Erasmus+

D.5.2 Implementation Report - Varna

D5.2. – Implementation Report - Varna

Project information

Grant Agreement Number	*2017 - 2863 / 001 - 001*
Project Full Title	Towards responsive engineering curricula through Europeanisation of dual higher education
Project Acronym	DYNAMIC
Funding scheme	*588378-EPP-1-2017-1-DE-EPPKA2-KA*
Start date of the project	01-11-2017
Duration	36 months + 4 months

Deliverable Information

Deliverable n°	D5.2 (1/2/3)
Deliverable title	Pilot Implementation Report NAVAL ENGINEERING AND MARINE TECHNOLOGY MARINE ENGINEERING DESIGN OF MARINE PLANTS AND SYSTEMS Varna
WP	WP5
WP Leader	TUV
Contributing Partners	MTG Dolphine, Keppel Fels Baltech, IHB Ship Design
Authors	Galina Ilieva, P. Georgiev, S. Valchev, Y.Denev, I. Kostova, C. Pirovsky
Reviewers	Galina Ilieva, P. Georgiev, Evgenia Mahler
Contractual Deadline	
Languages	English

Dissemination Level

PU	Public	x
PP	Restricted to other program participants (incl. Commission Services)	
RE	Restricted to a group specified by the consortium (incl. Commission Services)	
CO	Confidential, only for the members of the consortium (incl. Commission Services)	

Erasmus+

D.5.2 Implementation Report - Varna

Document Log

Version	Date	Description of Change
1	07.07.2020	Preliminary report - draft
2	23.12.2020	Prelinimary report with included final information for practices in Autumn, 2020
3	03.02.2021	Prefinal version
4	27.02.2021	Final version

Erasmus+

D.5.2 Implementation Report - Varna

Table of content

INTRODUCTION

We are entering to the so called Industry 4.0. However, many European countries face huge challenges in relation to their workforce. The industrial development demands new knowledge and skills-intensive jobs, and therefore require very well-educated and highly skilled employees. It is true especially for the engineering sector and for engineers who are the driving force of innovations and new technologies. Unfortunately, there is a shortage of talented engineers - many employers have difficulties in to find employees, with definite skills and last mentioned is seriously hindering the EU productivity and excellence. In addition, the youth unemployment, including engineering graduates, in some EU countries is very high (e.g. BG – 20% according to Eurostat and is growing due to the current pandemic situation with Covid-19).

Therefore, there is need for deep cooperation of different stakeholders so that they can discuss about skills needed in the sector of marine engineering (and not only), develop work-based learning curricula for engineering students in order to deliver education at both universities and workplaces, share experience and competences, in order to contribute to development of VET models, their successful implementation and future enhancement.

In this regard project DYNAMIC is the alternative solution to what has already been mentioned above.

The aim of the DYNAMIC project was to develop, implement, and evaluate three practice-integrated dual undergraduate engineering programs in Bulgaria, Romania and Croatia. The study program identified for the pilot project reflects the domains of strategic importance for the regions, in which the academic and industrial partners are located. Therefore, the following

programs were selected for adaptation in dual form: Mechatronics and Robotics, Naval Architecture and Marine Technology (initially) and Mechanical Engineering and Production. Experience was shared with German and Austrian partners – University of Applied Sciences Wismar and University of Applied Sciences Joanneum, as well as AHK Bulgarien. However, every team decided how to proceed with the development of dual education models due to many challenges that had arisen on the basis of laws and regulations in the educational systems in Bulgaria, Croatia and Romania.

The case in Bulgaria: the Innovation Strategy for Smart Specialization of Bulgaria as one of the thematic areas includes “Mechatronics and clean technology”. It’s important to mention here that at the end of 2018 the strategy was updated including a new priority direction “Blue economy – development technologies”. Currently, there is an urgent need for personnel in the shipbuilding and ship repair industry in Bulgaria. For this reason, the Technical University of Varna has selected not only the program “Naval Architecture and Marine Technology”, but added “Marine Engineering” and "Design of Marine Plants and Systems" for update of ongoing curricula and alignment with industry needs.

Current national regulations and institutional rules at the time of program selection allowed a different degree of adaptation for each of the three listed programs. The most flexible ones are the programs “Naval Architecture and Marine Technology”, bachelor degree and “Design of Marine Plants and Systems”, master degree. They allow the highest degree of dualisation. Nevertheless, due to the specific rule in the Higher Education Law that students must graduate their education in a strong agreement with the curriculum

which they started their study allows dualisation of the existing program only through a stepwise approach.

In the begging of the project, in months March (21.03), April (18.04) and May (16.05) 2018, 3 regional working group meetings were organized, comprising the TU-Varna as an educational institution; Keppel Fels Baltech Ltd and MTG Dolphine – as enterprises and AHK Bulgarien – a chamber of commerce and industry.

During those 3 meetings were discussed:

- models for dual education in EU and their applicability in the context of Bulgaria;
- DYNAMIC guidelines for pilot introduction of practice-integrated dual curricula;
- curricula of marine programs and corresponding laws and legislations in Bulgaria;
- ideas and possibilities for implementation of DE, requirements to partners ;
- possible showstoppers for implementation of dual education and many others.

It is clear that the development of new curricula and other training documents (new qualifications, curricula for existing and new specialties and a doctoral program and amendments to existing curricula and programs) shall be carried out in compliance with the following requirements:

- Law on Higher Education;
- Classifier of higher education areas and professional fields;
- Ordinance on the State Requirements for Higher Education for the Bachelor's Degree, Master's Degree and Professional Bachelor;

- Ordinance No. 21 on the implementation of a system for accumulation and transfer of credits in higher education institutions;
- Regulations for the structure and activity of the Technical University of Varna
- Standard of Technical University Varna in relation to the training of PhD students.

“Naval Architecture and Marine Technology“

The specialised training of students in the programme “Naval Architecture and Marine Technology“ is provided by the Department of "Naval Architecture and Marine Engineering", part of the Faculty of Shipbuilding at the Technical University Varna. The Faculty of Shipbuilding is the only faculty of this kind in the Bulgarian universities, specialised in education in “Naval architecture and marine technology“. The Department of "Naval Architecture and Marine Engineering" has a long tradition in training of engineers in the specialties of “Naval Architecture and Marine Technology“ and „Marine Engineering”. During their study at the Technical University of Varna, students in the acquire profound engineering knowledge of mathematics, hydrodynamics, ship theory, ship systems, marine engineering drawing, computer-aided design of ship hulls, etc.

“Marine Engineering”

The specialty of “Marine Engineering” is under the regulations and legislation of the Executive Agency “Maritime Administration” and meets all national and international requirements (IMO) for the qualification of seafarers.

Students after their graduation will work onboard of marine ships.

D.5.2 Implementation Report - Varna

The curriculum and programme in "Marine Engineering" must always meet the requirements of the International Maritime Organisation (IMO) for seafarers' competence STCW78 and are consistent with the strong requirements of the Executive Agency "Maritime Administration (EAMA). The programme "Marine engineering" is a regulated specialty in accordance with the uniform state requirements in the professional direction "Transport, Shipping and Aviation".

The training is carried out according to a specified curriculum approved by the Maritime Administration Executive Agency and meets all national requirements for the qualification of seafarers. Excerpt from Ordinance No. 6 related to the Competence of Seafarers in the Republic of Bulgaria:

"Art. 3. (1) All seafarers shall be trained and certified as specified in this regulation and:

1. for sea ships – in accordance with the requirements of the International Convention on Watchkeeping and Seafarers Training and Certification Standards of 1978 (STCW Convention) and Directive 2008/106 / EU, as amended;

2. for river ships – in accordance with the recommendations for the training of shipowners and their provision of certificates of competence for international navigation by the Inland Transport Committee of the United Nations Economic Commission for Europe, the Danube Commission and Directives 96 / 50 / EU and 91/672 / EEC.

(2) National standards for the competence of seafarers shall be determined by an order of the Executive Director of EA MA and shall be published on the website of Maritime administration.

…

Art. 6. Seafarers shall acquire legal capacity if they have:

1. a diploma for completed approved education;

2. a certificate of prior competence, issued by Marine Administration, or confirmation of a certificate issued by a member state of the European Union, when required;

3. a document certifying the existence of navigational experience;

4. a certificate of successful completion of the preparatory course approved by Marine Administration when required;

5. a medical certificate of health fitness;

6. undergone navigation training and / or training record, documented in a practical training

log when required… "

Students, according to the curriculum, must complete 6 months of onboard training after the 3rd year of their study. The possibility for onboard training is mainly from June to end of August.

Due to what's been mentioned above, practical phases and trainings are planned during the winter semester (6th semester) time according to what has been mentioned above.

"Design of Marine Power Plants and Systems"

Students enrolled to the program "Design of Marine Power Plants and Systems" have been included to the DYNAMIC project. The Master's program is in professional field 5.5 "Transport, Navigation and Aviation" and has a

duration of three semesters of academic study and one semester of pre-thesis graduate internship. The training ends with a diploma thesis.

1. Student selection process

The procedure of students' selection is oriented to quality and successful practice fulfilment in our case. Students' selection should involve a rigorous evaluation of knowledge, skills, and motivational aspects. The process of selection, during our initial discussions, could include the presentation of the CV, grades during the education, motivation letter and an interview with the candidate where the merits are assessed.

"Naval Architecture and Marine Technology"

Third-year students must have completed 60 hours of specialized practice after the 6th semester. Before the end of semester the students were familiarized with the conditions for the practice within the Dynamic project and the opportunities at the MTG-Dolphin - partner in the project.

Pilot implementation of dual study is based on a voluntary choice by the students.

The following students expressed their interest to be involved in the pilot implementation of the practice-integrated education, Table 1.

Table 1. Students (NAMT) involved to the dual study program in 2019.

№	Student – names	Faculty number
1	Angel Asenov Angelov	31632110
2	Biser Toshev Banchev	31632111
3	Seyhan Vasvidinov Redjebov	31632115

4	Yanko Todev Georgiev	31632117
5	Iliya Aleksandrov Iliev	31632118

For academic mentor was nominated Assist. Prof. Yordan Denev from Naval Architecture and Marine Engineering Department.

For mentor of the students from MTG Dolphin was appointed Hristo Nedelchev

"Marine Engineering"

Final decision for students enrolled to the program was, as the discipline "Repair of Marine Machinery" is mandatory for every student and the number of our students in groups, is not more than 10-12, the entire group for every year to be accepted for practical training at MTG Dolphin. This is also very helpful option, in order to provide opportunity to our students for better education at industry, not only in university labs.

Now, at the end of this project, students from the specialty of "Marine engineering" (4th study year, 7th semester) who completed practical training at MTG Dolphin, as follows:

- December, 2018: 6 students from the specialty "ME" completed 60 hours of training in "Repair of Marine machinery", Table 2;

Table 2. Students at MTG Dolphin, December 2018.

№	Student	Faculty number
1	Hristo Stanchev Ivanov	31534101
2	Lyubomir Plamenov Popov	31534102

3	Stefan Todorov Yonkov	31534104
4	Anton Rumenov Georgiev	31534106
5	Emil Kostadinov Mihalev	31534112
6	Eftim Dimitrov Eftimov	31534117

- November, 2019: 11 students from the specialty completed 60 hours of training in the same discipline, Table 3;

Table 3. Students at MTG Dolphin, November 2019.

№	Student	Faculty number
1	Ivan Detelinov Valchev	31634110
2	Daniel Dimchev Jekov	31634112
3	Radostin Petrov Petrov	31634109
4	Ibryam Halilov Ibryamov	31634105
5	Ivaylo Ivanov Ivanov	31634115
6	Kaloyan Dimitrov Rachev	31634106
7	Aksel Ivanov Dimitrov	31634108
8	Ivan Plamenov Ivanov	31634111
9	Bedros Artyun Keshkeryan	31634118
10	Hristo Pavlov Kostadinov	31634104
11	Tihomir Stefanov Popov	31634129

- October, 2020: 11 students from the specialty completed 60 hours of training in the same discipline, Table 4.

Table 4. Students at MTG Dolphin, October 2020.

№	Student	Faculty number
1	Rosen Martinov Matev	17321019
2	Krasimir Ivanov Kostadinov	17321011
3	Zhivko Yordanov Rachev	17321017
4	Stefan Stefanov Stoyanov	17321005
5	Hasan Mustafa Myumyun	17321015
6	Yordan Marinov Marinov	17321003
7	Boris Petrov Naidenov	17321007
8	Dimitar Zhivkov Dimitrov	17321014
9	Martin Slavov Dimchev	17321006
10	Denislav Slavov Dimitrov	17321013
11	Zdravko Dimitrov Dimov	17321016

"Design of Marine Power Plants and Systems"

The procedure of students' selection in this case is also oriented to quality and successful practice fulfilment.

As in the previous case (with students from the specialty "Marine Engineering"), our final decision was that all four students will be enrolled to the VET program.

Those four students, in the Autumn of 2018, were first year students in the Master degree program "Design of Marine Plants and Systems", Table 5. The program "Design of Marine Plants and Systems" is with 2 years duration.

Table 5. Students accepted by the associated partner, 2018-2020.

№	Student	Faculty number
1	Radina Mihailova Filipova	31832602
2	Teodora Nikolaeva Miteva	31832612
3	Zornitza Nedkova Gospodinova	31832614
4	Joro Tenchev Zotov	31832613

Student, enrolled to the program in 2019, who could follow the model (some subjects) for dual education, implemented to the first 4 students: Nikolai Georgiev Georgiev 31932602. Students enrolled to the program in 2020 and on the way to follow the model for dual education, implemented to the first 4 ones: Simona Krasimirova Georgieva faculty number 20353191, Filip Vasilev Ivanov faculty number 20353192, Ivaylo Antonov Iliev faculty number 20353193.

Under the circumstances of needed a pre-selection stage and screening for candidates, our decision (for the future as we intend to proceed furthermore with the development and implementation of dual education) is to establish a strong selection procedure, based on CV-s, grades, a short motivation letter with revealed vision for future career development in the area and an interview with students- candidates for practical training. The interview is the most important part of the selection process and we have to work on to develop the specific questions for the future.

2. Describe semester projects at the university assigned by companies (if applicable)

“Naval Architecture and Marine Technology“

Diploma thesis with topic agred with the industrial partner and related to its activities.

“Marine Engineering”

N/A for “Marine Engineering”

"Design of Marine Power Plants and Systems"

Term project in “Design of ship pipelines” – a discipline included to the 3rd semester with 30 hours lectures, 30 exercises and 15 hours, provided for explanations regarding the preparation of the assigned term project. The topic for term project was assigned by the company.

In the period 20.01.20 – 31.01.20 students fulfilled their internship training - 60 hours duration according to the curriculum at IHB “Ship Design”, a company accepted as our associated partner.

For the training period, students had logbooks in which they filled-out provided assignments and their completion on a daily basis. The tasks were reviewed by 2 company mentors and by academic mentors.

Also, should be mentioned once again the completion of diploma thesis with topic assigned by the company.

3. Describe the content of the practical exercises and the activities performed by the students (input from partner companies)

“Naval Architecture and Marine Technology“

For each of the participants were defined specific areas of the manufacturing process in which to conduct practical training. Students and areas are presented in Table 6 and Table 7.

Table 6. Areas for practical training at MTG Dolphin and KFB in 2019.

No	Student	Area
1	Angel Asenov Angelov	Fabrication and assembly of sections
2	Biser Toshev Banchev	
3	Seyhan Vasvidinov Redjebov	
4	Yanko Todev Georgiev	Plasma cutting
5	Iliya Aleksandrov Iliev	Installation of ship mechanisms

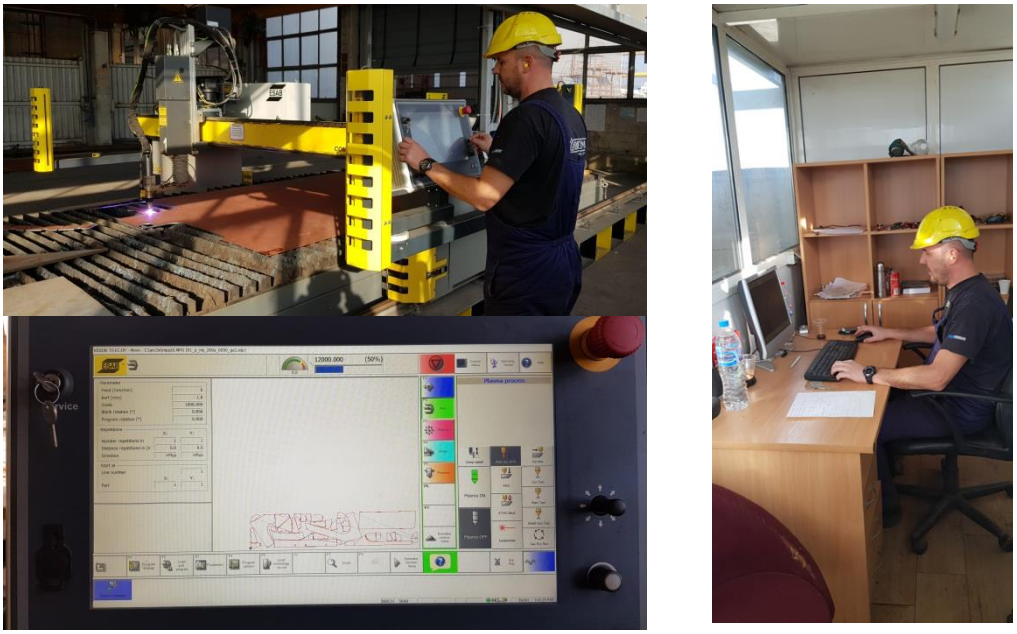

Figure 1. Activities of Plamen Yankov in plasma cutting workshop.

Table.7. Areas for practical training at MTG Dolphin (summer 2020)

No	Student	Area
1	Stanislav Hristov Stoykov	Fabrication and assembly of sections
2	Hristo Kolev Kolev	
3	Bedri Fevzi Mustafa	

"Marine Engineering" – practical training at MTG Dolphin

During a period of two weeks, the students pass their practical training directly involved in the repairs of marine machines and mechanisms. This is very important for the students, as they are going to meet face-to-face the specifics of the marine machinery repair process in order to be able to carry on their duties on-board. During the training, the students are full-time at the company for two weeks, which has been formalised by a contract signed between the students and MTG Dolphin. A contract between TU Varna and MTG Dolphin has also been signed in advance before the training.

Content of the practical exercises and activities performed by students: repair of marine boilers and boiler's elements – evaporators, super-heaters, safety valves, burners, etc.; repair of main diesel engines and their parts; repair of propeller shafts; gearboxes; repair of other marine machinery, depending on the ships accepted at the yard.

All practical exercises are described in logbooks.

For the practical phases students have training logbooks in which they record daily assignments and their performance. At the end of the day, industrial mentors check everything written, have discussions with students, provide

opinion about performed work, advices if any for the future work and sign diaries.

At the end of the practical training, the diaries are endorsed by both the industry and university mentors.

Mentors from industry and academia were asked to complete evaluation reports for students' work and gained practical knowledge and experience; **to** share their opinion and recommendations (if any) on the overall practical training.

(a) *(b)*

Figure 2(a,b). Students' practical training in December, 2018 and November, 2019 – MTG Dolphin.

In figure 2(a) is shown the procedure of marine gear installation. In figure 2(b) students are disassembling few boiler safety valves. The day task is to disassemble, clean, replace all gaskets and seals and test the valves after

assembly. In the second picture is shown the procedure of marine gear installation.

“Design of Marine Plants and Systems” - practical training at IHB Ship Design (assoc. partner)

Students accomplished training at the IHB Ship Design in the following subjects:

- "Computer systems for design of ships and marine equipment" – Part 1 – 45 hours exercises (in accordance with the curriculum and additional hours training)
- "Design of systems and devices for ships and marine equipment" – 30 hours of

lectures / 15 hours of exercises

- "Design of ship pipelines" – 30 hours exercises (in accordance with the curriculum and additional hours training)
- "Computer systems for design of ships and marine equipment" – Part 2 – 60 hours exercise (in accordance with the curriculum and additional hours training)

Students filled out training logbooks considering their tasks and developed new skills and knowledge. Students enrolled to the program “Design of marine plants and systems” had the opportunity to get theoretical and practical training in the field of design of marine machinery and systems, to get acquainted with specific software products on the premises of the company IHB Ship Design. Besides that, mentors revealed for them some undescribed in reference books approaches and secrets of design in the area of marine machinery and systems.

Those first 4 students, who were enrolled to the program “Design marine plants and systems” and started their dual education in the autumn of 2018, not only started work for the company IHB Ship Design but also passed their undergraduate internship of 60 hours at IHB Ship Design, in January 2020. Additionally, students completed their diploma thesis at IHB Ship Design. Its topic was closely related to their work for the company and the tasks provided. All that provided them with a deeper look at the idea of dual training.

4. Final thesis on industry-related problem (if applicable)

“Naval Architecture and Marine Technology“

In accordance with the adopted operational curriculum, students must define the topic of their diploma thesis during the practice phase in the company. They have the opportunity to comment on all aspects of the development of the thesis with the academic mentor, and subsequently with their industria mentor. Students have (according to the curriculum) 10 weeks to prepare their diploma thesis, the defence takes place in mid-July. They can start the work on the thesis practically after finishing of the practice in the company.

Table 7 contains the titles of the theses related to practical problems, defined during the internship in the partner companies, Table 8.

Table 8. Diploma thesis topics on industry-related problems.

No	Student	Area
1	Angel Asenov Angelov	Retrofit of a tanker to collect oil spills
2	Biser Toshev Banchev	Technological provision of the thermal straightening of ship beams
3	Seyhan Vasvidinov	Technological process for welding of

	Redjebov	flat sections
4	Yanko Todev Georgiev	Technological provision of ship structure details cutting
5	Iliya Aleksandrov Iliev	Technological process of shell painting of m/v "LUDOGORETS"
6	Vihren Nikolaev Valchev	Development of technical and working documentation by 3D Aveva Marine.

“Marine Engineering”

Students, enrolled to the bachelor program “Marine Engineering”, graduate with state exams in “Marine machinery” and English language for marine engineers.

"Design of Marine Power Plants and Systems”

First 4 students enrolled to the program “Design of marine plants and systems” completed in May 2020 and defended in June 2020 their diploma thesis. Its topic was closely related to their work for the company and the tasks provided. Students were guided by academic and industrial tutors. Main academic tutors – assoc. prof. Irina Kostova and assoc. prof. Christo Pirovsky.

During the practical activities, students were mentored by tutors (industry mentors) from the companies involved in the dual study program. Each of the students has the task:

-to get acquainted with the safety measures and the requirements, especially in Covid19 situation and to get acquainted with the organisation of work at the company;

-to get familiar with the responsibilities of all participants in the process;

- to be responsible and try to get more knowledge and specific skills;

- to participate in various operations and activities, seek additional information;

-to compare the obtained theoretical knowledge with the practical phases and skills obtained;

-to be able to formulate relevant topic connected with the area of training;

- to be able to find possible subject of future diploma thesis;

Dedicated practical activities have been developed according to the syllabus of the specialty subjects that have been selected for dual implementation. The syllabus contents have been agreed on between the academic professors/mentors and industrial mentors. The industry mentors from the respective department have been involved in the activity development, student instruction and direct supervision during the activity execution.

5. Implementation plan: preparation; timeline; periodical rotation/block model

Preparation of dual model for test and further implementation:

- **3 Regional meetings at the Technical University of Varna**

A regional working group comprising the TU-Varna as an educational institution; Keppel Fels Baltech Ltd and MTG Dolphine – as enterprises and AHK Bulgarien – a chamber of commerce and industry, was organized.

On 21.03.2018, 18.04.2018 and 16.05.2018 2018, 3 regional meetings were organized at the Technical University of Varna, figure 3, figure 4 and figure 5. Regional group meetings aimed at:

- discussion on possible models for VET at the TUV ;

- guidelines for pilot introduction of practice-integrated dual curricula – discussions;

- attention to the curricula of Naval Architecture and Marine Technology, “Marine Engineering” and possibilities for “Design of Marine Plants and Systems” – presentations and discussion of all specific features and possible models;

- ideas and possibilities for implementation of dual study models, requirements to industrial partners

- discussions on the content of contract between TU-Varna and industrial partners for collaboration and practical training of students;

- discussions on content of contract – industrial partners and students;

- discussions on possible models for dual education;

- discussions on frameworks of workshops for mentors and students;

- future course “Train the trainer”- contents, need of industrial mentors for training;

- other documents from Toolkit, etc.

Figure 3. A moment from first regional meeting, 21.03.2018 at the TU-Varna.

Figure 4. A moment from second regional group meeting at the TUV, 21.04.2018.

Figure 5. A moment from third regional group meeting at the TUV, 16.05.2018.

Next steps in preparation of dual education model and training phases:

- Discussions, solutions and preparation of training logbooks;
- Content of contract between student and industrial partner, between MTG Dolphin and TU-Varna – preparation;

- Preparation of practical phases – cooperation among industrial mentors; and mentors from the TU-Varna aiming at clarifications on practical training and its content;
- Syllabus of special subjects has been updated in collaboration with industry stakeholders for all 3 programs;
- Where was suitable, laboratory exercises have also been allocated in the partner companies.

The preparation of the implementation phase also included training of the academic and industry mentors involved in the practical training and supervision of the students. For the training of the academic mentors, a special Toolkit for implementation and documentation of dual higher education programs has been developed in the scope of the DYNAMIC project. The Toolkit aims to support the mentoring at the companies. It consists of templates of necessary standardized documents such as practice report – diary, evaluation and assessment of the students´ performance, a feedback questionnaire for the student, application for Bachelor thesis, and procedure of the visit in the company – a checklist (info folder and visit schedule) as well as the protocol for the mentor meeting in the company. All documents support the mentors during the mentoring process and make their job easier as well as more transparent in compliance with the quality assurance aspects.

The preparation of students enrolled to the program “Naval Architecture and Marine Technology“ included informational workshop to familiarize students with the conditions for the practice within the company.

Each company organized work safety training for the students before the initial start of the practical training.

Each student signed contract with the company, as well as companies signed contracts with the TU-Varna. Students were relevant contract and sign a declaration according to the General Data Protection Regulation (EU) 2016/679. The contractual templates have been prepared according to the national labor and education rules and legislations.

- **Logbooks:** students were required to fill in their logbooks throughout the entire learning experience; at the end of the industrial training, mentors completed evaluation reports for students' work and gained practical knowledge and experience.
- **Questionnaire** to be filled after the training, why? Students have to share experience; provide advice about the fulfilled practice and ideas to its improvement; ideas how to improve the cooperation between University and industry, etc.
- **Timeline:**

"Naval Architecture and Marine Technology": to be effective and to meet the needs of industrial partners, it was agreed during the regional meeting at TUV that the practice should last 600 hours 640 academic hours (480 astronomical hours). This is equal to 60 working days (eight hours for 1working day).

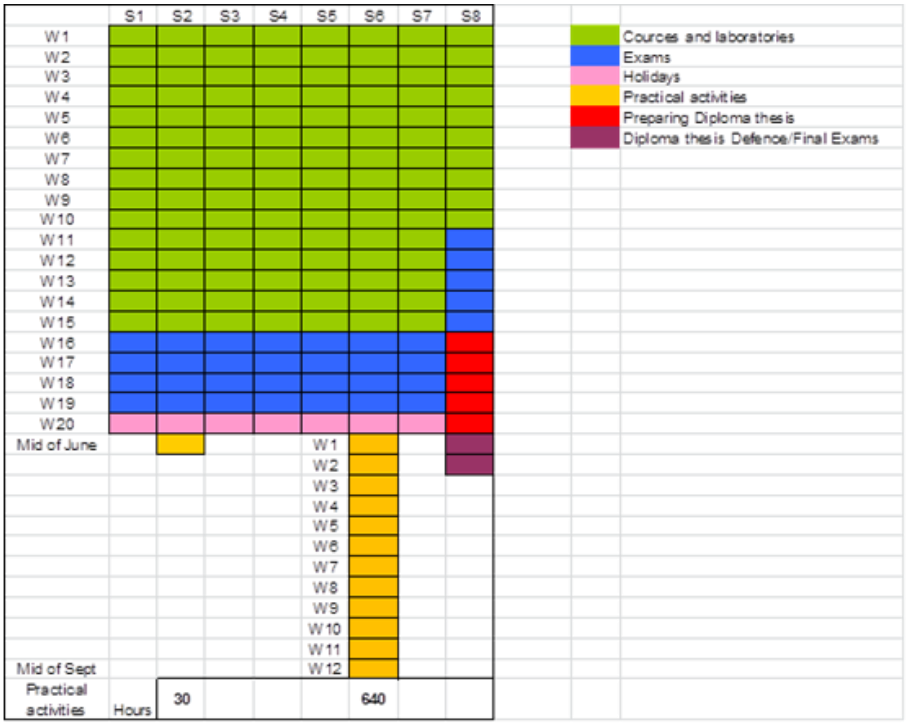

Figure 6. Structure for study and practical activities.

The practice started with an approval by the company. The planned duration was 12 weeks from 17.06.2019 until 06.09.2019, figure 6.

However, in the middle of July was decided to suspend the activity of MTG Dolphin temporally and the employees were put on leave. This required the practice to be terminated and posponed for the Autumn of 2019. In fact, the practical training was not restored until the beginning of the academic year. These circumstances prevented a full picture of the application of practical training in the company.

In the beginning of the new academic year (2019/2020) students continued their practical training in definite days free of lectures and exercises at the TU-Varna, during the Autumn of 2019, in accordance with prelinimary agreed schedule.

The same students, in 2020 students were busy in preparation of their diploma thesis.

New students, included to the dual study program, followed next activities: participation to workshop to get aquintained to the main aimes of the dual study, to get familiar with the industrial partner (main activities, scope of work) and in days free of lecturers and exercises at the University , were engaged in practical phases at the industrial partner.

"Marine Engineering": practical training was scheduled during the 7th semester – 60 hours, distributed into two weeks. During a period of two weeks, the students pass their practical training directly involved in the repairs of marine machines and mechanisms.

"Design of Marine Plants and Systems": practical training is scheduled for the 1st semester, 2nd and 3rd semesters. Students are involved into the practical phases, depending on the curricula, needed time to put the basis for computer modelling, tracing of pipelines, gain specific knowledge on marine systems, etc and the schedule for disciplines, semester by semester.

- **Block model** is being accepted for the VET for students in the specialties "Marine Engineering" and "Design of Marine Plants and Systems".

For students enrolled to the program "Naval Architecture and Marine Technology", due to the suspended activities of MTG Dolphin, was applied block model for diploma thesis preparation and rotational principle for training phases.

6. Student assessment process

Assessment process for NAMT students were exams in all disciplines and diploma defense for the graduating students.

The subject "Repair of Marine Machinery", according to the curricula of specialty "Marine Engineering", ends without definite mark, but "passed".

However, after the completion of practical training, our students had a discussion with their academic mentor and other professors from the department, involved in the project and in students' education.

"Repair of marine machinery" is very important subject for students who will work onboard of marine ships, because in case of a problem in the engine room, the engineer on duty is responsible for the repair operations and must get the ship moving to the nearby port.

Way of assessment for various disciples, included in the dual education model, subject of dualisation, was exam. Students were examined by professors – lectors and academic mentors and by industrial mentors. Some of the exams were held at the office of IHB Ship Design, it was required for students to use specialized software products for design and modeling.

As it is related to the pilot implementation and its assessment – very important issues, that should be mentioned herein, the evaluation was a continuous process that took place during the whole duration of the DYNAMIC project. It was organised in several cycles such as joint evaluation of the focus group meetings related to the curriculum development process as well as self-evaluation of the partners (implementation reports) and peer reviews related to the implementation phase. Especially in Bulgaria, the peer-review meetings took place in the period 17-19.02.2020, figure 7 and figure 8.

Figure 7. Meeting of peer-reviewers with some students from the 3 programs.

Figure 8. Meeting of peer-reviewers with representatives from MTG Dolphin and Keppel Fels.

7. Experience and impressions of the academic mentors

For academic mentors were selected assistant professors (Marine engineering) or assoc. professors (Design of marine plants and systems), involved in the students‘ training in the same/similar disciplines. Also, they are people with

strong academic backgrounds and already well developed organisational and time management skills. Last mentioned is crucial to the quality of the mentoring processes.

To prepare the mentors for their role, an „Introduction into specifics of mentoring“ workshop was collaboratively designed and implemented by learning advisors from the university’s academic learning support services, the qualification centre and the maritime training centre

The learning advisors were invited to contribute to the workshop as they had researched mentoring and coaching widely and were experienced in training staff in relation to a wide range of learning and teaching activities.

The workshop introduced the selected academic mentors, more broadly, to the characteristics of effective mentoring programs and specific strategies for effective mentoring.

Academic mentors were acquainted with the importance of reflection and the role of written reflections in the project data collection process.

Mentor’s experience can contribute to the success of the program and, more importantly, can lead to strong self efficacy for the mentors.

The mentors’ experiences, both positive and negative, were discussed - our aim was to elaborate specific program/approaches for successful mentoring. The results of last mentioned will have implications for the development of future mentoring programs, particularly in terms of better mentor's preparation.

Benefits for mentors - satisfaction of well done job, development of two-way communication between mentor and students; development of lifelong

professional knowledge, fostering the connection student-mentor; gaining new personal insights, etc.

Personal experience, shared ideas and outcomes from the mentoring periods:

- it is always good approach to organize a workshop for students and make them familiar for their future industrial training
- need to understand students‘ expectations and needs;
- to possess strong knowledge and teacher’s background;
- need to learn how to fit cognitive (what to learn), affective (why learn), and metacognitive (how to learn) parts of the learning process and present them tot he students;
- academic mentor must be able to engage students in ongoing dialogue, monitor their progress on a daily basis, and adapt information to student needs
- an academic mentor must focus on self-regulated learning;
- frustrations: worries over failing to engage with particular mentees; possible difficulties with contacting students, especially if some are still onboard for training and unavailable to present during the preparational phases for industrial training; insufficient time for mentoring many students.
- need of detailed discussions and collaboration with industrial mentors in order to identify students‘ needs, possible problems and clarify ways to overcome possible problems and showstoppers.

8. Experience and impressions of the industrial mentors

The industrial mentor works actively as a committee member performing the interviews with candidates for practical training at the company, is actively involved into the mentoring process and organises the practical phases and

internships, evaluates and mentors the progress of the mentored students, assesses the student´s performance and gives at the same time feedback to the student.

Also, mentors must be technically up-to-date, have needed professional skills, knowledge and experience.

For instance, main questions attention of students and academic mentors was concerned on (within the training and after), are:

-how students were accepted into the enterprise;

- whether the industry mentors explain in advance what the day's tasks will be;

- whether the industrial mentors explain in advance what and how the particular task will be done;

- whether industrial mentors explain in details everything to students;

- whether students are supported and assisted by mentors when needed;

- what is the students satisfaction with practice content and their mentors;

- what has been learned and its specific application during the work onboard.

In this regards, the so called course “Train the trainer” helped industrial mentors to improve their social, training, organisational and communication skills. Last mentioned has helped students to get theoretical and practical knowledge and training by real professionals in the area, people with improved social and didactic skills. If it is related to the impressions of industrial mentors, they are satisfied by the dual training system, which has not been known to them so far. The mentors from companies expressed the opinion that they would like to continue working in the way required by the dual system and thus have the opportunity to meet their potential future colleagues and help them train and grow in the profession.

9. Communication between academic and industrial partners

If we think about communication between industrial and academic mentors we have to admit that the communication before the beginning of students' practice was not very intensive and there is much more to be desired.

However, before starting the practical training of our students, the content of the curriculum in the respective discipline was discussed with representatives of MTG Dolphin. The idea was to align the training topics with and according to the requirements of the Maritime Administration and current legislations and rules of Ministry of Education to be followed.

There was further discussion of what more could be offered to the students, as the main objective was students to gain additional knowledge and train activities they could not learn in the university laboratory.

For the future we need of serious collaboration across curricula and disciplines included in it in order to carefully design and manage content of study programs, to fit education with industry needs, to encourage people from Academia and industry to work together and provide more opportunities for our students, assure strong knowledge background and prepare for their future career path.

10. Employment rate of dual pilot students (if applicable)

“Naval architecture and marine technology”

“Marine Engineering”

At the moment, first 6 students (2018) who were enrolled to the pilot implementation of dual education, of the dual education are engaged with

their post-graduation practice at maritime companies. Two of them are engaged in industrial companies from the maritime sector, however not at the MTG Dolphin, as they were proposed leading positions.

Next 11 participants (2019) – some of them have already graduated in 2020 and now work onboard of marine ships.

Last 11 participants (2020) - at the end of their 4th study year and are preparing for state exams – specialized English language and state exam in the program of "Marine machinery".

"Design of Marine Plants and Systems"

First students enrolled to the program (2019) are following their career path at IHB Ship Design.

Other students, enrolled to the program – 1 (2019) and 3 (2020) – they are students respectively in 2nd and 1st study year at the TUV.

11. Self-assessment (partners' own feedback questionnaires for students)

Students after completion of their practical training filled-up questionnaires. Main idea of questionnaires is:

- students to share their experience in industry;
- students to share experiences and impressions of practical training;
- to provide ideas for the development of dual training and possible improvements of the VET models;
- share ideas how to improve the cooperation with industrial partners and put more efforts to the VET.

Nevertheless, most aspects of training were highly evaluated by students at large:

- gained valuable engineering job experience;
- enhanced personal skills such as self-confidence, self-efficiency and self-motivation;
- upgraded technical skills;
- successfully supported by both academic and company mentors
- feel more competitive for the future career.

Some students recomended company mentors to share more specific knowledge as well as company MTG Dolphin to provide financial support during the period of training and work.

12. Lessons learnt, what could be better, and recommendations for the reaccreditation of the program; recommendations for further development

•Graduate employability - students are already selected by a company and have got a training contract for the duration of their study, which often switches to a regular employment contract after successful graduation.

• The dual higher education has demonstrated potential for improved student retention rate in the region, which is of great importance for the development of the maritime industry in the country. Currently, the sector suffers not only a stronger pressure from Asian competitors but also a brain-drain problem, as many graduates trained locally prefer to have career pathways abroad.

•The dual education is an opportunity for the companies to build early connection to the students in order to establish more aggressive, proactive and pertinent relationship with potential employee still through the years of study.

•Dual education is great opportunity to increase the number of students available by making the maritime field of study more attractive in terms of learning experience and career perspectives.

Some of the main strengths, weaknesses, opportunities, threats and conclusions could be found in the following SWOT analysis:

Strengths	Weaknesses
• Continuous need for personnel for the shipbuilding and ship repair industry; • Traditions in the education of Naval Architects in Bulgaria for more than 55 years; • Concentrating the shipbuilding industry and the university in one city – easy communication.	• Poor motivation of young people; • Inability to introduce two curricula – standard and for dual education in the small number of candidates; • Reluctance to study engineering disciplines, that leads to small number of students.
Opportunities	**Threats**
• Increasing interest by tying with production and financial support in the learning process; • Quick entry into the profession and fast career development; • Positive attitude of students to the opportunities for practical training during university studies; • Real opportunities for development of topics with practical implementation in Diploma thesis. • The curricula is closely related to the company's activity	• A small interest from companies in the industry for the introduction of dual training in higher education; • Little experience in the country at national level; • Lack of state strategy on dual learning in higher education; • Continuous declining number of candidates for the last 3-4 years; • Lack of support and strategy for the development of the maritime business in Bulgaria.

13. Vision for the dual program after the pilot implementation

In September 19th, 2019, a meeting of the Academic Council was held at the Technical University of Varna, with Mr. Krassimir Valchev - Minister of Education and Science and Mr. Ivan Portnih, Mayor of Varna, as guests. During the meeting, topical issues related to the prospects for higher education were discussed and special attention was paid to the important role of TU-Varna in the development of the region as a technology centre.

During the meeting, the issue of the widespread implementation of dual education in the Bulgarian educational system was raised. The DYNAMIC project was briefly presented as well as its objectives. Minister Krasimir Valchev expressed his support for the project, as well as the desire to continue the discussion with the support of his colleagues on the achieved results under the DYNAMIC project and to take certain steps on legislative changes that would support the introduction of dual education at Bulgarian universities.

We are in a process of preparation for meeting with Mr. K. Valchev and other people from the Ministry of Science and Education, in order to present our plans and requests for necessary changes to certain laws for the imposition of dual training in Bulgarian universities. This would be a long procedure, however we need to do it.

After that, we are going to re-develop current models and include more subjects to the dual education.

It should be underlined that in case of planned changes in curricula and syllabus of various subjects: those changes must be approved by the

Department Council, Faculty Council and the Academic Council at the University. Changes must be in a strong agreement with State regulations and

especially for the program "Marine engineering" – with the Marine Administration. However, another very important showstopper is that according to the Higher Education Law - student must graduate their education in a strong agreement with the curriculum which they started their study.

If we consider the program „Naval Architecture and Marine technology" - it is a complex engineering discipline in which the training is based on a broad basis, and graduates can find their career path in the area of ship design, shipbuilding, ship repair, survey and certification, etc.

On the other hand, this activity is highly competitive and is influenced by many global processes. It is often accompanied by cyclical developments with ups and downs as a result of various economic crises, and in recent year by the Covid-19.

This also affects the training of staff, as the practice at the Technical University of Varna and in Bulgaria shows that year in which more than 50 students graduate can be followed by years with only five graduates.

This makes the vision of development difficult to define, and the question of the balance between needs and real interest in young people remains constantly open. The situation is complicated by the constantly declining interest in engineering

Taking into account the experience from the pilot implementation, it can be concluded that in the situation the adopted approach of stepwise dualization of ongoing curriculum with increasing practical training is only the right one.

As it is related to the intentions for extension of the dual education, envisaged steps and activities are as follows:

- include new specialties;
- chose new industrial companies to cover VET for the new specialties included into the dual education program;
- organize meetings and workshops with industrial partners to discuss and fit curricula with needs of industry for more qualified and educated people with improved skills … ;
- workshops with students for identification of their needs for education and qualified training;
- development of new curricula for newly included specialties, however in agreement with state legislations and rules;
- development of appropriate dual models;
- development of appropriate toolkit of documents (logbooks, trainings, questionnaires, etc);
- start of models implementation;
- validation, verification of models …. approaches for their improvement.

Another very important issue that should we focus on is the partnership between academia and industry. It is extremely crucial to science, industry development, and building of successful collaborations, at all.

There are many advantages of collaboration, for both industry and academia. For academics, these include career opportunities, research funding, awareness of industry trends, and inspiration by application of derived discussions. For industry, these involve access to extended networks, thinking outside the box, training, ability to find new talent to hire and access to specialized, world-leading resources. Making contacts and exchange of knowledge are just some

of the advantages for both partner sides. The strong collaborations between industry and academia can also have important potential societal and economic benefits.

14. Scalability of the model at country level

Scalability in the context of this project is about developing models and tools to be applied beyond this particular project, preferably to support earning within the framework of dual education cooperation in Bulgaria. The scalability requirement refers to the preparation of models, methodologies, changes in curricula and training contents which can be used in a broader context and which can be repeated in the future. Firthermore, to serve as the basis for developing of more complex approaches to dual education.

The training in „Naval Architecture and Marine Technology“ and “Design of Marine Plants and Systems” is carried out only at the Technical University of Varna. In this aspect, experience in other specialties cannot be used directly. „Marine Engineering“ – in TU Varna and Naval Academy, also.

In order to spread our experience to other programs, there must be some characteristic features of the considered specialty as follows:

- the specialty should be broadly profiled, and the practical skills can be acquired only in real conditions due to the dimensions and scale of the engineering product. This is not only about the large-scale shipbuilding, design of marine systems, but also the scale of the project documentation subject to development and many others;
- cyclical production and demand for staff;

- presence of informal and formal business associations for easy communication with partner companies;
- adequate material incentives and mutually beneficial conditions for conducting practical training.