

<b>Assuring the long-term sustainability of the Surveying &amp; MARiTime internet of thingS EducAtion (SMARTSEA) Project</b> <i>(Ana Serafia, Mariana Golumbeanu)</i>	<b>“Cercetări Marine”</b> <b>Issue no. 52</b> <b>Pages 148-158</b>	<b>2022</b>
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# **ASSURING THE LONG-TERM SUSTAINABILITY OF THE SURVEYING & MARITIME INTERNET OF THINGS EDUCATION (SMARTSEA) PROJECT**

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## **ABSTRACT**

The study is focused on the exploitation and dissemination activities for the sustainability of the MSc program on Smart Maritime & Surveying Systems within the Surveying & MARiTime internet of thingS EducAtion (SMARTSEA) project. A key factor for success is to ensure that the results and achievements of the project are made widely available to its target audience comprised of students, industrial partners, academic & market business and scientific community.

As a unique European pilot-project funded by the European Union’s Erasmus+ Programme Knowledge Alliances, SMARTSEA aimed to develop an advanced interactive certified MSc course related to Maritime & Surveyor IoT applications that will train individuals with the necessary skills & knowledge to work in the rising “Smart Maritime & Surveying” industry. To reach its target audiences according to its expected impacts, an effective communication strategy was developed, based on project-specific dissemination and communication activities.

This approach will provide an overview of the resources needed to accomplish the exploitation and dissemination objectives throughout the project lifecycle, while creating guidelines for future development and exploitation.

**Keywords:** exploitation and dissemination activities, target audience, communication strategy

## **AIMS AND BACKGROUND**

Exploitation is associated with the use of the project’s results, during and after the implementation of the project. In SMARTSEA, the main exploitation strategy on which all partners agreed, focused on attracting more students, gain new knowledge, cooperate with industry, offer consulting services to the industry, cooperate with government agencies and strengthen their scientific publication record.

For covering all aspects of the project, the exploitation strategy was to turn outcomes into benefits, favoring the future development of SMARTSEA

MSc and help us launch new related activities.

From the first stage of the project, it was established that dissemination is one of the most important elements for assuring the long-term sustainability of the project. Thus, the appropriate management of the dissemination activities ensured that the project created awareness among the target groups.

Dissemination actively supported and promoted the exploitation of the project outcomes.

Driven by its innovation nature, SMARTSEA was aligned with industrial and market needs and had the potential to impact the educational community shortly after its completion. We considered that the adaptability, flexibility and maintainability of the developed curriculum and measurement system demonstrator, combined with the fact that they are mostly based on existing and emerging technologies, will allowed the project to be easily integrated in existing industrial infrastructures, and effectively mature to a Master's degree with reasonable student fees and configuration efforts, just like other existing Master programs (Katranas *et al.*, 2020).

The main SMARTSEA Project future objective is to set-up a Smart Maritime & Surveying Systems MSc fully integrated at International Hellenic University, Greece. Therefore, the academic partners participants (International Hellenic University, Escola Superior Náutica Infante D. Henrique, Maritime University of Szczecin, University of Slovenia, Tallinn University of Technology, and University of Salamanca-BISITE) aimed to foster long term cooperation and fortify their curriculum by joining this project (Plaza-Hernández *et al.*, 2019). Another specific objective was to educate the students in order to ensure that future graduates will be able to use the acquired knowledge in their upcoming work within the Maritime and Surveying Industry.

## **EXPERIMENTAL**

Depending on the partner, we identified benefits that could be both financial or non-financial (increase knowledge in the Maritime & Surveying ICT/IoTs field, better use of standards, receive recognition as an innovative company, or peer to peer appreciation).

The success of the future version of SMARTSEA lies not only in the satisfaction of professional needs, but also in the establishment of attractive benefits for recent graduates. This is the actual aim of the future SMARTSEA. The form of a practical training must be kept providing in situ experience to the future students, especially for the professional path. An obligatory thesis will also exist for the MSc path and in total 120 ECTS will be awarded to the graduates. To track the long-term success of the project, each partner needed to identify how it will benefit from SMARTSEA results (Table 1).

**Table 1.** Benefits of the SMARTSEA Project for the consortium

<b>Benefits of the SMARTSEA Project for the consortium</b>
<p><b>Academic Institutions:</b> International Hellenic University, Escola Superior Náutica Infante D. Henrique, Maritime University of Szczecin, University of Slovenia, Tallinn University of Technology, University of Salamanca</p>
<ul style="list-style-type: none"> <li>• design and deliver modern, module-based pilot curriculum</li> <li>• improve teaching practices</li> <li>• improve qualification of the teaching staff</li> <li>• enable staff to develop their own expertise and research as specialists in Maritime &amp; Surveying industry development</li> <li>• improve students experience in higher education</li> <li>• strengthen collaboration among partners in the view of future projects or initiatives</li> <li>• participation to key events, including conferences or workshops</li> </ul>
<p><b>SME partners:</b> Cerca Trova Ltd, ECQA GmbH</p>
<ul style="list-style-type: none"> <li>• apply lessons learned toward future endeavors</li> <li>• exchange knowledge</li> <li>• establishing partnerships</li> <li>• acquire new insights and explore opportunities in subsequent projects and workshops</li> <li>• strengthen collaboration among partners in the view of future initiatives</li> <li>• Participation to key events, including conferences or workshops</li> <li>• Extend client portfolio</li> </ul>
<p><b>Research Institute:</b> National Institute for Marine Research and Development "Grigore Antipa"</p>
<ul style="list-style-type: none"> <li>• enable its staff to develop their own expertise and research as specialists in Maritime &amp; Surveying industry development</li> <li>• participation to key events, including conferences or workshops</li> <li>• strengthen collaboration among partners in the view of future projects or initiatives</li> </ul>
<p><b>Industrial Partners:</b> RINA Hellas SA, Creocean, Danaos Shipping Company Ltd</p>

- opportunity to share insights and exchange know-hows
- increase position and competitiveness within Maritime & surveying industry
- strengthen collaboration among partners in the view of future projects or initiatives
- participation to key events, including conferences or workshops
- extend client portfolio

Industry representatives will be involved in the course creation so the project sustainability will be further ensured. A cooperation network will be created between students and industrial partners that will persist even after the mobility period ends. Future projects and new workplaces will be created through this network.

## RESULTS AND DISCUSSIONS

**Business Model.** The SMARTSEA consortium brings together a range of partners from different nationalities and organizational types who contributed significantly to meeting the project objectives. The consortium comprises six universities, one research center, two small and medium enterprises and three environmental surveying and shipping companies. Partners presented the most recent knowledge and technology on Maritime Engineering, Shipping/Environmental Surveying and IoT systems on the component and systems level. The educational institutions hold facilities equipped with instrumentation for testing and developing IoT systems. Additionally, the SMEs and shipping/environmental surveying companies constitute the industrial part of the project, bringing appropriate experience and techniques. The most important goal for SMARTSEA to be successfully developed into a profitable product, were reached through business model. The essential aspects of the project identified by each partner, covering four main areas: customers, offering, infrastructure and financial viability (Table 2 SMARTSEA Business Model). To create an accurate model that will provide substantial improvement, a series of questions that needed to be answered, concerning customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure were addressed.

By gathering different perspectives, this tool has helped to have a clearer picture of how our customers' needs will be met across the market in the next couple of years

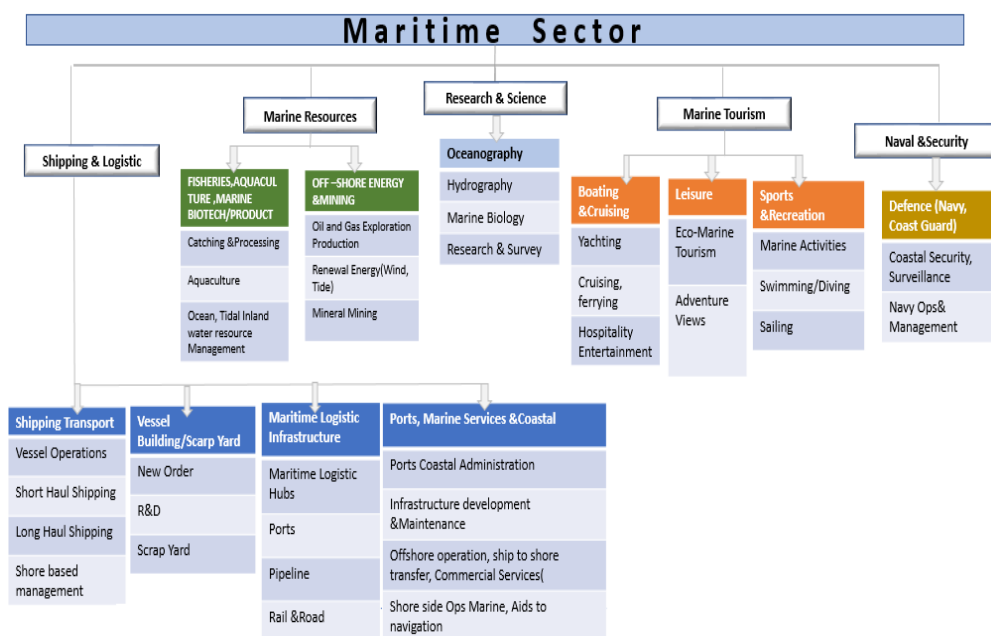
**Market Potential.** The central objective of the exploitation plan was to maintain the main project tangible outputs (master program) and intangible outputs (gained knowledge, experience and skills by students and teaching staff) after the end of the SMARTSEA project funding. Therefore, our interest in pursuing sustainability of the SMARTSEA Master program has been based

on:

a) Project attractiveness through communication, study program quality, curricula evaluation and update, students' employability, employers' awareness.

b) Project operational capacity through the involvement of the mobility partners: Danaos Shipping Company, Maritime University of Szczecin, RINA Hellas and Creocan.

Besides, a diverse array of organizations and a series of new and exciting career opportunities a Smart Maritime Network were identified. (Fig.1).

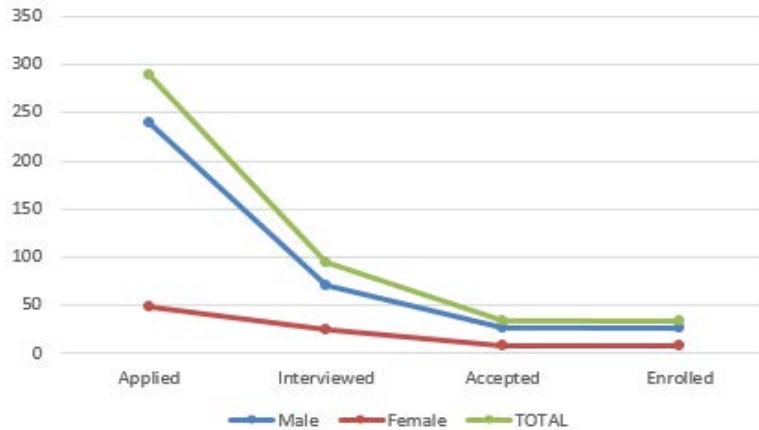


**Fig. 1.** Smart Maritime Network

**Market Analysis.** Conducting a market analysis helped us determine SMARTSEA specific segment of applicants (Table 3, Fig. 2), based on age and gender as demographic information.

**Table 3.** Count of applied, interviewed, accepted and enrolled students

Applicants	Applied	Interviewed	Accepted	Enrolled
Male	240	71	27	26
Female	49	24	7	7
<b>TOTAL</b>	<b>289</b>	<b>95</b>	<b>34</b>	<b>33</b>

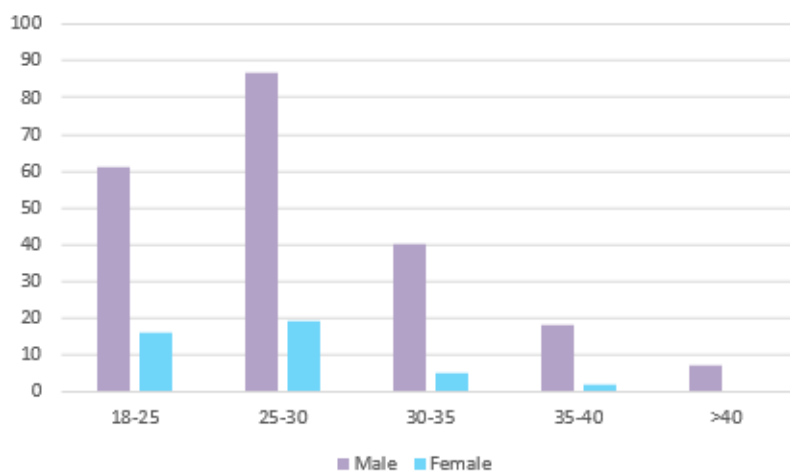


**Fig. 2.** Visual representation of applied, interviewed, accepted and enrolled students

Demographic statistics were especially useful to understand how the target audience was (Table 4, Fig. 3). The analyses revealed a substantial gender gap in applications, the MSc program attracted fewer female applicants than male (Table 5, Fig. 4).

**Table 4.** Applicants by individual age and gender

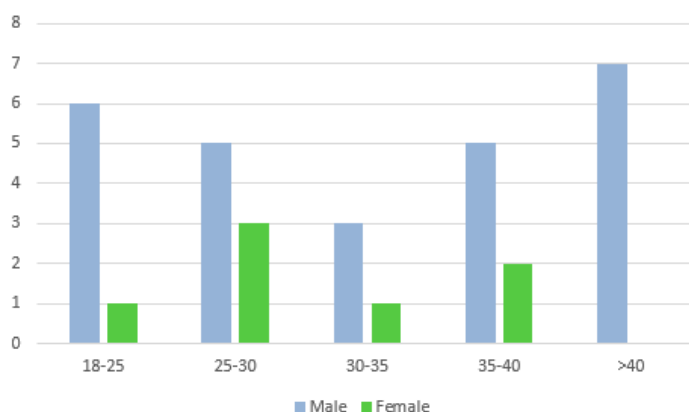
Age	18-25 years	25-30 years	30-35 years	35-40 years	Over 40 years
Male	61	87	40	18	7
Female	16	19	5	2	0
<b>TOTAL</b>	<b>77</b>	<b>106</b>	<b>45</b>	<b>20</b>	<b>7</b>



**Fig. 3.** Visual representation of applicants by individual age and gender

**Table 5.** Enrolled applicants by individual age and gender

Age	18-25 years	25-30 years	30-35 years	35-40 years	Over 40 years
Male	6	5	3	5	7
Female	1	3	1	2	0
<b>TOTAL</b>	<b>7</b>	<b>8</b>	<b>4</b>	<b>7</b>	<b>7</b>



**Fig. 4.** Visual representation of enrolled applicants by individual age and gender

**Project Sustainability.** For a successful exploitation, it was considered the concrete objects that will be able to continue after the project's end. To pursue an efficient sustainability, the following steps needed to be assured:

- Identify what outcomes does the consortium want to sustain over time and what strategies does the consortium need to sustain to achieve their outcomes.
- Identify what resources are required (costs, training) for the consortium to sustain the outcomes over time.

The course and the main results from the SMARTSEA project will be kept beyond project lifetime through continued collaboration between partners. Specifically, the academic collaboration between the academic partners will continue in several directions: the Joint course in Maritime Surveyor ICT systems to be fully integrated in the syllabus of the Universities and will become institutionally and nationally accredited; updating and fine-tuning of the MSc Course, following the evaluation of results of the pilot course, which will finish beyond project lifetime; preparing joint research papers in the field of Maritime & Surveyor ICT/IoT systems that may be generated within current project; SMARTSEA e-Learning platform will contain available learning materials on Maritime Surveyor ICT systems, peer learning forum and other collaboration facilities; the developed Laboratory Apparatus Design &

Teaching Methodology will be made available as open educational resources (OER); maintain the ongoing collaboration between the consortium partners; create and expand a community in Maritime Surveyor ICT systems.

The course's financial sustainability will be ensured by collecting student fees and through the scholarships that industrial companies may offer to train their personnel and stay competitive in this emerging field. The fees will cover the participant's training, laboratory apparatus & demonstrator equipment maintenance. It will also cover the student's mobility between academic institutions and to the industrial partners for their practice. It is expected that the course will be taught among other academic institutions & industrial partner's clusters, following the same principles and guidelines.

The collaboration with business partners and external associated partners will continue in the field of updating the launched course and in the development of new ones, in the same theme to further cater the market needs and provide a deeper interdisciplinary knowledge and understanding.

**Risk Management.** The risk management is the process of minimizing any potential problems that may negatively impact project's timetable. Therefore, identifying risk that may occur throughout SMARTSEA project lifecycle was one of the key topics to ensure its sustainability.

A large series of aspects about SMARTSEA were identified and highlighted in a SWOT analysis (Table 6).

**Table 6.** SMARTSEA SWOT analysis

<b>Strengths</b>	<b>Weaknesses</b>
<ul style="list-style-type: none"> <li>• deep knowledge of the Market</li> <li>• international consortium with substantial expertise in the respective markets</li> <li>• innovative programme in Smart Maritime and IoT</li> <li>• EU-accredited qualification</li> <li>• new innovative teaching materials and approaches</li> </ul>	<ul style="list-style-type: none"> <li>• industrial network to build (identify contributors)</li> <li>• long term development (3 years project)</li> <li>• lack of involvement from new potential industry partners</li> <li>• funding opportunities</li> </ul>
<b>Opportunities</b>	<b>Threats</b>
<ul style="list-style-type: none"> <li>• increased student participation in the course</li> <li>• industrial demand of the IoT measurement system &amp; ROUVs</li> <li>• academic demand for course teaching</li> <li>• research of valuable data</li> <li>• strengthen the connection between universities</li> </ul>	<ul style="list-style-type: none"> <li>• limited investment in some countries due to financial crisis</li> <li>• completely new technology to appear in the market</li> <li>• economic factors</li> <li>• travel restrictions during the mobility period</li> </ul>



## CONCLUSIONS

A main part of SMARTSEA successful implementation was understanding how we can exploit the project results for future developments. The goal of this exploitation strategy was to determine the best possible path to achieve the most important outcomes of the project, in the form of:

- ✓ New MSc curricula / program developed, implemented and accredited.
- ✓ Innovative teaching / learning materials created.
- ✓ E-learning courses continuously updated.
- ✓ User friendly e-learning platform designed and maintained.
- ✓ Partner and alumni network established.

Furthermore, the dissemination activities have contributed for better visibility and sustainability for project exploitation during and after project lifetime. The planned events for popularization had specified the current achievements and the expected outcomes. The events complied with project's stage of development and demonstrated the importance of the connection between education and business.

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**Table 2.** SMARTSEA Business Model

<b>SMARTSEA Business Model Canvas</b>				
<b>Key partners</b> <b>Academic partners:</b> USAL IHU FMST CT ECQA NIMRD ENIDH TalTech  <b>Industrial partners:</b> CT ECQA DANAOS RINA CREOCEAN MUS End-users (potential new partners)	<b>Key activities</b> Generation/update of program materials Creation/maintenance of the e-Learning platform Design & set up of demonstrators Learning mobility activities for students & educators Dissemination materials & events Develop strategic partnerships Preparation/update of the Business Plan, Quality Plan & Risk Management Teaching activities	<b>Value proposition</b> <b>SMARTSEA objectives</b> - To complete the market void in technical and maintenance specialists generated by the rapid expansion of the Smart Maritime & Surveying industry. - To develop an innovative and certified MSc program on Maritime & Surveyor ICT/IoT. - To create cost-effective reconfigurable tools used across industries and online platforms for global access to reduce the learning cost in academia and empower distant learning. - To modernize the didactic techniques of higher education institutes by creating interactive learning methods and industrial tools. - To ignite entrepreneurship by using interactive teaching and participation methods that boost innovative thinking. - To offer a chance to augment the skills of lifelong learners and maintain them on top of the employment market.	<b>Customer relationships</b> <b>Short-term relationship</b> Customers need to speak to a person and use technology We will need to work harder to acquire our customers <b>Types of relationships</b> Dedicated Personal Assistance: a very close interaction between the customer and the company. Self-Service: the customer experience is placed on the tools the company provides (e-learning platform, lab equipment, demonstrators)	<b>Customer segments</b> - Graduate/postgraduate/ PhD students - The scientific community (researchers) - Academic and market business role - The European start-up and SME ecosystem - Industrial partners: management and key personnel, maintenance operators, front-line industry workers and local authorities
	<b>Key resources</b> Courses contents & materials (knowledge & expertise) E-learning platform Laboratory equipment & demonstrators Lecturers/teachers/educators/material developers Personnel: administrative & financials, maintenance		<b>Channels</b> Web portal & social media channels Promotional content Media/technical publications Partners' networks (mailing lists) Dissemination events (community days, industrial events, forums, workshops, etc.)	

	(website, e-learning platform), IT & lab infrastructure, students & teachers' coordination	<ul style="list-style-type: none"> <li>- To address participants from backgrounds with fewer opportunities and foster social integration.</li> <li>- <b>Knowledge Alliance objectives</b></li> <li>- To boost innovation in higher education and business.</li> <li>- To stimulate and develop an entrepreneurial mindset and skills.</li> <li>- To stimulate the flow and exchange of knowledge between higher education of European universities and industrial partners.</li> <li>- To develop new, innovative and multidisciplinary approaches to teaching and learning.</li> <li>- To build inclusive and connected education systems</li> <li>- To promote excellence in skills development</li> </ul>		
<b>Cost Structure</b> Value driven (focused on value creation, premium value proposition) Fixed Costs: costs that remain the same over a period of time (administrative, lecturers, lab equipment, demonstrators, etc.). Variable Costs: as the name suggests, these costs vary according to a variance in production (accommodation and travel costs for the learning mobility activities).			<b>Revenue streams</b> Asset Sale: the company sells the right of ownership over the good to the customer (SMARTSEA sells knowledge & expertise). Usage Fee: the company charges the customer for the use of its product or service (tuition fees). Lending/Leasing/Renting: the customer pays to get exclusive access to the product for a time-bound period (e-learning platform, laboratory equipment, demonstrators). Licensing: the company charges for the use of its intellectual property.	