

## **EVALUATION OF PRACTICE-INTEGRATED DUAL STUDY MODELS IN BULGARIA AND ROMANIA AND IMPLICATIONS FOR CROSS- BORDER EUROPEAN COOPERATION BETWEEN UNIVERSITIES AND BUSINESS**

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**Abstract.** The paper addresses the country-specific pilot implementation of dual higher education programmes from the engineering domain in Bulgaria and Romania. The paper presents a summary of the findings from the evaluation of the pilot programmes. The data evaluated has been collected in each country by the means of a peer review in the implementing institutions with the participation of the three main stakeholder groups involved - students, academic staff and industrial mentors. Qualitative data collection tools and interpretative data evaluation methods have been applied in this research. The set of methods include table-based group exercises with each stakeholder group combining open-ended questions, semi-structured group discussions and observation. Inductive research approach has been applied in the evaluation of the collected data. Finally, the data interpretation serves to discuss the impact of the piloted dual education model in both countries and provides an outlook with regard to the cooperation in education and training at European level.

*Keywords:* dual higher education; in-company training; responsive engineering curricula; industry-related skills; professional education

### **Introduction**

A strong industrial base is perceived as fundamental for Europe's competitiveness, economic growth and job creation<sup>1)</sup>. Eastern Europe represents a region of opportunities for the development of a modern industrial landscape taking into consideration regional core advantages such as strategic geographic location with market proximity to Western EU, Russia and Asia, highly educated affordable workforce, stable macroeconomic environment and strong digital infrastructure<sup>2)</sup>. Despite the numerous advantages as an investment destination, the region has been exposed to increased international competition developing third countries that drives a shift to high value-added and dynamic manufacturing strongly relying on high-skilled labour (Marr 2019).

Technological advancement, knowledge-based and service-linked activities, shift to network-based organisation and emerging of new business practices, new professions and new customer needs and preferences shape the new profile of the manufacturing industries.<sup>3)</sup> Thus, the competitive industrial development needs to be in line with innovation policies that promote close cooperation between companies and universities (Aiginger 2012; 2014). As the sector is becoming increasingly knowledge-intensive academic and industrial stakeholder will need to work together in order to develop people with appropriate skills. This is why dual education has gained a lot of attention in the recent years in the countries Bulgaria and Romania. While dual education has been introduced by law at secondary level, dual higher education is still subject to investigation and testing of pilot models.

Dual study is defined as a hybrid qualification model combining elements from both vocational and higher education systems. A dual study programme is composed of academic elements acquired at the university and professional elements practically acquired at a company. The company-based elements rest and construct on the theory basics from the academic part of education. The direct involvement of industrial stakeholder in the curriculum design and delivery is seen an opportunity to keep certain study programmes closely relevant to the needs of the labour market. The integration of regular practical in-company phases aims to make curricula more flexible and responsive in order to keep pace with the rapid technological advancement and increasing innovation pressure (Mahler & Bernett 2015).

### **Research context**

Education providers are challenged to regularly update engineering curricula in order to respond to the rapidly changing business and technological environment. However, the modernisation of the ongoing curriculum is often obstructed by long process of design, approval and accreditation phases within the laggard legal framework (Mahler, et.al. 2019). The project DYNAMIC has been developed to address the urgent need to create a flexible, adaptable and active learning workforce in the new EU member states. This objective has been materialised through the joint development and implementation of practice-integrated dual study programmes by working groups of academic and industrial partners in Bulgaria and Romania. An initial analysis of the conditional framework was conducted in order to explore the feasibility for implementation of the dual study model in both countries. In the course of this analysis, transferable elements from the German education system were explored. As a result, potential parallels with the practice-integrated dual studies model in Germany were defined in specific implementation recommendations. These recommendations served as foundation for the development of a pilot programmes in the scope of the „DYNAMIC” project. The pilot dual programmes encompass amended/adapted existing engineering curricula and newly developed curricula parts for practical training at partner companies. The pilot implementation

of the dual programmes has been evaluated in the scope of two peer reviews. The findings of the evaluation process are subject to the present paper.

### **Methodology**

The methodological framework of the described study uses empirical data collection through qualitative methods. A peer review at Lucian Blaga University of Sibiu (Romania) and Technical University Varna (Bulgaria) was used to capture the experience and impressions of all direct stakeholder gained through the pilot implementation. The overall purpose of the peer reviews was to reflect on the implementation of the dual curricula developed, identifying strengths and challenges for the involved stakeholders during the implementation process. The evaluation model developed for the peer reviews incorporates the following components:

- General reflection of the programme implementation using two structured questionnaires for the stakeholder groups 1) students of the dual study programme and 2) industry mentors;
- Semi-structured interviews with academic mentors;
- Feedback collected in written form from each of the stakeholder groups 1) students of the dual study programme, 2) academic mentors and 3) industry mentors, using the principles of the method called “World Café”.

Evaluation model applies several methods. First, World Café method as a structured group session with common parts serving the comparability between the stakeholder groups and of specialised elements designed for each of the stakeholder groups separately. The common method used with each of the stakeholder groups is the question round with each of the groups. The purpose was to find out to what extend the expectations of the separate stakeholder groups towards the dual study model match. The method also serves the comparability of the data collected during the peer review in Romania and Bulgaria. The following questions were asked:

**Question 1:** Do you see the connection between the theoretically taught contents of the university and the given practical training at all?

**Question 2:** What do you see as the biggest benefit for the company and the students?

**Question 3:** How can you understand whether the company's activities really complement the curriculum?

**Question 4:** Are the quantity and quality of care provided by the mentors sufficient?

**Question 5:** Which kind of assessment and feedback tools (written or oral) did you use to reflect the practical training? To whom these were submitted?

Additional methods were then applied specific for each stakeholder group.

#### Additional methods used with the students:

Prior to the face-to-face interaction with the group of the students, an online-based questionnaire was distributed to all dual students participated in the pilot.

In total, 56 students were selected for the dual option and participated in practical training (41 in Romania and 15 in Bulgaria). The online questionnaire aimed to collect data from as many participants as possible, knowing that only a part of the dual students will be able to attend the face-to-face meeting with the peer review team.

The questions represent the following topical areas:

- Satisfaction with the programme;
- Satisfaction with the organisation;
- Satisfaction with the mentorship provided (supervision, support, assessment).

The questionnaire filled in in advance for identifying challenges as well as potentials during the implementation that could be addressed more detailed during the face-to-face session.

Additional methods used with the industry mentors:

After the 5-question round, a guided discussion of 40 minutes took place. During the discussion, the companies were asked about their experience in working with the students, in particular challenges, providing feedback and assessment of students, communication with university, impressions and lessons learnt from the “Train the Trainer Training”. After the face-to-face meeting with the industry mentors, they were provided with an online-based open-question questionnaire to answer and send back. The questionnaire targeted department instructors, responsible for the technical instruction and activity supervision and HR staff, responsible for the general organization.

Additional methods used with the academic mentors:

An interview with question catalogue was prepared in order to collect data specific for this stakeholder group. Due to time restrictions during the face-to-face interaction, the question catalogue was distributed digitally to the academic mentors via google online form after the peer review. The reflection from the online question catalogue addresses the implementation of the practical phases, the assessment of students’ results as well as communication and administration issues.

### **Summarised results and main findings**

The main findings from the peer reviews and the interaction with the three stakeholder groups in Bulgaria and Romania are summarised in generic form representing common similarities for the target groups in both countries. Where such generalisation was not possible due to context and implementation specific factors, the findings are explicitly presented per country or addressed pilot case.

Main findings for the group of students:

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 biggest benefit from the dual form of education students see in its value for career orientation and the opportunity to create a vision for their future career development.

*“When we start academic education, the job perspectives are still a “black hole”. The practical training helped me to get aware about the opportunities in my professional field.” (Interview with a TUV student, February 2020)*

Several students expressed a preference to extend the practical experience during their study to more companies. Nevertheless, they also understand the benefits of practical rotations in the same company. This is seen as an opportunity to acquire deeper knowledge in a certain professional field and to specialise in the processes in the one company, which is a potential employer after graduation.

Although the overall satisfaction with the piloted dual models is very high, a few areas for future improvement could be identified after the discussions with the students:

1) A group of students expressed the opinion that the company did not use their full potential during the practical training. This was observed in the companies with less experience with the dual education or other forms of university-business cooperation. In order to make the best benefits of the dual training, partner companies should establish trust in the capabilities of the students and assign them more responsibilities during the practical phases.

2) In general, students experienced good quality of mentoring during the practical trainings but would wish more “quantity”. This could be explained with the innovative character of the dual study form creating the necessity for more intensive guidance until experience is generated and can be shared among peers.

Finally, the practical trainings integrated into the pilot dual programmes have been indicated as a great learning opportunity and a means to shape the individual career pathway. Its potential to foster personalised education and training in higher education has been recognised by the students leading to the expressed desire for individual task plan that better match company activities with students’ strengths and interests.

Main findings for the group of company representative:

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.

A positive outcome from the early engagement with the students is the recognition of their innovation potential, which could be observed still during the first in-company phase of the 1st year students in Romania. Despite their limited knowledge in the professional specialisation of the department they were assigned to, students still could meaningfully contribute to the idea generation process in the team.

*“1st year students were good in thinking outside of the box as they still don't know what is inside the box. However, their communication skills and self-confidence need to be strengthened.” (Interview company representative, October 2019)*

The 1st year students were more creative than higher grade students, which makes them a valuable creative force especially for the R&D department. However, they often fear to express their thoughts and lack of confidence which is a challenge for the mentor to use this potential. Therefore, students need to learn very early how to sustain or make use of good ideas and to acquire practice of good documentation and presentation. During the first practical phase the companies have also noticed the power of motivation and inspiration when 1st year students had the chance to meet and interact with higher grade students working in the company.

As a short-term benefit from the pilot dual format, the companies appointed the training for industrial mentor 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 and Romania. 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 instead of “pushing them into the cold water”.

In general, all mentors indicate the first practical phase as a learning experience rather than application of already acquired knowledge. Such type of interaction between students and companies required more personal than technical mentorship. Mentoring the dual students was more intensive requiring more time invested to learn about the job, the colleagues, the product, etc. However, a in long-term companies expect that this investment will be more rewarding in building up relationship with future employees.

**Main findings for the group of academic mentors:**

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.

Additional benefit from the regular communication and feedback loops between academic and industrial mentors could be identified for improving the quality also of the regular programmes. During the adaptation process, missing aspects in the curriculum were supported by introducing additional elective courses delivered by the company at the university. These additional courses were mandatory for the dual students but free to attend by all other students. Moreover, the new insights in the current industrial processes gained by the academic mentors during the exchange with the industrial mentors or during company visits are applied in the teaching of both dual and regular structures programmes.

Among the challenges identified by the academic mentors is the lack of mentoring experience and additional time effort related to the mentorship of the dual students as long as this form is not officially recognised and the workload is adjusted to the new teaching methods. In addition, the intensity of the academic mentoring was restricted due to the fact that the whole process was running during the holiday period in order to avoid significant interventions in the approved study plan.

### **Limitations of the findings**

In the interpretation of the presented findings, the following limitations should be taken into consideration: Within the project lifetime limited to 3 years, it is not possible to develop, implement, observe and evaluate dual students throughout the whole study. In the pilot case in Bulgaria, higher semester students have been selected, so that they can apply prior knowledge from the university in performing activities assigned in the company. This implies significant restrictions on the adaptation extend possible for the ongoing study plan. According to the Higher Education Law, the student has to complete his/her training on the curriculum on which he / she started. (Ilieva 2019)

In the pilot case of Romania, 1st year students have been involved in the dual implementation. Thus, they have less background knowledge and can undergo limited specialisation within the project lifetime (two practical rotation, the first of which has introduction character). During the first year, students are usually taught mainly theory in basics subjects. In some subjects such as Technical Drawing, students could apply university knowledge in the company. In other basic subjects such as Maths or

Chemistry, the connection between theory and practice at this stage is difficult.

### **Impact**

Preceding literature review has indicated the possibility of intensive collaboration between companies and educational institutions without existing regulatory framework at macro-level. Such collaboration on the meso-level is a necessary activity for the implementation, reproduction and continuity of the system (Gessler 2017). A feasibility study conducted with respect of the transferability of the dual study model in Bulgaria and Romania indicated favourable framework conditions (both political and economic) set up so that a fundamental transfer potential exists (Mahler et.al, 2019). The evaluation of the pilot dual programmes confirmed that the flexibilization of engineering higher education through integration of VET resp. company-based learning components is possible but the process is slow. Ongoing curricula allows only moderate changes or adaptations as the case in Bulgaria showed. The impact can be maximised if programmes are designed as dual, as demonstrated in Romania. However, a political support in form of appropriate regulatory framework is necessary in a mid-term to establish quality assurance measures, transparency and certification of dual higher education. The relationship and communication between a higher education institution and its partner companies has been confirmed as central success factor. Particularly in programmes subject to mandatory national and international standards (e.g. in the field of maritime engineering), in which curriculum changes are extremely difficult, the close collaboration is essential to enable regular updates.

### **Implications for cross-border EU cooperation**

The Bologna Declaration started a coordinated activity to establish a common European Higher Education Area (EHEA) by meanwhile 48 signatory countries, including Bulgaria and Romania, with the aim to increase transparency, mobility and mutual recognition (Heitmann & Kretzschmar 2017, p.13). The adaptation of the pilot programmes for dual implementation has been guided by the Bologna principles and the integration of the practical activities followed the logic of nationally and institutionally approved curricula design and approval procedures. In the case of dual higher education, the in-company training is mapped to learning outcomes and the workload is calculated with the ECTS methodology. Curricula adaptation and training design approach based on the EHEA instruments allows transparency and comparability of the pilot programmes subject to evaluation. Thus, the evaluated pilot programmes demonstrate a high degree of transferability and adaptation in other national settings within the EHEA.

Since the pilot programmes have been developed and tested within the existing national legal framework applying minor curricular changes that are in line with the Bologna system, a student mobility component could be integrated without significant recognition obstacles. Moreover, the practical phases are assigned in



the summer months so that the usual semester plan, confirmed at ministerial level, could remain unchanged. Such timely arrangements allow two types of student mobility, using the Erasmus+ mobility schemes:

mobility for practical training in a company subsidiary abroad

mobility for academic semester in partner university

Beside the mobility implications, the piloting of the dual higher education model in Bulgaria and Romania result in an added value for the university-business research community at European level. The new cooperation model between industry and academia provides new practitioner cases and new country-specific examples that contribute in the discussion of student employability and skills development in respect of future industry needs.

### **Conclusion**

Skills shortage and rapid workplace change create the need for agile workforce. To achieve this goal, higher education curricula should be more flexible and adaptive to the current industrial needs. The close business-academia cooperation is expected to strengthen the employability of the graduates by providing them with improved knowledge, skills and motivation. The dual higher education model provides a solution for more responsive education and talent growing for the benefit of all stakeholders.

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### **NOTES**

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