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Adapting the capacities of higher education institutions to labour market needs in the use of smart technologies in marine exploitation

R Boşneagu[1], D Coşofreţ[2]*, R Avram[3], D Atodiresei[4], G Li[5], A Bautu[6], A Nedelcu[7]

[1] Ph D.Eng., "Mircea cel Bătrân" Naval Academy, Constanta, Romania
[2] Ph D.Eng., "Mircea cel Bătrân" Naval Academy, Constanta, Romania
[3] Ph D.Eng., "Mircea cel Bătrân" Naval Academy, Constanta, Romania
[4] Ph D.Eng., "Mircea cel Bătrân" Naval Academy, Constanta, Romania
[5] Ph D.Eng., Norges teknisk-naturvitenskapelige universitet, Alesund, Norway
[6] Ph D., "Mircea cel Bătrân" Naval Academy, Constanta, Romania
[7] Ph D.Eng., "Mircea cel Bătrân" Naval Academy, Constanta, Romania

*Corresponding author

Abstract: Maintaining a high-performing education system requires continuously adapting its capabilities to technological developments, and labour market needs by preparing graduates to use these technologies. It can be achieved by developing the teaching base with new technologies and by adapting the curricula to the requirements of the labour market, including the exchange of experiences with other educational institutions in the field, through joint projects. One such project is the "Marintech" project between the "Mircea cel Bătrân" Naval Academy (MBNA) in Romania, and the Norges teknisk-naturvitenskapelige universitet (NTNU) in Norway, whose main objective is to adapt curricula to the intelligent technologies used in the field of marine exploitation.

Keywords: ANMB, NTNU, Marintech project, curricula, smart technologies, maritime industry, maritime robotics, machine learning

1. Introduction

The maritime industry is deeply anchored in the national economy and traditions of both Norway and Romania. In recent decades, there has been a growing interest from economic operators in the development and use of new intelligent technologies for maritime operations of high difficulty. Maritime operations depend on the interaction between technology, human factors and business. The SWOT analysis identified two challenges as priorities for improving the technological level and productivity of the maritime industry. The first challenge is the development and implementation of smart technologies (autonomous and automated) to operate in dynamic and complex marine environments. The second issue facing the maritime industry is the lack of skilled personnel to service these technologies.

There are other areas using these technologies, such as the port industry, marine resource exploitation industry, bio-marine research, the defense system, etc., which need qualified personnel to use them.

The project "Romanian - Norwegian strategic cooperation in maritime higher education for enhancement human capital and knowledge base in field of marine intelligent" under the acronym MARINTECH, funded by EEA GRANTS, which is implemented by the "Mircea cel Bătrân" Naval Academy (MBNA) and the Norges teknisk-naturvitenskapelige universitet (NTNU) is based on the needs identified during discussions with representatives of the maritime industry, on meeting the labor

market requirements for training personnel in the field of new and intelligent technologies in the maritime industry based on SWOT analysis. The aim is to improve human capital in the field of smart maritime technologies by improving the skills and competences of students and staff in higher education (HE), by facilitating the learning mobility of students and staff from the two universities, by strengthening the institutional cooperation of the two HE partners based on the identified common needs. The "MARINTECH" project will also strengthen the partnership in marine engineering and interdisciplinary programs between the two universities [1].

2. Data and Methods

In order to achieve the overall objectives of the project, shown in Figure 1, both universities carried out a selection process for the project teams, with each partner appointing representatives from among professors with experience in the field of smart technologies in the maritime industry.
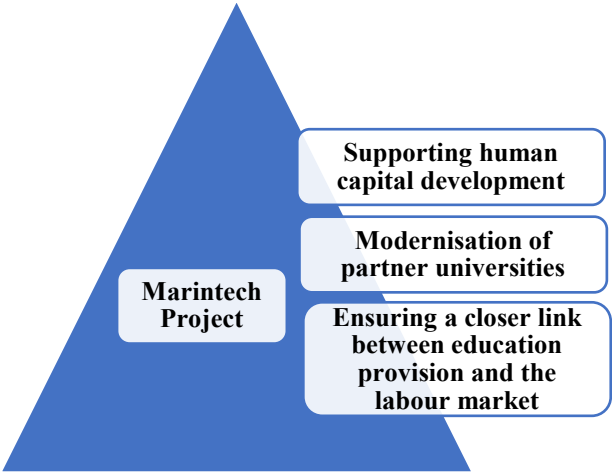

Figure 1. General objectives of the Marintech project

They defined specific objectives for each general objective of the project taking into account the labor market needs of the maritime industry in the field of smart technologies in the maritime industry, based on the SWOT analysis carried out by the universities before the start of the project. The resulting team of experts established a common list of competences, skills and knowledge to be acquired by the graduates of both universities, as well as the teaching methods and tools to achieve the identified specific objectives.
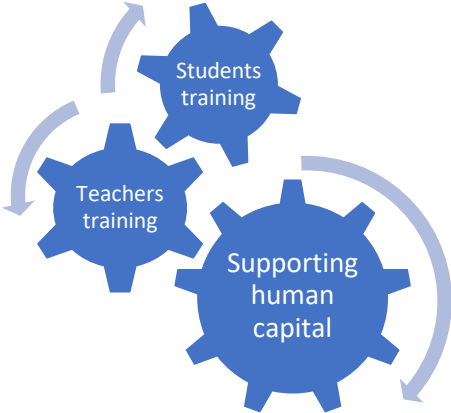

Figure 2. Action lines to achieve the objective "Human capital support".

In order to support the development of human capital in the field of intelligent technologies, the directions of action have been defined, as shown in Figure 2. Thus, for the training of students, as a first specific objective, the need to design new joint programs has been identified, through the development

of a curriculum for the joint course consisting of 3 multidisciplinary course modules, containing practical applications in the field of maritime robotics, machine learning and in the field of bathymetry and oceanography. The courses will be recognized by both universities and jointly certified with ECTS credits [2, 3, 4]. The effectiveness of these courses will be verified through feedback from students participating in the courses and summer schools organized at both universities, as well as from the labor market actors participating in the workshops organized by both partners. The students participating in these training sessions will be selected from among master students from both universities. Another specific objective is the joint training of teachers from both universities on the use of innovative teaching methods and tools compatible with the field of smart technologies in the maritime industry.

Therefore, with a view to the professional development of human capital in the field of smart marine technologies (academic staff, students), joint summer schools, short-term student mobility and short-term staff training events will be organised with the participation of specialists in the field.

The upgrading of the universities is achieved by improving teaching/learning and assessment methods in the virtual environment, by implementing the joint curriculum in marine smart technologies in the curricula of the two universities, by exchanging experience in the field and by sharing the facilities of each partner. The project will also develop a virtual platform (VTP) as an open source and e-campus for the implementation of mutual learning activities, exchange of academic knowledge, experience and best practices in the field of smart marine technologies, supporting staff and student exchange, allowing employers access to the project activities, thus encouraging students' involvement in activities allowing direct contact with economic partners in solving concrete problems. They are freely available on VTP for transfer to all interested higher education institutions or any other interested parties.
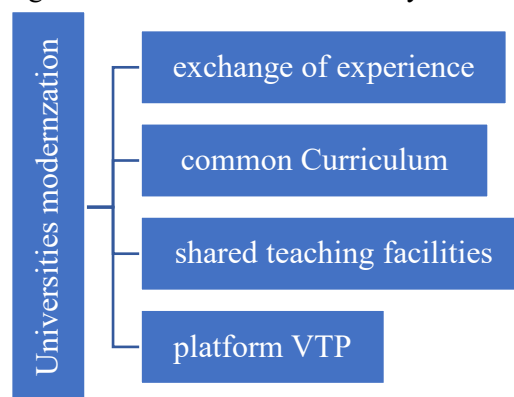

Figure 3. Directions for action on university modernisation

Ensuring a closer relationship between the educational offer and the labour market will be achieved by promoting and disseminating the results of the project, through the project website and the joint publication of scientific articles, as well as by holding joint awareness raising events (workshops) with potential labour market employers. Labour market actors will also have free access to the project's VTP platform with the possibility to interact with the teachers in order to continuously improve the curriculum, as well as to propose collaborative projects to recruit students to practical activities to be carried out in maritime industry companies.

3. Results and conclusions

For the implementation of the project objectives, a project management plan was developed in which intellectual outputs, workshops and learning/training/education activities were defined within a respective and agreed timeframe.

The intellectual outcomes of the project are:

- Joint realisation of the curriculum "Applications of Intelligent Technologies in the Maritime Industry". It comprises 3 modules, as follows: "Practical Applications in Maritime Robotics", Applications of Intelligent Technologies in Bathymetry and Oceanography" and "Applications of Machine Learning in the Maritime Industry". Each course lasts 28 hours of which 14 hours are lecture and 14 hours laboratory. Each course module is also allocated 4 ECTS credits.

- the creation of the virtual platform (VTP) and the project website which is accessible on the partner

universities' websites;

- joint production of scientific articles presenting innovative teaching methods and tools applicable to the teaching of intelligent technologies in the field of marine exploitation and intelligent technologies applicable to the maritime industry.

The intellectual results developed through the project could be shared as a pilot module with other interested universities.

Through the training sessions carried out in the framework of the project (2 summer schools, 2 short-term student mobilities and 2 short-term staff training events), the objectives of the project are achieved through the acquisition of competences and practical skills in the field of smart marine technologies for both students and academic staff of the two partner universities, which will facilitate students' access to the labour market and their direct contact with economic partners.

Another impact of the project is to strengthen future cooperation between the two universities in order to modernise them, by continuing the course "Applications of smart technologies in the maritime industry" and after the end of the project, by continuing the exchange of experience between teachers and students with the help of the Erasmus programme implemented during this project between the two universities.

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