 70 research institutes spread all over Germany and employ more than 30,000 researchers and staff. Their main mission is to bridge the gap between scientific discovery and industrial application. The institutes are often located near universities or integrated into universities and work closely with both academia and the private sector. R&D is carried out with the private sector in many areas such as shipbuilding technologies, maritime sensors, fuel efficiency studies (Fraunhofer, 2025). Institutes such as Fraunhofer CML (Hamburg) specialize in maritime logistics, port operations, autonomous shipping, and simulation-based decision support tools. These activities make Fraunhofer a relevant reference model for establishing joint university-industry research and development centers in the maritime sector.

4.2. Maritime Innovation & Knowledge Platforms – Digital Knowledge Sharing and Project Platforms

These platforms to be created digitally at regional or national level:

- Ensures that sector problems are transformed into academic projects,
- Shares real-time needed competencies (e.g. “digital navigation”, “green ship technologies”) with universities,
- Common database includes training contents, webinars and research reports,

- Prepares the ground for the emergence of larger projects with inter-university consortia.

MARINET2 is among the successful examples of this model. It is a digital and physical platform that facilitates knowledge exchange, data sharing, and collaborative research in the field of marine renewable energy technologies. It brings together test centers, universities, research institutions, and industrial partners to accelerate innovation in the maritime sector, particularly wave, tidal, and offshore wind technologies (Marei, 2025). As a good example due to its real-time matching between sectoral needs and academic talents, promotes international and interdisciplinary collaboration in maritime innovation and helps universities stay up-to-date with emerging technology trends.

4.3. Sectoral Advisory Boards

Boards should be established within each maritime faculty or vocational school in which sector representatives actively participate. These committees:

- Contributes directly to curriculum updates,
- Provides mentoring support for graduate employment and career development,
- Establishes feedback mechanisms on graduate performance.

An example of such a committee is the Lloyd's Register Maritime Advisory Board, which supports the University of Southampton's maritime academic programs and research activities. The board includes senior representatives from shipbuilding companies, classification societies, port authorities, and technology firms. The Lloyd's Register Maritime Advisory Board can provide support in matters such as curriculum harmonization, graduate recruitment, identifying and

working on joint projects and thesis topics, providing guest lecturers for courses and company visits. It is considered a good example because it institutionalizes sectoral input into academic decision-making, provides a continuous feedback loop between education and practice, and strengthens the relevance of graduates and the reputation of the university in the maritime sector.

4.4. University Based Incubator Centres – Maritime Tech Incubators

The term "University Based Incubator Centres – Maritime Tech Incubators" refers to incubation centers located within a university that work in the field of maritime technologies. Such centers provide research, mentoring, infrastructure, funding and commercialization support to entrepreneurs. University-based incubators play a key role in regional innovation systems as driving both economic and social advancements. (Jamali et al., 2024). To support maritime-oriented business ideas developed by students and academics at an early stage:

- Centres offering financing, mentoring and office infrastructure should be established,
- Entrepreneurs should be directly matched with investors from the Maritime Sector,
- Specialized subsets should be developed in areas such as sustainable ship technologies, marine IoT systems, artificial intelligence applications.

Some examples falling into this category are given in Table 1.

COVE is a collaborative innovation hub, supporting ocean technology startups by providing access to research facilities, prototyping space, and mentorship. The center brings together entrepreneurs, research-

Table 1. Some examples for University Based Incubator Centers

Incubator Name	Affiliated University	Focus Area	Country
COVE (Centre for Ocean Ventures & Entrepreneurship)	Dalhousie University (Nova Scotia)	Ocean technology, maritime innovation	Canada
NTNU Ocean Lab	Norwegian University of Science and Technology (NTNU)	Marine engineering, autonomous vessels, maritime digitalization	Norway
Texas A&M Maritime Business Incubator	Texas A&M University at Galveston	Maritime logistics, ocean sustainability, marine safety	USA
Ocean Startup Project	Partnership incl. Memorial University of Newfoundland	Blue economy, ocean tech, early-stage maritime startups	Canada
ITU ARI Teknokent (Maritime-focused Startups)	Istanbul Technical University (ITU)	Marine data systems, autonomous surface vessels, ocean robotics	Turkey

Source: Created by the author.

ers, and industry partners, focusing on areas such as subsea sensors, autonomous marine systems, and ocean data analytics.

Known for its strong maritime research programs and partnerships with the shipping industry, NTNU Ocean Lab is a cutting-edge facility supporting research and innovation in maritime technologies. It offers infrastructure and academic collaboration for startups working on marine engineering, digitalization of shipping, autonomous vessels, and sustainable marine operations.

Texas A&M Maritime Business Incubator is dedicated to supporting maritime and ocean-related ventures. It provides early-stage companies with business development resources, industry mentorship, and access to academic expertise.

The Ocean Startup Project is a Canadian accelerator initiative supported by a consortium of universities including Memorial University of Newfoundland. It focuses on helping early-stage ocean technology startups through funding, mentorship, and access to research networks. The program is deeply aligned with the “blue economy” and targets innovation in marine robotics, fisheries tech, ocean sensors, and offshore energy.

Part of Istanbul Technical University (ITU), ARI Teknokent is one of Turkey’s leading university-affiliated technology parks. While not exclusively maritime-focused, it supports startups working in marine technologies such as autonomous surface vehicles, underwater systems, and marine data platforms. ITU’s strong engineering faculty and proximity to the Bosphorus make it a natural hub for maritime innovation.

Technology Transfer Offices are organizations where activities related to efficient and rapid industrialization of academic research outcomes are carried out

(Morgül, 2012). Technology Transfer Offices try to realize university-industry cooperation processes by matching appropriate academicians with project proposals obtained as a result of the regular visits made to the industry and the incoming requests from the industry. Academicians contact Technology Transfer Offices in order to participate in this process (Yalcintas et al., 2015). Technology Transfer offices provide significant advantages to academicians who want to take part in the projects based on R&D and innovation. academicians can earn income for their services, without university revolving capital and income tax deductions. Bamford et al. (2024) states that impact and knowledge transfer can be evaluated, but requires active facilitation before, during and after the project, plus a level of openness and expert engagement within the partnerships.

4.5. Shipyard and Port Cooperation

These offices, which will be established within the university, are liaison units that will ensure daily communication with the sector. The main functions of these offices include coordinating student internship and on-site training programs, organizing academic observation studies in ports and shipyards, and organizing joint trainings, seminars and technical trips. Some examples falling into this category are given in Table 2.

The most fundamental element to be considered when creating these structures is the principle of institutionalization and sustainability. Instead of temporary projects, these platforms should be transformed into institutional structures that are legally grounded, have a budget and are supported by a governance structure. In this way, university-industry cooperation is not limited to specific periods; it becomes a permanent and developing system where both parties produce mutual value.

Table 2. Some examples of liaison units for Shipyard and Port Cooperation

Office / Program Name	University	Main Functions	Country
MARPART (Maritime Preparedness and International Partnership Office)	Nord University	Industry collaboration, academic projects, internships, port/shipyard-based exercises	Norway
Maritime Business and Port Industry Liaison Office	University of Plymouth	Student placements, academic visits to ports, seminars with port authorities	United Kingdom
Maritime Sector Cooperation Office	Istanbul Technical University (ITU)	Internship coordination, shipyard/port visits, sector-focused seminars and joint programs	Turkey
Industry Liaison Office	World Maritime University (WMU)	Collaboration with IMO and industry, curriculum alignment, student exposure to global maritime operations	Sweden
Cooperative Education Program Office	Massachusetts Maritime Academy	Sea terms, onboard training, technical trips, industry-sponsored training events	United States

Source: Created by the author.

5. INITIATIVES FOR TRANSITION FROM INCUBATORS TO INNOVATION RESEARCH CENTERS

In order to make the cooperation between universities and the maritime industry effective and sustainable, first of all, there is a need for environments where ideas can come to life, where they can take risks and be open to experimentation. These environments are often described as incubators, but over time they need to evolve into research centers for ideas to mature and gain commercial value. Incubators provide physical and non-material resources to new ventures to spark new ideas (Becker & Gas-smann, 2006). They are ideal environments for realizing and testing early-stage initiatives, but in-depth research and advanced innovation processes are needed before a product or technology can be integrated into the industry. Managing this transition correctly will make university-industry collaboration more efficient, ultimately bringing tangible and sustainable benefits to the sector.

Aiming to demonstrate how university technology incubators can be successfully established and developed, O'Neal (2015) emphasized that a successful incubator should offer not only physical space but also a comprehensive support system (mentoring, access to financing, university resources, networking, etc.). O'Neal's (2015) recommendations on how a university can start and grow a technology incubator; what the focus should be; and what the requirements are in terms of basic services and infrastructure are summarized in Table 3.

The following subheadings explain the main steps and initiatives that need to be taken in the process of transition from incubators to innovation research centers.

5.1. Supportive Steps for Maturation of Incubator-Level Initiatives

Incubators are of great importance as spaces where new ventures are born and business ideas are tested. However, ensuring the integration of these initiatives with the sector is not limited to the development of the business idea. Initiatives need to be aligned with the sector through the following strategies in Table 3.

- **Incubators Driven by Sectoral Needs and Trends:** Directing the activities of incubators based on sectoral needs will make innovation processes more efficient. In this context, developments in technology and sustainability in the maritime sector should be the main determinants of the direction of projects in incubators.
- **Mentoring and Sector Consultancy:** From the idea stage to commercial maturity, mentoring by experienced professionals in the industry plays a critical role. This will help entrepreneurs better understand sectoral issues and develop the right strategies.
- **Prototype Testing and Simulation Facilities:** Since the maritime sector is a field that requires real-world application, it is important to test the prototypes of projects in real conditions. Testing opportunities should be provided in maritime simulation centers established on university campuses or in infrastructures belonging to the maritime sector.

5.2. Establishment of Innovation Research Centers and Strategies

Initiatives that mature in incubators should evolve into Innovation Research Centers to make a broader contribution to the sector. These centers not only

Table 3. Essential steps, requirements and focus areas for a technology incubator

Start and grow a technology incubator	Focusing	Essential services and infrastructure
- Identify the need and strategic value. - Secure strong university support and leadership. - Build diverse funding from internal and external sources. - Promote public awareness through media and events. - Learn best practices from other incubators. - Use a structured process to select high-potential clients.	- Support early-stage tech startups. - Align with university research strengths. - Encourage commercialization of innovations. - Build a strong entrepreneurial ecosystem. - Create local economic impact.	- Business development help (mentoring, planning, funding). - Flexible office space and shared resources. - Access to university labs, students, and faculty. - Strong community and industry partnerships. - Educational programs and networking opportunities.

Source: O'Neal, 2015.

bring ideas to life but also provide a structure that develops sector-specific solutions through in-depth research. The main strategies to be followed in establishing innovation research centers are as follows:

- **Research Focused on Emerging Technologies:** Innovation research centers should be centers where the latest developments and trends in the maritime sector are monitored and research is focused on these areas. For example, sector-specific solutions should be developed in areas such as autonomous ships, green energy technologies (renewable energy, electric ships), digitalization and artificial intelligence.
- **International Collaborations and Funding:** For innovation research centers to be successful, it is important to establish global collaborations and apply for international research funding. International academic partnerships and collaborations with leading companies in the maritime sector will expand the impact of these centers.
- **Project Management Offices and Industry Relations Units:** Project management offices should be established within innovation centers to manage research projects in a way that meets the real needs of the industry. In addition, industrial relations units will ensure continuous interaction with the sector and ensure the continuity of cooperation.

5.3. Integration of Innovation Centers into the Sector

Innovation research centers should create value not only by conducting academic studies, but also by creating solutions to practical problems in the sector. At this point, the following mechanisms are important to integrate research centers into the sector:

- **Joint R&D Projects:** Innovation centers should combine theoretical research with sectoral needs by initiating joint R&D projects with maritime companies. These projects can produce a wide range of solutions, from ship technologies to port operations.
- **Real-Time Testing of Prototypes:** Prototypes developed in innovation centers should be tested under real conditions in the maritime sector. These tests are critical to measure the practical effectiveness of the technologies being developed.
- **Training Programs Related to Sectoral Trends:** As part of innovation hubs, training programs on innovative technologies in the maritime sector should be organized. These training programs

should be targeted at both industry professionals and students and should convey innovative developments in the industry.

With these initiatives, the successful transition from incubators to innovation research centers will pave the way for a process that will benefit not only universities but also sectoral stakeholders. Continuous cooperation between both parties to accelerate technology transfer will increase the competitiveness of the sector and support sustainable development.

6. STRATEGIC ROADMAP AND POLICY RECOMMENDATIONS

The steps to be taken to activate and sustain the cooperation between universities and the maritime industry should be determined not only at the academic and sectoral level, but also within the framework of government policies and international cooperation. At this point, it is of great importance to create a strategic roadmap to strengthen university-industry cooperation and to develop policy recommendations to support this map.

Strategic steps and policy recommendations to deepen the cooperation between universities and the maritime sector are presented below:

6.1. Basic Needs of Cooperation and Strategic Steps

The main steps that need to be taken to strengthen cooperation should be designed to make the most efficient use of the potential of both universities and the sector. These steps can be categorized under the following headings:

- **Conducting Academic and Sectoral Needs Analyses:** As a first step, a comprehensive analysis of the maritime sector's expectations from the academic world and the universities' potential for sector-related education, research and practice should be conducted. This analysis will be the basis for updating curricula and designing practical training for the sector.
- **Establishing Lasting Partnerships and Platforms:** More than temporary collaborations, permanent partnerships between universities and sectoral stakeholders should be established. These partnerships will ensure that university-industry collaboration platforms become permanent and will encourage a variety of research projects and sector-oriented innovation efforts. Such partnerships can be shaped with both public and private sector support.

- **Launching Joint Research and Development Programs:** Collaboration between universities and the maritime industry should be reinforced through joint R&D projects to produce innovative solutions for the sector. These projects can develop solutions to meet the future needs of the sector by conducting in-depth research, especially in the fields of autonomous shipping, environmentally friendly maritime practices and digitalization.
- **Establishment of Permanent organizations for cooperation:** To ensure sustainable and strong cooperation, it is necessary to establish permanent cooperation organisations. To achieve this, permanent committees and commissions should be established instead of ad hoc committees.
- **State as a shareholder and regulatory authority:** Almost all activities related to maritime affairs are subject to international and national regulations. States that incorporate maritime agreements into their domestic laws and are responsible for oversight should participate as shareholders in cooperation-related organisations in their capacity as regulatory authorities.
- **Research and innovation:** Scientific research and innovation activities are gaining importance to keep pace with current technological developments and reflect them in the maritime sector. It is considered necessary to establish national and international maritime excellence centres to plan, implement and coordinate these activities.
- **Transfer of Best Practices:** Best practises in the successful countries are important to develop local models and mode of operations. Awasthy et al. (2020) explained that measures and best practice have been proposed and disseminated to improve collaboration effectiveness, however, more holistic frameworks would be valuable and meaningful.
- **Strengthening the Legal Infrastructure for Maritime Education and Research:** Legal arrangements should be made to support maritime education and research activities in the academic world. Legal frameworks should be established to regulate the cooperation between universities and the sector and to enable practice-based education and research. In addition, public policies for the sector should be shaped to support this cooperation.
- **Encouraging Sectoral Training and Certification Programs:** In addition to establishing academic programs based on collaboration with the sector, sector-specific training and certification programs for students should be offered. The government should provide policies and support to encourage such programs and develop strategies to directly strengthen cooperation between universities and industry.
- **Encouraging International Collaborations:** Co-operation between universities and maritime sectors needs to be strengthened not only at national level but also internationally. In this context, the government should encourage the strengthening of collaborations with universities and maritime sectors abroad. International research projects, hybrid education programs and cultural exchange programs can boost sectoral innovation.

6.2. Policy Recommendations

Some critical steps and recommendations that the government and relevant institutions should take to increase the effectiveness of university-industry cooperation in the maritime sector are as follows:

- **Creation of Publicly Supported Innovation Funds:** The government should create special funds to support innovative projects and academic research in the maritime sector. These funds should be directed towards the establishment of research centers, the implementation of sectoral innovations, and projects that build strong links between universities and the sector.

6.3. Implementation Stages of the Roadmap

In order for the strategic roadmap to be implemented effectively, the following steps should be taken into consideration:

- **Updating Training Programs and Identifying Needs:** The first step is to update the education curricula for the sector and clearly identify the needs of the sector. In line with these needs, departments that prioritize practical training and directly contribute to the sector should be established within the university.
- **Establishment of Joint R&D Centers:** By establishing joint R&D centers between the university and sectoral stakeholders, theoretical knowledge should be directly applied to the problems in the sector. The projects to be carried out in these centers will both increase the research capacity of the university and offer concrete solutions to the sector.
- **Implementation of Pilot Projects and Establishment of Monitoring System:** In the first phase, joint projects can be initiated as small-scale pilot projects. The progress, impact and

success rate of these projects should be monitored, and continuous feedback should be provided. This will ensure that the transition to large-scale implementations is based on more solid foundations.

This strategic roadmap and policy recommendations will ensure that the cooperation between universities and the maritime sector becomes more productive and will strengthen the culture of innovation both in the academic world and in the sector. Both universities and industry stakeholders will mutually benefit from this cooperation process and the maritime industry will move forward with stronger steps into the future.

7. THE ROLE OF THE MARITIME SECTOR

While universities are expected to proactively align their education, research, and innovation activities with the needs of the maritime sector, the sector itself must also assume an active and strategic role in nurturing this partnership. The success of university-industry collaboration depends not only on the academic side's responsiveness but also on the industry's willingness to co-create knowledge, share expertise, and invest in long-term cooperation. Chambers of Shipping will be a driving force in this respect. For example, Piri Reis University receives the support of the Chamber of Shipping in the organization of scientific events that address the problems of the maritime sector.

The maritime sector has strong strategic incentives to actively support university collaboration. By engaging with academia, the Maritime industry can secure a future-ready workforce, influence curriculum development, and gain access to cost-effective, cutting-edge research that fosters innovation in areas like green shipping and digitalization. Universities also help maritime companies meet environmental regulations, enhance ESG (Environmental, Social, and

Governance) performance, and reduce R&D risks through shared infrastructure and expertise. Ultimately, this partnership strengthens the sector's global competitiveness and ensures long-term sustainability by aligning educational outcomes with real-world operational needs.

To contribute effectively to university collaboration, the maritime sector can implement several targeted strategies. These include establishing dedicated liaison units to manage academic partnerships, sponsoring real-world student projects to foster innovation, and co-investing in research infrastructure such as simulation labs and maritime tech hubs. Additionally, active participation in academic networks enhances information flow and visibility into emerging trends, while offering incentives like scholarships, fellowships, and industry mentorship encourages deeper academic engagement. Together, these actions help create a structured, mutually beneficial ecosystem for innovation and talent development. Figure 1 shows how the Maritime sector can create a "Value Added Chain" in cooperation with the university.

The process that starts with the needs of the maritime sector produces outputs (qualified manpower, innovation, sustainability) thanks to the collaborations with universities, and these outputs return to the maritime sector as value. This process can be explained with a simple example.

A shipping company may enter a partnership with a university from which it wishes to benefit from educational facilities, considering the refresher training and professional development needs of its personnel working on ships. It may propose innovations in the university's maritime education programs, based on the determination that the personnel are deficient in using new technologies and implementing new rules. It may conduct research and development activities with academics in order to produce economical solutions in ship and fleet operations.

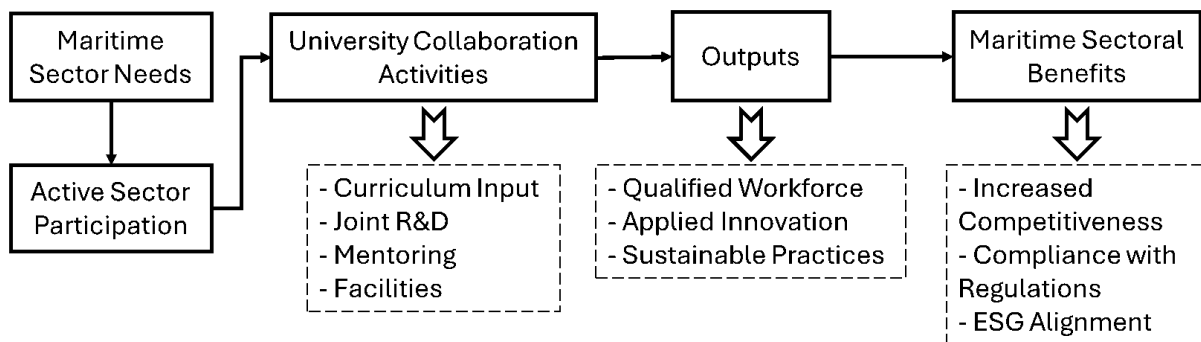


Figure 1. Value added chain of maritime sector & the university cooperation. (Source: Created by the author.)

As a result of this cooperation, it can employ more qualified seafarer personnel and benefit from technological solutions. As a result, it can increase its competitiveness compared to other companies and become a leading company in ESG compliance in terms of complying with the new rules published by IMO.

In addition to making curriculum updates in undergraduate programs, it will also be possible to open graduate programs according to the needs of the maritime sector within the scope of this cooperation. The Maritime Technology and Management master's program offered by the National University of Singapore (NUS) is a good example in this respect. With the aim to train and equip graduates with key skill-sets to enable next-generation port capabilities, this master's degree is strongly supported by the Maritime and Port Authority of Singapore and PSA Singapore, and students are offered 15-week internships at maritime-related companies to integrate knowledge and theory on maritime technology and management (NUS, 2025).

8. CONCLUSION

The maritime industry is a critical sector for the global economy, requiring continuous innovation and adaptation to ensure sustainable growth and development. Universities offer great potential to contribute to this process. The cooperation between the maritime sector and universities will result in the training of "Qualified Human Resources (QHR)", development of "Technological Innovations (TI)" and enhancement of "Global Competitiveness (GC)", as expressed in the formula below.

$$\text{Maritime Sector} + \text{University} = \text{QHR} + \text{TI} + \text{GC}$$

In this study, structures, platforms and strategies to strengthen university-industry cooperation are discussed, and various suggestions are presented on how this cooperation can be made more effective. However, a strong framework is needed to increase the effectiveness and sustainability of collaboration between universities and the maritime industry.

Firstly, permanent platforms and common structures, namely Joint application and Development centres to meet the needs and demands of the maritime industry, should be established to make the cooperation between universities and the maritime industry permanent and productive. Forming a bridge between scientific research and sectoral application, these platforms will provide a critical basis for research and development projects and training programs for sectoral needs and will accelerate knowledge sharing both in the academic world and

in the sector. Examples such as Fraunhofer Institutes can be a source of inspiration for maritime industry stakeholders and universities with expertise in the maritime field. To serve the same purpose, The Maritime Innovation & Knowledge Platforms, which will be established in the Digital Knowledge Sharing type, will enable both structures to support each other with online methodology by providing facilities such as real-time problem sharing, access to common educational resources and the formation of inter-platform research consortia. The MARINET2 project, which provides both physical and digital platforms for knowledge exchange, data sharing, and collaborative research, can be considered as a good example for sector stakeholders and educational institutions aiming Digital Knowledge Sharing. The active role of the state as a regulatory authority and even as a shareholder will support the development of these organizations.

Permanent committees and commissions should be established instead of ad hoc committees to ensure sustainable and strong cooperation. In addition, the state should participate in these organisations as a shareholder in their capacity as a regulatory authority.

Secondly, for this collaboration to take off, a transition process from incubator level to innovation research centres is needed. While incubators provide an important space for the development of early-stage startups, innovative research centres should be structures that will provide solutions to large-scale problems in the sector by conducting in-depth research into the sector. This process will start a mutually beneficial cycle for both parties. Incubation and innovation centre initiatives must be thought of as a reaction to shipbuilding technology and maritime industry sustainability trends. Priorities for strategic focus such as autonomous shipping, green ship technology, and marine digitalization must drive lines of research.

Thirdly, a strategic roadmap and supporting policies need to be developed to manage this process effectively. The government and especially Chamber of Shipping should encourage special funds, legal regulations and international collaborations that support university-industry cooperation, which will make this process sustainable in the long term.

Fourthly, it is considered necessary to establish national and international maritime excellence centres, particularly for the purpose of conducting scientific research and innovation activities.

In conjunction with these activities, it would be beneficial for universities to establish sectoral advisory boards with the participation of relevant representa-

tives from the maritime sector, especially in terms of curriculum updates, providing mentoring and expanding practical training opportunities in the workplace.

In conclusion, collaboration between universities and the maritime industry will shape not only academic and industry success, but also the future transformation of the global maritime industry. Strengthening this collaboration will increase the potential to generate innovative solutions and add lasting value to the industry. In this context, universities, the maritime industry and government, working in collaboration, can build a strong and sustainable foundation for the maritime industry of the future.

While this research outlines institutional infrastructures and strategic channels to stimulate university-industry collaboration within the maritime sector, there are areas that need to be further investigated. Future studies could look into the long-run performance of collaborative maritime R&D centres using empirical impact assessments, i.e., cross-country comparative case studies. Also needed is further research into digital collaboration platforms and how they can enhance real-time knowledge exchange.

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