Erasmus+

D6.3.2: Second internal evaluation report – v2.0

D6.3.1 – Second internal evaluation report - Version 2.0

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1. Introduction

The second evaluation report aims to reveal in which depth the three university partners adapted their curricula to the dual education model, how they implemented the practical in-company trainings into their study programmes, as well as the level of development of the student's skills, usefulness and satisfaction from the main project participants in the practical activities – students and companies.

2. Objectivities and evaluation methods/steps

In the following section it will be presented the methods and steps for evaluation of the implementation process in the three countries. The implementation plan including timetable for preparation and implementation of the practical in-company trainings of the university partners will be described.

The following aspects will be covered by the current evaluation report:

- Presenting the general structure of the three partners' timetable plan for practical activities and time periods
- Analysing the results of the implementation process
- Comparison between the three implementation processes
- Highlighting the common parts of the 3 updated curricula
- Main findings from the peer reviews
- Recommendations

The evaluation report is based on the results of the practical activities from the Implementation reports from the three university partners during the academic year 2018/19. The practical activities were organized by Lucian Blaga Univeristy of Sibiu (Romania), Technical University Varna (Bulgaria) and University Juraj Dobrila Pula (Croatia) and their partner companies.

Finally, a reflection on the project qualitative and quantitative indicators as well as assessment of the current level of short-term results and long-term outcomes achievement has been conducted with the closure of the pilot implementation phase.

3. Overview of the three implementation reports from the three countries

3.1 Example from LBUS

The choice of adaptation of "Mechatronics" to the dual-study specialization was conducted because of the high demand on the labour market of graduates in this study program due to the rapidly developing industrial region of Sibiu.

As a regular study program, Mechatronics is offered in 8 semesters with compulsory 240 hours of practical activities, excluding the first year of study. To adapt the program for the needs of a dual-study specialization, LBUS added 810 hours for practical activities to the existing 240 hours or all together 1050 hours practical activity.

Nine weeks of supplementary hours were added at the end of the 2nd, 4th and 6th semesters (a period which now is allocated to the summer holidays). Consequently, the total amount of hours for practical activities will reach 1050 for the dual-study specialization.

Another difference between the regular and dual study forms is that students from dual study program must attend the extracurricular courses organized by the companies (mandatory requirement), while for the students from the regular study program the attendance is optional.

The students in the academic year 2018-2019 were able to choose between the regular form and the dual form of the Mechatronics specialization. A limited number of places were allocated to the dual study specialization, and the selection of the students was done according to a selection procedure proposed and agreed between LBUS and the industrial partners.

The practical phases organized by the partner companies Continental Automotive Systems Sibiu (CASS) and Marquardt Schaltsysteme SCS Sibiu (MSS) took place between 08.07.19 and 16.09.19 and it included nine weeks of internship and one week for assessment activities. Forty-one students were selected by the companies to take part in the practical activities. From these 41, 35 attended and completed the whole internship. Twenty-six students conducted the practical phases at Continental Automotive Systems Sibiu (CASS) and 9 students were at Marquardt Schaltsysteme SCS Sibiu (MSS).

Although practical activities took place in two different companies, there are similarities and a common general structure. The content was also organized in such a way so that it can comply with the requirements of both sides – the companies and the university. Tutors, who were trained within the Train the trainer course organized by IHK Romania, were accompanying the students during the whole practical activity.

The implementation plan was organized in a rotation model, since all the students were enrolled in 1st year. By using the rotation plan the students had the opportunity to try different activities after they got familiar with the company's structure and organization. Below is presented the rotation plan of the partner company Continental:

Plant/ R&D	Department	Area	Students/ 3 week period	Total Students for 9 weeks
Plant	Industrial Engineering	Smart Applications Lab (multidisciplinary)	4	26
R&D	Qualification Laboratory	Qualification Lab (multidisciplinary)	4	
Plant	Interior Body & Security	Test (Software & Electronics)	3	26
Plant	Transmission & Engine Systems	Test (Software & Electronics)	3	
Plant	Advanced Driver Assistance Systems	Test (Software & Electronics)	3	
R&D	Vehicle Dynamics	Mechanical Design & Laboratory	5	26
R&D	Engine & Drivetrain Systems	Mechanical Design & Simulation	4	

In Marquardt the activities took place in the following departments:

- Initial training (08.07-09.07)
- Assembly Department (10.07-16.07)
- Varnishing Department (17.07-23.07)
- R&D Department (24.07-06.08)
- Quality Department (07.08-20.08)

- Logistics Department (21.08-27.08)
- Industrialization Department (28.08-10.09)

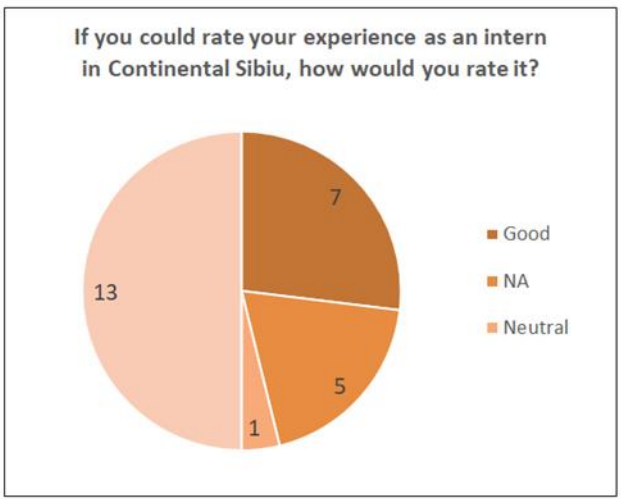
Below is showed the structure of the practical activities at Marquardt Schaltsysteme SCS Sibiu (MSS)

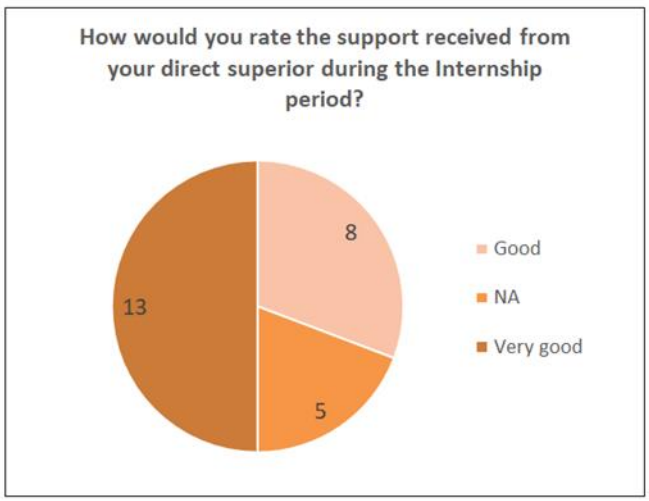
Fig. 1 Structure of the practical activities at MSS

During the practical phases the students received also payment, according to the laws and regulations and in an agreement between the university and the companies.

Both partner companies evaluated the students using tables with performance and competences requirements.

During the feedback meetings, the students could give their opinion about the satisfaction and the results from the first internship program. Below are presented two examples representing the results from the students' questionnaires.





In general, the students which participated at the practical activities are satisfied with the experience, they learned many things, they could gain experience and meet with a lot of people working there, who helped them with all their questions. Some of the students noted that they find the practical experience the best teaching method, as they received the experience from first hand and they could

assimilate the new knowledge, technics and develop key skills faster than when they are in the classroom.

Photos collected during the practical activities in the companies are presented below:

Fig.2 LBUS students during practical activities

The employability of the students after the first phase cannot be estimated yet, since all of the students are enrolled in the 1st semester of their study, but most of them got the opportunity to work part-time in CASS and MSS.

Academic mentors received as a feedback from the students, which took part in the internship, that the quality of their academic training is now much more realistic. The students in the dual program could get familiar with the necessary skills and qualities, which the labour market exactly expects from mechatronic specialist. As a result, it will be more effective if the students get involved in the syllabus design in the future.

The industrial mentors had as a task to develop the students' competencies by putting a focus mostly on the practical activities and it this way to prepare them for the requirements of the industry. Both CASS and MSS used the method of Problem Based Learning which includes real case scenarios normally conducted in a laboratory. During regular bilateral meetings between the industrial mentors and the university, the mentors concluded that the students could handle the tasks successfully, even though they are still in the beginning of their study.

For the academic year 2019/2020 the implementation of the following actions is planned:

- Development of practical competencies with focus on the Mechatronic specialization

- Learning of the principles and processes underlying the activity within the departments
- Coaching and Mentoring competencies

Mechatronics, as dual-study program will continue in the framework of Dynamic project, but will have also a new start in 2019-2020, with students in the 1st semester:

- 15 students at CASS
- 10 students at MSS

Final results and recommendations

As it can be seen from the results and outcomes below, the implementation phase was relatively successful.

- The number of interested students in the dual study internship is much higher, then originally expected
- The integration of the students in the practical activities in the companies was faster and easier than expected
- More companies are interested to participate in the practical activities within the dual study program, due to the dissemination of information for Dynamic
- The know-how and the experience of LBUS within Dynamic Project, can be also transferred to other universities in the whole country as there is an interest in the dual study programs, due to the latest industrial development of the country.

3.2 Examples of TU - Varna

3.2.1 Marine Engineering

In the student selection process was taken into consideration the knowledge, skills and motivational aspects of the students. The selection procedure also included presenting a CV, grades during the study, cover letter and an interview with the students.

The specialty “Marine Engineering” is regulated by the Maritime Administration and the students who graduate in this specialty will be working on board of the marine ships. According to the curricula of the specialty, the students have to complete 6 months practical training on board. The industrial trainings are planned for the semester time.

Students from the specialty of “Marine engineering” (4th study year, 7th semester) completed industrial training at MTG Dolphin. In December 2018, 6 students from the specialty “ME” completed 60 hours of training in “Repair of Marine machinery”. In November 2019, 11 students from the specialty completed 60 hours of training in the same subject.

During the practical activities the students were recording their tasks and performance in a logbook. The industrial mentor is giving a feedback and ideas for optimization of the work based on the results written in the logbook. At the end of the practical activity, the logbooks are also reviewed and evaluated by the university and industrial mentors.

The implementation process included the following steps:

- **Regional meetings:** including discussions with regard to the possible models for VET, guidelines for pilot introduction of practice-integrated dual curricula, review of the curricula of Naval Architecture and Marine Technology, Marine Engineering and Design of Marine Plants and Systems, contracts between TU-Varna and the industrial partners for collaboration and practical training of students, as well as contracts between industrial partners and the students, discussions on future workshops for mentors and students
- **Preparation of Logbooks:** the students were required to fill in the logbooks during the whole learning process and at the end they were evaluated by the mentors
- **Questionnaire:** in order to be shared the experience, notes, advices and ideas for improvements
- **Timeline:** the practical training is scheduled for the 7th semester – 60 hours for two weeks.
- **Block model:** this is accepted for the VET of students in the specialty "Marine engineering"

3.2.2 Naval Architecture and Marine Technology

During the discussions at the regional meetings, organized during the first phase of the project there were outlined the principles of internal (belong to the Technical University Rules) and national legislation that should be taken into account. These rules dictate the choice of the structure of pilot implementation of dual education training. There were also principles mutually agreed with business partners. The following rules have been taken into account:

- Any adaptation made to the curricula and in the contents of the syllabus, for various subjects, under consideration for dual education, must be approved by the responsible institutions. The procedure starts with a proposal of Department Council, acceptance by the Faculty Council and finally approval by Academic Council;
- According to the Higher Education Law, the student has to complete his/her training on the curriculum on which he/she started. This means, that in the frame of the project it's not possible to change the curriculum and to provide a pilot implementation;
- It was agreed that could be useful for the students who are conducting the dual training, the diploma work at last year of study to be related to the activity of the corresponding company. At the same time, there is a rule that a Diploma thesis can develop students with a certain minimum grades. This should be considered case by case;
- The all documents and corresponding agreements between the Technical University of Varna, Business partner and Student will be agreed between the parties and will take into account all local rules and regulations.

According to the actual curriculum there are two practical activities. After second semester there is so-called "Introduction Practice" (30 hours) and after 6-th semester "Specialized practice" (60 academic hours - 2 ECTS). Based on this the structure the dual –study is organized in two phases: During semesters in TUV and in partner company – in summer vacation after 6th semester. The place and duration of practical activities in the curriculum are presented in Figure 1.

Student selection process: 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 PLC,– partner in the project. Pilot implementation of dual study is based on a voluntary choice by the students.

After the selection process, 5 students were involved in the pilot implementation of the practice-integrated education. 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.

Implementation plan: In order 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 working day), 3.

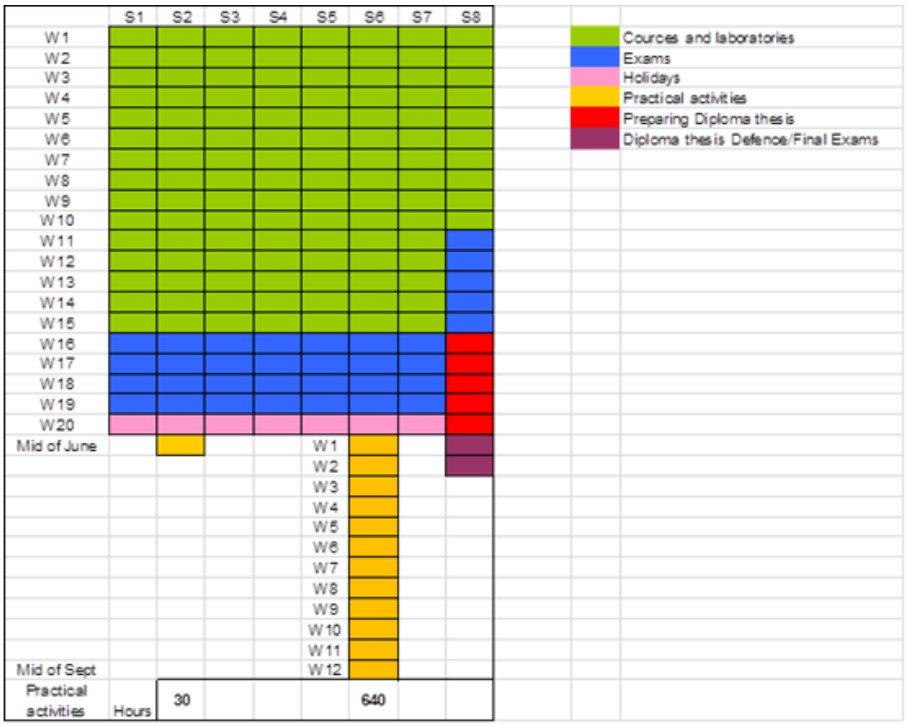


Figure 3. Structure for practical activities at TUV

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

Content of the practical tasks: For each of the participants were defined specific areas of the manufacturing process in which to conduct practical training. Each of the students has the task:

- to get acquainted with the safety measures and the requirements in the respective activity;
- to get acquainted with the organization of work;
- to examine the responsibilities of all participants in the process;
- to participate in various operations and activities;
- to seek additional information on all accompanying activities;
- to compare the obtained theoretical knowledge with the practice that is adopted in the enterprise;
- to be able to formulate interesting topic connected with the area of training to be the subject of future diploma thesis.

Conducting the practice

Preparatory phase

Each student was obliged to conclude a relevant contract and sign a declaration according to the General Data Protection Regulation (EU) 2016/679.

After the completion of the practical training, the student must present an official note from the company for the realized special practice required by the standard curriculum and a Diary for the practical training.

Control of the practical training

The academic mentor has the obligation to control the conduct of the internship. This control is carried out through communication with trainees by telephone or through on-site visits. Figure presents moments from activities of Yanko Georgiev in the plasma cutting workshop.

End of training

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. 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.

Figure 4. Pictures from plasma cutting workshop

Figure 5. Pictures from ship repair activities of structures in MTG Dolphin

Main conclusions from pilot implementation

Some of the main conclusions are given 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 close 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 in KMT for the last 3-4 years; • Lack of support and strategy for the development of the maritime business in Bulgaria.

The developed documents will be used in the academic year 2019/2020 in the summer period of 2020.

During this phase of the implementation a valuable experience has been gained, which will be further developed in the next year.

The activities in MTG Dolphin are mainly related to ship repair and new construction on ships. Conducting the practical training between the 3rd and 4th course gives full opportunity to test the theoretical knowledge acquired in the specialty "Ship structures" and "Ship Piping" in the 3rd year and

preparation for the study of the "Ship design" and "Production Technology for Ships and Marine Structures" in the 4 th year.

The company MTG Dolphin is a member of the Council of Specialty Naval Architecture and Marine Technology. As such, it participates in the harmonization of the qualification characteristic and the curriculum of the specialty. This is also a requirement of TU-Varna when developing the educational documentation. The Council of NAMT specialty is unique for a TU – Varna. The experience from this practical training will be further used in this direction.

3.3 Example from UNIPU

For the dual-curricula Mechanical Production Engineering undergraduate studies program, supplementary hours of practical activities were added. The additional practice has been added in all semesters based on student's availability, which is therefore slightly different from the initial proposal (represented on figure 3) of the dual-curriculum implementation. The winter semesters (1st, 3rd, and 5th semesters) were introduced to 5 weeks of practical activities, while for the summer semesters (2nd, 4th, 6th semesters) additional 2 weeks have been added. The figure 6 shows the integration of the supplementary hours of practical activities into the present curriculum.

Fig. 6: Schematic representation of technical studies on Mechanical Production Engineering Department

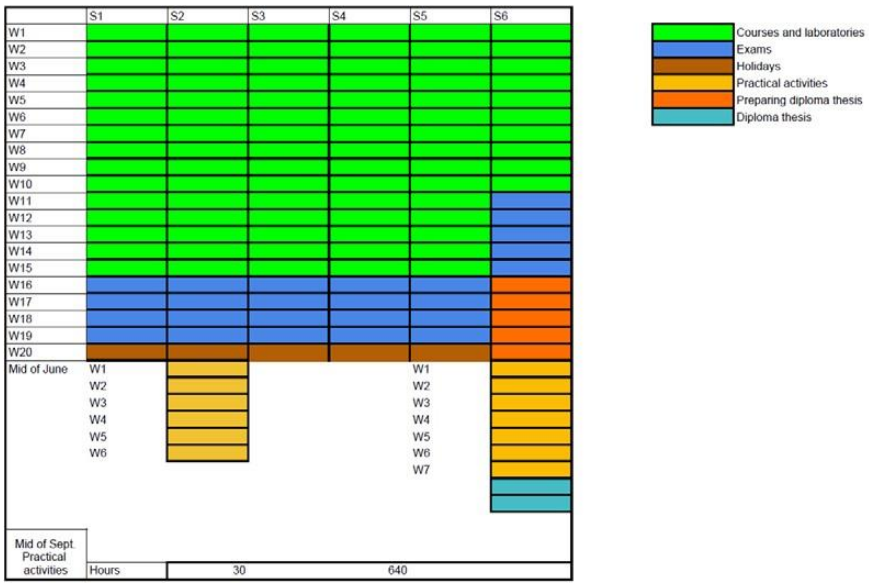


Fig. 7: Dual-curriculum implementation initial proposal

Practical activities are distributed in the way that students are equally burdened throughout all semesters. In the academic year 2019-2020, students from 2nd and 3rd year were able to choose between the regular form and the dual form of study. A limited number of places were allocated to the dual-curricula specialization, and the selection of the students was done according to a pre-defined selection procedure that was proposed and agreed between UNIPU and the industrial partners HOLCIM Ltd and RED FORK.

Selection of students: For this project, 5 students in total were selected, two students were from the 2nd and three from the 3rd year of the Mechanical Production Engineer undergraduate studies program. The selection criteria were made by UNIPU and the companies RED FORK and HOLCIM Ltd. The selection criteria involved:

- academic results - students with the good ranks were selected;
- motivational letter - students interested in the dual-study program had to write a motivational letter on why they would like to participate in this program;
- interview of the students in order to assess the student determination and motivation;

previous knowledge and skills in the field of CAD modeling, technical documentation, and production engineering.

Duration: The practical activities in the partner company HOLCIM Ltd were carried out between 05.11.2019. and 12.03.2020., (5 weeks in the winter semester and 2 weeks in the summer semester).

Due to the subsequent involvement of Red Fork partners in June 2020., the planned student internship activities could be carried out only in the period from: 22.05.2020. (kick off-pre-start meeting) to 22.09.2020. In that period an additional 7 weeks of student practical activities were satisfied.

Participants: The possibility to follow the dual-curricular program was presented to the students from the 2nd and 3rd year of Mechanical Production Engineering undergraduate studies, in total 31

students. Students who showed interest were able to apply to the program and enter the student selection process. 5 students in total were selected, 3 students from the 3rd year to perform practical activities at the company HOLCIM Ltd, and 2 students from the 2nd year to perform practical activities at the company
RED FORK.

Implementation plan: Because of the small number of students, both companies decided that there was no need for a periodical rotation of the students, and that they would rather work with all the students together on the same or similar tasks. The timeline for both the companies was similar with exceptions in certain segments as presented in figure 8 and 9.

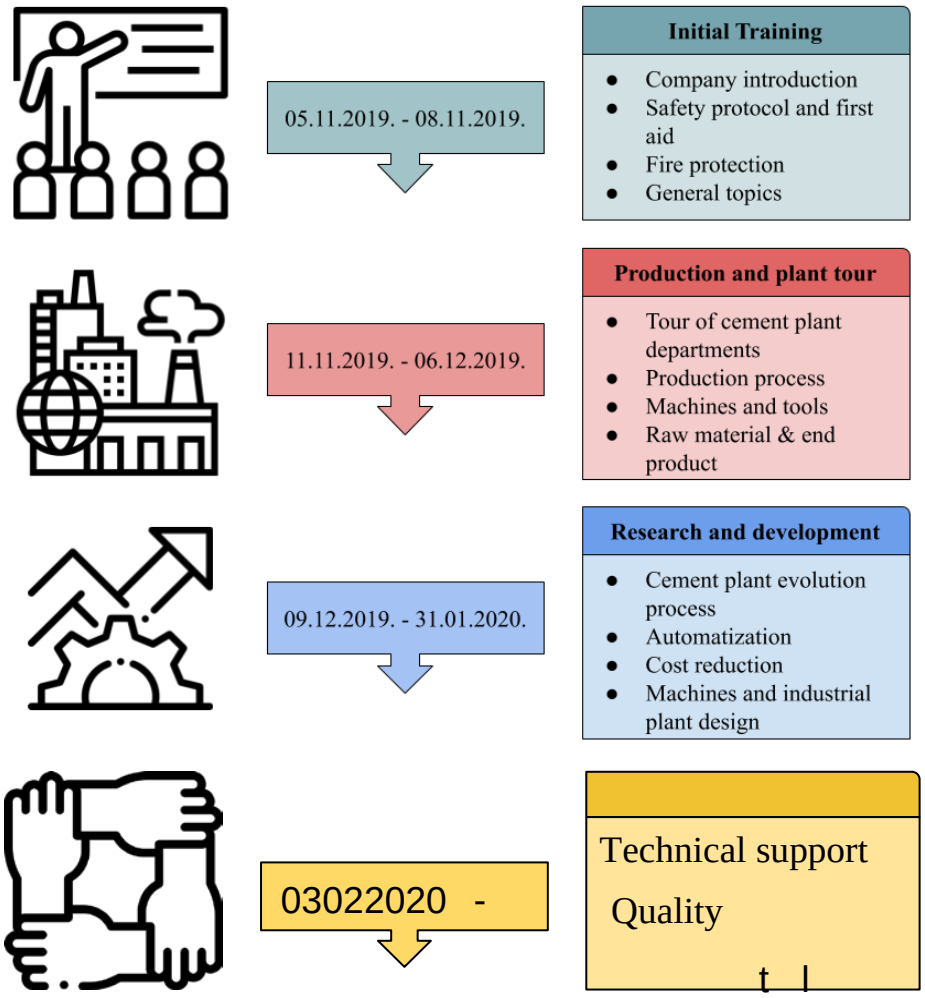


Fig. 8: HOLCIM practical activities timeline

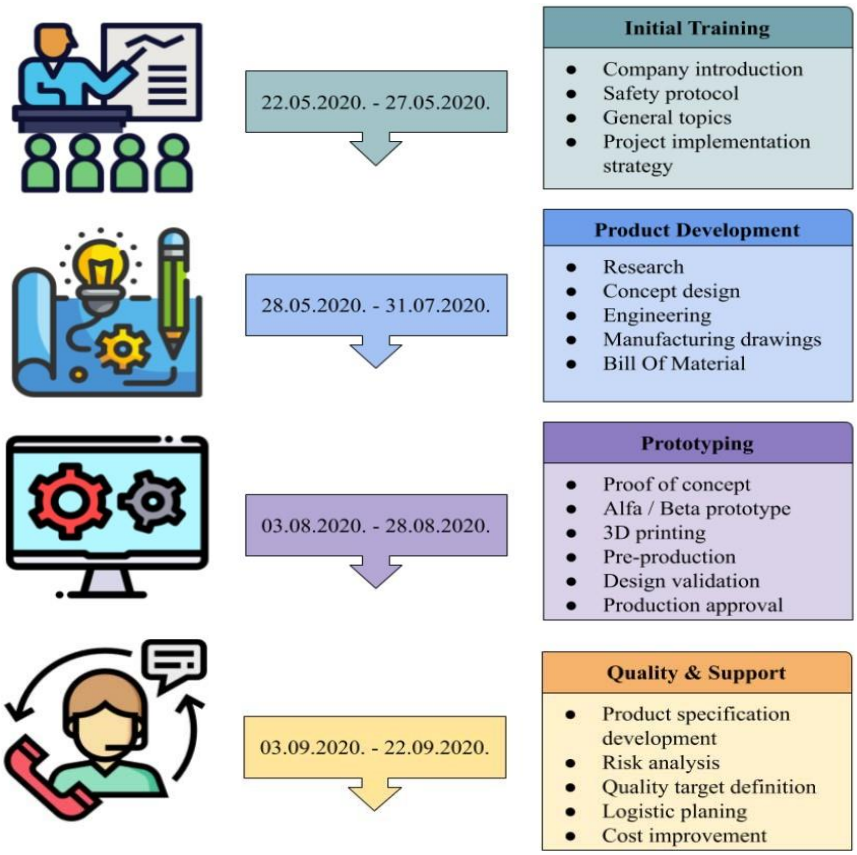


Fig. 9: RED FORK practical activities timeline

Student assessment: The student's evaluation took place at the end of the practical activities. Mentors from each company included in the project evaluated the students. Feedback meetings were organized to assess the students' feedback regarding the first results of the internship program.

Fig. 10: Students and tutors at Holcim (source: UNIPU)

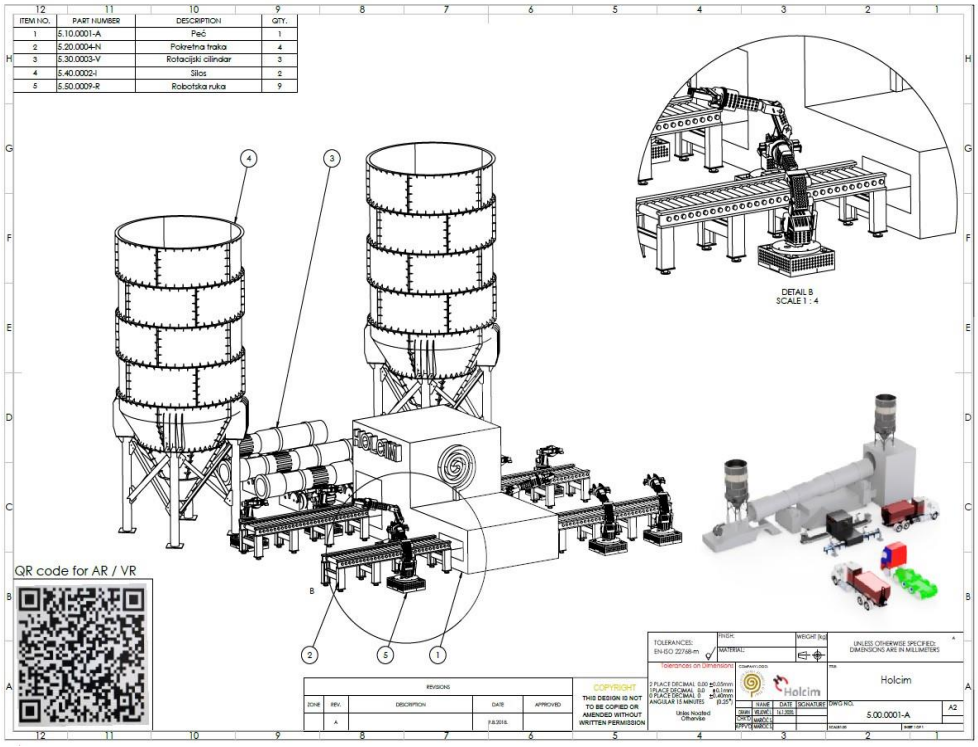


Fig. *11*a: CAD model drawing - one of the results of practical activities (source: UNIPU and HOLCIM Hrvatska)

Fig. 11b: CAD model drawing - one of the results of practical activities (source: UNIPU and HOLCIM Hrvatska)

4. Comparison between the implementation process in the three universities

Subject to comparison are the following parameters related to the pilot implementation of the dual programmes in Bulgaria, Romania and Croatia: student selection criteria and procedures, preparation of the participants and the mentors, rotation principles and examples for practical activities, student assessment and evaluation of the practical phases.

4.1 Student selection process

In all three country cases, the practical training has been based on a voluntary choice by the students and afterwards approval by the industrial partners. The selection procedures have been jointly agreed by the universities and the partner companies.

In the undergraduate programme Mechatronics at the University Lucian Blaga Sibiu, the students enrolled during the academic year 2018-2019 were able to choose between the regular form and the dual form of the Mechatronics specialisation. A limited number of places were allocated to the dual study specialisation, and the selection of the students was done according to a selection procedure proposed and agreed between LBUS and the industrial partners.

Due to the limited number of students in this specialty, it was possible to divide students in groups in not more than 10-12 students (the biggest group), so that the entire group for every year can be accepted for a practical training at MTG Dolphin. Similar circumstances explain the opportunity provided to all students from the programme “Mechanical Engineering” at the University Juraj Dobrila Pula in Croatia to apply, and if accepted by the partner companies, to attend practical training. The selection criteria applied in the case of Croatia included academic results, a motivation letter, an interview with the students in order to assess the student determination and motivation and previous knowledge and skills in the field of CAD modelling, technical documentation, and production engineering.

Similar selection approach was applied in the pilot programmes in the three countries. The procedure of students’ selection was oriented to quality and successful practice fulfilment. Students’ selection involves a rigorous evaluation of knowledge, skills, and motivational aspects. The process of selection included the presentation of a CV, academic results and grades during the course of education, motivation letter and an interview with the candidate where the merits were assessed. The interview was the most important part of the selection process.

4.2 Participants

Due to the highest number of participants selected from one dual programme, the distribution of the selected students will be presented on the example of the case dual “Mechatronics” in University Lucian Blaga Sibiu Romania. All students enrolled at Mechatronics specialization (57) were presented the possibility to follow the programme in a dual system, by means of a dedicated presentation at LBUS and a visit at the two partner companies. A number of 41 students were selected by the companies. Finally, a total number of 35 students attended and finalized the internship. In the pilots in Bulgaria and Croatia, additional 16 students were involved in the pilot implementation.

4.3 Preparation

The preparation of the students included informational workshop that familiarized students with the conditions for the practice within their company. Each company organised then a separate kick-off at

its premises in the beginning of the first practical phase and conducted work safety training for the students.

The implementation preparation phase also included training of the academic and industrial 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 programme 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/templates (produced in WP3), a checklist (info folder and visit schedule) as well as the protocol for the mentor meeting in company. A dedicated training for academic mentor in using the Toolkit has been conducted during the project meeting in Graz.

The German Chambers of Industry and Commerce in Romania and Bulgaria are using an approved by the Association of German Chambers of Industry and Commerce (DIHK) training programme for mentors to acquire basic pedagogical and psychological knowledge and skills in working with trainees in real work environment. The programme is intended for mentors in enterprises in conducting dual education and includes: objectives of the training, structuring of the study time, content and expected learning outcomes. The programme explains the legal framework for dual education (dual training system) as well as the planning, implementation and evaluation of practical training.

4.4 Rotation principle

In all three pilot cases, the rotation principle of the practical phases follows a block model. The theoretical cycles at the university during the semester are changing with practical phases mostly during the semester breaks in the companies. Even if the practical activities were unfolded in different companies, there were many similarities in their general structure. At the beginning of the programme and then of each semester an informational workshop is jointly organised by university lecturers and company representatives on the campus. The workshop delivers information about the dual model, explains the rotation principles and presents the organisation and schedule of the implementation. During the first introduction workshop all companies explain how the practical training will be implemented in each company. Then students decide for which company to apply. Once selected by the company of choice, the students must complete all practical phases with the same company. The first practical phase in the company mostly has the function to familiarise the students with the company and its operation as a general. During this orientation phase the students spend time in all company departments to get impression about the processes and operations performed in each department. The orientation practical phase is followed by a regular semester in the university. Prior to the second practical phase the students have a consultation with the HR department in order to identify the department and team in which they best fit in. The consequent practical phases take place in the select the department. Each practical phase end with a feedback round for each student in the company and afterwards in the university. During the practical phases the academic mentors remain available for questions and support to students.

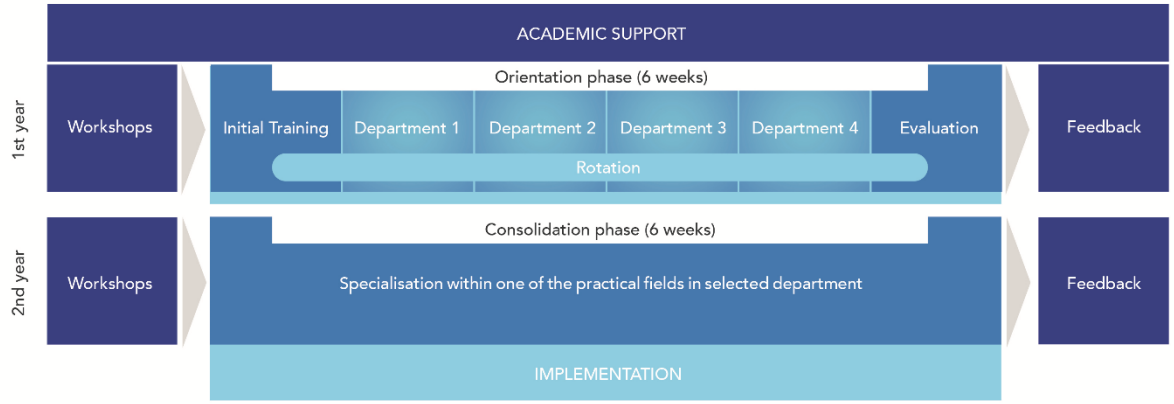


Fig. 12 Example for practical phases organisation from the dual Bachelor in Mechatronics

4.5 Practical activities

The content of the practical activities was tailored to both the requirements of the industrial partners and the new syllabus designed by the universities. Therefore, this aspect of the pilot implementation differs significantly among the partners. Examples of practical activities are provided in the description of the pilot implementation in section 3 of this report and in the dedicated chapter in the DYNAMIC Guidelines on design and implementation of dual practice-integrate higher education engineering programmes in the context of Bulgaria, Romania and Croatia (D6.5).

Dedicated practical activities have been developed according to the syllabus of the specialty subjects that have been selected for dual implementation. The syllabus were agreed between the academic and industrial partners during the focus group meetings. The industrial mentors from the respective department have been involved in the activity development, student instruction and direct supervision during the activity execution. A major similarity in all three pilots was the documentation of the practical activities. Each of the activities performed by the students had to be registered and described in the student logbooks/practice diaries, which they filled in during the practical phases.

The practical activities performed by students had the specific objective to develop new industry-related skills and improve the knowledge they have acquired during their study. The students that were involved in practical activities with the company HOLCIM Ltd, acquired skills specific for the cement industry and improved their existing skills for CAD modelling and in making technical and assembly drawings. The students that were involved in practical activities with the company RED FORK, acquired new skills in the area of biotechnology, additive technology and IT science as well as improving skills for CAD modelling and in making technical documentation and assembly drawings. The figures below illustrate examples of practical activities in the companies Holcim Hrvatska Ltd. And RED FORK, Croatia.

Fig. 13. Examples of practical activities in Holcim Hravatska and RED RORK

During practical activities, students were permanently mentored by tutors from the companies involved in the dual study programme. For each of the participants were defined specific areas or process in which to conduct practical training.

4.6 Student assessment

The assessment of the students for their practical assignments follows similar procedures in all three pilots. The student's evaluation took place at the end of the practical activities. The first step of the student evaluation process takes place in the training companies. Mentors from each department included in the Rotation Plan evaluated the students. Feedback meetings were organized to assess the students' feedback regarding the first results of the internship programme. Feedback questionnaires were distributed to the students. After completion of their practical training students also filled-up feedback questionnaires provided at the university. The purpose of these questionnaires is:

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

The following aspects of training were most appreciated by the majority of the students who filled in the questionnaires:

- 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.

During the entire practical phase students have to fill-in every day a diary, in which they keep records of their daily assignments with explanation of provided and solved tasks. At the end of the practical training, the diaries are endorsed by both the industry and university mentors. Mentors from industry and academia are asked to complete evaluation reports for students' work and gained practical knowledge and experience; share their opinion and recommendations (if any) on the overall practical training. The practice diaries and the mentors' reports provide the basis for student assessment and grading of the practical part of the dual study.

5. Common issues and adaptive elements

This section syntheses the common limitations, similarities and common parts derived from the comparison of the approaches and country-specific implementations.

In the three countries of pilot implementation different approaches have been followed in the curriculum development respectively curriculum adaptation process. In all cases, the approach has been guided by the national higher education regulation and determined by the degree of institutional autonomy in the implementation of the national rules. In the case, where international regulation imply, such as the case of the programme "Marine Engineering" at the TU Varna is, amendments in the ongoing curriculum are even more compounding. Initiating a bottom-up curriculum update approach in such case is less motivating due prolonged and sometimes bureaucratic communication chain.

Regardless of the different conditional framework in all national cases, it was possible to establish or to expand existing university-business-cooperation forms. Cooperation readiness and communication between academic and industrial stakeholders played a determinant role in the success of the solution-finding process despite the restrictive regulatory environment. While national higher education law and institutional rules were a common challenge for establishing dual higher education programmes in all three countries, the creativity and cooperation spirit of the stakeholders has led to a suitable solution in each country-specific context.

A comparative analysis was conducted during the DYANAMIC project with the aim to identify similarities and common parts and highlight major differences between the dual models developed and piloted in Romania, Bulgaria and Croatia. The comparison was guided by the following criteria:

- total amount of ECTS for entire study
- total amount of ECTS for the practical activity
- duration of practical activity
- number of semesters for practical activity
- main subjects
- beginning
- rotation principle
- selection criteria for choosing students
- payment
- contracts and logbooks.

The results of the comparison analysis indicate the following similarities and common parts of the three country-specific models and curriculum development/adaptation approachs:

- Mandatory practical components in the ongoing curricula such as internships or industrial practices have been allocated in the partner companies
- Syllabus of specialty subjects has been updated in collaboration with industrial stakeholders
- Where deemed suitable, laboratory exercises have also been allocated in the partner companies
- Where possible, planned hours (respectively credits) for independent work, which were also incorporated into the industrial enterprise training.
- Allowed flexibility rules have been applied to increase the workload of practical activities where possible
- ECTS basis is used to integrated the practical phases in the curriculum
- The final thesis must be completed on a practical topic co-supervised by the partner company
- Similar documentation is used for the documentation of the practical activities and for the assessment process
- Refence letter reflecting the student performance during the work in the company shall be issued to each student by the hosting company at the end of the programme
- Industrial experts hold lectures at the university
- Study visits at the partner companies
- Although a selection process has been established in all programmes, the partners strive to offer dual learning opportunity to as many as possible students willing to be involved. In the programmes with lower number of students enrolled it was possible involve the entire cohort in the pilot (e.g. cases Bulgaria and Croatia).

Among the differences in the presented models count the rotation principles, which have been determined by the curricular approach for each programme and the semester organisation in each university. In addition, the contractual agreements and payment schemes differed from one another depending on the national labour laws and company renumeration practices.

6. Reflection on the quantitative and qualitative project results

After the pilot implementation and evaluation of the dual programmes, a general evaluation of the project results indicators has been conducted based on the criteria set in the project evaluation plan (D6.1). The purpose of this interim internal evaluation is to identify the level of result achievement and highlight the focus areas of the project consortium for the remaining project duration. Later on, this overview will serve the evaluation of the level of achievement of the overall project objectives that will be reflected in the project final report. The results are presented in the table below.

WP	Indicators	Comments
WP1	1 consortium agreement signed between the coordinator and each partner	consortium agreement signed in the beginning of the project
	7 project meetings organised	5 meetings conducted as planned and 2 meetings organised online due to covid-19 restrictions. PB meetings combined with project meetings, open access for all partners
	6 project board meetings organised	
	80% level satisfaction from project meetings	Satisfaction level reached, however survey participation low
	1 interim and 1 final reports produced on time	Fully fulfilled
	1 web-based communication tool established	Fully fulfilled
	1 monitoring and implementation report in M13	Final version needs revision
WP2	1 meeting report from Transnational stakeholder workshop in M2	Fully fulfilled
	3 practice-integrated dual programmes developed and approved	Fully fulfilled
	9 focus group meetings (FGM) organised (LBUS, TUV and PTP each 3)	Fully fulfilled
	9 agendas and meeting notes from FGM	Fully fulfilled
	3 consolidated FGM reports (LBUS, TUV and PTP each 1)	Fully fulfilled
	3 contractual templates in national languages	Fully fulfilled
	3 reports on approved dual curricula (LBUS, TUV and PTP each 1)	Fully fulfilled
WP3	15 academic supervisors trained	Fully fulfilled

	80% level satisfaction from training workshop 80% satisfaction with the developed tools 1 process flowchart for development of dual higher education programmes Number of tools and templates developed	Fully fulfilled Fully fulfilled Fully fulfilled Partly fulfilled, final data in process
WP4	12 industrial supervisors trained 80% level satisfaction from seminars/ events 3 training courses with customised & translated training materials At least 9 chamber instructors trained (3 per chamber) 3 national face-to-face training workshops in M31 (1 in each BG, RO, HR) Nr. of trainings to industrial stakeholders outside the partnership within the project lifetime (15-20 in each BG/RO/HR)	25 in RO; Data from Bulgarian and Croatian trainings in processing Fully fulfilled Partly fulfilled, 2 out of 3 reached Partly fulfilled, final data in process Partly fulfilled, final data in process Partly fulfilled, final data in process
WP5	25 student placements created by the project At least 80% level of satisfaction from student placements Nr. of students registered for the selection process 3 implementation reports (LBUS, TUV and UNIPU each 1)	51 students in total from all three countries Fully fulfilled 80 Fully fulfilled
WP6	Number of evaluation tools and templates developed 2 interim evaluation reports produced on time 1 final evaluation report produced by external evaluator 1 Guidelines produced and translated by the end of the project	Final data in process Fully fulfilled In progress, delayed due to partner change and covid-19 Publication process in progress
WP7	550 participants on targeted events 3000 visits on the project website	Partly fulfilled, final data in process Partly fulfilled, final data in process

	80% level satisfaction from project events	Fully fulfilled
	2000 final project brochures distributed (150 at final conference, the rest by the partners)	distribution mainly online due to covid-19 restriction (cancellation of events or online mode, avoiding handing physical objects); 200 print copies available
	6 scientific papers presented on expert conferences	Fully fulfilled
	17 articles published in media (6 in national & 11in local media)	Partly fulfilled, final data in process
	2000 stakeholders reached via social media & e-newsletter (target 2000)	Partly fulfilled, final data in process
	250 stakeholders reached via the two dissemination conferences	Fully fulfilled

The evaluation of short-term results and long-term outcomes during the project lifetime also follows pre-defined indicators set in the project evaluation plan. The indicators for the short-term project results and the long-term outcomes are presented in the tables below:

Short term results	**Target groups/potential beneficiaries**	**Quantitative indicators**	**Qualitative indicators**
Approved updated curricula with applying the dual training approach	Students/universities and industrial companies	Curricula for 3 study programmes	Common undergraduate competences currently required by the labour market integrated into academic curricula
Toolkit for implementation & documentation of dual practical phases	Academic teachers	Nr. of teachers applying the new tools Nr. of tool downloads Nr of academic staff trained	Level of satisfaction and feedback from academic and industrial partners
Training materials for industrial mentors involved in dual education	Chambers, enterprises, industrial mentors	Industrial stakeholders reached Number of persons trained Number of students required by industrial partners Nr of projects mentored	Level of satisfaction from trainings
Student placements for practical-phase training	Students	Nr. of days spent in the enterprises Nr. of projects completed	Improvement of student academic results
Knowledge transfer & exchange	Chambers, enterprises, universities, industrial & academic mentors	Nr.of transnational meetings organised Nr of stakeholders involved in knowledge exchange	% of stakeholder satisfaction and feedback

Web-based communication platform	Universities, industrial companies, chambers	1 web-based platform Number of interactions between academic and industrial stakeholders	Real-time communication between partners, transparency and secured data storage
Public website	All stakeholders	Nr. of unique visits Nr. of resources uploaded Nr. of pages visited Nr. of output downloads	Average time of visits

Long term outcome	**Target groups/potential beneficiaries**	**Quantitative indicators**	**Qualitative indicators**
New approach of curricula delivery in BG/RO/HR	Students	Nr. of students applying for the dual programmes offered in LBUS, TUV, PTP Nr. of students mentored by industrial stakeholders	Percentage of students integrated within workforce after graduation (in their field of study)
New approach of engineering curricula delivery in BG/HR/RO	Shipbuilding & Ship Repair sector Manufacturing & Production sector	Nr. of dual programmes created with Association member enterprises Nr. of applicants for technical jobs with high practical skills	Level of alignment between applicant qualification profile and job profile Level of industry-related competences of the hired specialists
Methodological Guidelines	Industrial companies Universities	Nr. of dual programmes in LBUS, TUV, PTP Nr. of HEIs adopting the developed methodologies Nr. of dual higher education programmes in the target countries started outside the partnership	Quality of engineering education offered in the regions of pilot implementation Rating scores of the new dual programmes
Training materials for industrial mentors involved in dual education	Chambers, enterprises	Nr. of enterprises reached & trained outside the partnership	Level of course recommendation by trained enterprises
Improved innovation environment	Industrial companies	Nr of projects integrated Nr. of patents related to student project and UBC	% of successful transfer in hosting enterprise
Network for UBC	Industrial companies Universities	Nr of new dual programmes in the partner HEIs Nr. of long-term cooperation projects between HEIs & enterprises	% of DYNAMIC and new partners

Discussion on the short-term results indicators:

In general, students have demonstrated high interest in the new dual forms of their study programmes and readiness to participate in the practical trainings in the partner companies. In the example of Romania, all students start as regular students being informed about the dual option just after admission. From 64 students enrolled in the Bachelor programme in "Mechatronics" in the year of the pilot, 41 have selected the dual option. In Bulgaria this rate of students enrolled in the dual option also represents about 2/3. The common motivation for the extra effort in comparison with the regular study form is to acquire competitive advantage to other job seekers after graduation. Considering the situation that work experience is still a challenge when applying for a job position, the interviewed higher semester students expressed that hands-on learning made them more confident for job application process.

The satisfaction of the partner companies involved in the piloting could be also assessed as high. Despite the challenges identified during the pilot, the experience in general was positive stimulating the companies to seek further engagement opportunities with the academia. As a short-term benefit from the pilot dual format, the companies appointed the training for industrial mentors that was offered to them prior to the first in-company practical phase. The training for industrial mentors has been designed according a standardised training model developed the German Chamber of Industry and Commerce, customised to the specific national context in Bulgaria, Romania and Croatia. The training has been delivered with respect of the work load of the industrial experts who will act as mentors during the pilot implementation. The train the trainer course raised awareness about methods and techniques used in the work with students. As most beneficial component of the training the industrial mentors pointed out the communication patterns practiced. This was particularly the case of departments such as in the mechanical production, where it was difficult to translate the complex technical information to understandable for the "students' language". The mentors learned during a practical workshop how to approach the students from simple to complex situations, taking them step by step along the learning curve.

In general, the group of the academic mentors sees the benefits of the dual higher education in the connection with the company that allows combining the theoretical and practical knowledge. This form of education provides students with better understanding of contents and work and helps to educate well-qualified engineers. The academic mentors could observe increased understanding in the taught subject area and more motivated student participation after the practical phase in the company. The academic mentors see the biggest benefit for the students gaining practical skills, they are prepared for the world of work, the curricula can be constantly improved and aligned with needs from the industry.

The details of evaluation of the country-specific pilot implementation of dual higher education programmes in Bulgaria and Romania has been reflected in the research paper "Evaluation of practice-integrated dual study models in Bulgaria and Romania and implications for cross-border European cooperation between universities and business" submitted and accepted for open access publication by the scientific journal "Vocational Education" (https://vocedu.azbuki.bg/en/).

Discussion on the long-term outcomes:

The evaluation of impact and long-term outcomes from the project is only possible to very limited extend during the project lifetime. Nevertheless, the partners attempt to make projections for some of the indicators such as student employability, graduate retention in the region and regional development potential, based on the evaluation findings and indication in the country implementation reports.

For the target group of the students as one of the main stakeholder group, dual higher education is expected to contribute to higher level of **graduate employability** in a medium term. An attractive feature of the dual model is that 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. In addition to processing their own projects according to the requirements during the study with additional support from the teaching staff, the dual students should be largely incorporated in the normal working process. At the stage of pilot implementation, it is difficult to make projection on graduate employability in relation to the dual study model. Especially in Romania all the students involved in the dual study programme are enrolled in the 1st year of study, thus employment rate cannot be estimated for them yet. However, it must be noted that most of them are working part time for CASS and MSS, which are offering them a flexible working programme, in order not to interfere with their academic timetable. During the summer practice students were hired as engineering interns, with the optional possibility to continue part time during the academic year, and most of them had chosen that option.

In the case of Bulgaria, the first 6 students who were involved into the pilot implementation 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 partner MTG Dolphin, as they were proposed leading positions in other companies. Next 11 participants are at the end of their 4th study year and are preparing for the state exams. 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 pursue career pathways abroad. In the region of Varna, there are limited number of companies – about 6 design offices and about 3 companies active in ship building and repair. These companies do not see each other as direct competitors in operations but are competing for employees. Therefore, 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 also an 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. To achieve these objectives, companies are still experimenting with different models in working with the academia. The difference reached through the project DYNAMIC is seen in the possibility of more flexible work between university and the partnering companies as well as in the opportunity for the **students to become more specialised** moving away from the previously practiced common stream of students. In order to better promote the networking and active cooperation with companies, the partner university in Varna also emphasise the necessity to formalise dual higher education at national level.

7. Conclusions and recommendations

Since the pilot models have been developed and implemented within the existing legal framework and applicable regulations, reliable recommendations can be formulated to a limited extend only, taking into account the self-evaluation and improvement plans of the partners. Also, the findings of the direct dialogue with the stakeholders during the peer reviews provide a basis for realistic recommendations attached to the operational environment and existing capacities of the partners.

As the peer review and the discussions with the participants from all stakeholder groups have indicated, a central element for the implementation is the mentoring process. All participant groups have recognised the necessity for suitable structures to improve the communication process between the mentors. In addition, each group of mentors has its own needs that have to considered in the improvement planning. Currently, the academic supervision of the students during the practical phases in the companies and the coordination meetings with the industry mentors count as an add-on to the general duties of the academic mentors at the university. This leads to an increased workload of the academic mentors in comparison to the staff not engaged in dual education. In the long-term such situation can cause decrease in motivation unless suitable structures and rules are being established for academic mentors. The interviews with the academic and industry mentors have confirmed the necessity for good preparation and training for both groups of mentors. For the industry mentors the focus is on suitable communication tools/techniques and the understandable translation of complex tasks to the level of knowledge of the students.

The evaluation has indicated a very high interest of the students towards dual higher education. The high interest is reflected in the number of students applied and accepted for the pilot implementation of the dual programmes, which was much higher than initially planned in the beginning of the project. With the growing number of students entering the dual higher education programmes in the partner universities, there will be an increasing need for more and bigger variety of companies accommodating the dual learners. The partner LBUS, which had the highest number of dual students within the project DYNAMIC, has already started the acquisition of further partner companies, in order to expand the enrolment in the dual programme.

Another point noticed during the evaluation of the pilot implementation is the need for establishing structures for monitoring students' employability and tracking career paths of dual students. This will serve the purpose of impact and long-term outcome evaluation. In addition, maintaining contact to graduates employed in the industry is seen as an opportunity in the acquisition of partner companies or increasing the availability of industry mentors.

As a closing remark, it shall be mentioned that the described pilot models of practice-integrated dual study programmes in Romania, Bulgaria and Croatia have been developed within a limited timeframe define by a project-based schedule and with limited project resources. Due to circumstances implying a partner change in Croatia, the model presented for this country has been developed in the time frame of one year only. Therefore, the presented models cannot be considered as an end product but rather as a prototype subject to continuous improvement and further development.