

Understanding University–Industry Engagement through Challenge-Based Learning: Evidence from Industry Perspectives

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Abstract

Universities are increasingly expected to contribute to innovation, sustainability, and regional development alongside their traditional missions of education and research. Challenge-Based Learning (CBL) has emerged as a pedagogical approach that connects students, higher education institutions, and external stakeholders through student engagement with real-world challenges. While prior research has predominantly examined the effects of CBL on student learning and skill development, limited attention has been given to its outcomes for industry and organizational partners acting as challenge providers. This study addresses this gap by exploring how regional actors perceive their participation in CBL and whether such collaboration supports meaningful university–industry engagement. Using a qualitative exploratory research design, semi-structured in-depth interviews were conducted with six organizations from diverse sectors that collaborated with a university through CBL projects. The interview data were thematically analyzed to identify perceived benefits, outcomes, and challenges associated with CBL collaboration. The findings indicate that CBL provides organizations with access to new perspectives, supports reflection on organizational practices, and contributes to early-stage problem exploration and innovation processes. At the same time, challenges related to time constraints, feasibility of student-generated solutions, flexibility of the collaboration model, and variability in student motivation were reported. Despite these limitations, all participating organizations assessed the overall value of CBL collaboration positively, emphasizing its long-term potential for knowledge exchange, relationship building, and future collaboration. The study contributes to research on university–industry collaboration by providing empirical insights from the perspective of external stakeholders and by positioning CBL as a pedagogical approach that can create mutual value beyond student learning, supporting the broader societal role of higher education institutions.

Keywords: Challenge-Based Learning, University–Industry Collaboration, Student Engagement, Knowledge Exchange, Higher Education

1. Introduction

Universities are increasingly expected to contribute not only to education and research but also to broader societal and economic development. In response to technological change, sustainability challenges, and evolving innovation demands, higher education institutions have expanded their role within regional and innovation systems through activities associated with the “third mission,” including knowledge exchange and external collaboration [1]. Within this context, university–industry engagement has gained importance as a mechanism for facilitating collaboration, innovation, and interaction between academic institutions and external organizations. Collaboration between universities and industry enables the exchange of expertise, resources, and practical knowledge that can support both educational and organizational development. Universities contribute research capabilities and access to emerging talent, while industry partners provide practical contexts and real-world challenges that can enrich learning processes and collaborative activities [2], [3].

These interactions have increasingly extended into educational settings through experiential and challenge-oriented learning approaches that connect students with real-world problems and external stakeholders [4]. As a result, universities are increasingly adopting more integrated models that combine education, research, innovation, and societal engagement [5].

One pedagogical approach associated with these developments is Challenge-Based Learning (CBL). CBL involves students in collaborative engagement with real-world challenges through interaction with peers, educators, and external actors, linking academic learning to applied problem solving [6]. Previous studies have primarily examined CBL in relation to student learning and experiential engagement with real-world

challenges. However, comparatively less attention has been given to the perspectives of industry partners and external stakeholders involved in these collaborations [4], [7].

This study addresses this gap by examining how organizations perceive their participation in Challenge-Based Learning and how such collaboration contributes to university–industry engagement. More specifically, the study explores the perceived benefits, outcomes, and challenges experienced by regional actors involved in student-driven CBL projects. Using a qualitative exploratory design based on semi-structured interviews with industry partners, the study provides empirical insight into how CBL may support interaction, collaboration, and knowledge exchange between universities and external stakeholders [2], [8]. The paper contributes to research on higher education and collaborative learning by extending discussion of CBL beyond student-centered outcomes and situating it within broader debates on university–industry collaboration. In doing so, it highlights the potential role of students as participants in collaborative knowledge exchange processes and emphasizes how pedagogical approaches may support the evolving societal role of universities.

2. Literature Review and Theoretical Framework

2.1 University–Industry Collaboration in Higher Education

University–industry collaboration (UIC) describes interactions between higher education institutions and external organizations that facilitate the exchange of knowledge, expertise, and technology [9]. Increasing technological complexity and competitive pressures have contributed to the growing importance of these collaborations, particularly as organizations seek access to external knowledge and innovation networks [10], [11].

Alongside these developments, universities have faced increasing expectations to contribute more directly to economic and societal development. This has strengthened the emphasis on external engagement and positioned universities more prominently within regional innovation systems and knowledge-transfer activities [12], [3].

UIC encompasses a range of collaborative activities, including joint research, knowledge exchange, and educational partnerships. Through these interactions, industry partners gain access to academic expertise and research capabilities, while universities benefit from engagement with practical challenges and applied contexts [13]. Governments have also encouraged university–industry interaction as part of broader innovation and economic development strategies [14].

More recently, collaboration between universities and industry has increasingly extended into educational settings through internships, student projects, and collaborative supervision models [15], [2]. These forms of engagement connect students with external stakeholders and support practice-oriented learning experiences that extend beyond traditional research partnerships [2].

2.2 Experiential Learning and Challenge-Based Learning

The involvement of external stakeholders in educational activities reflects a broader shift toward experiential and practice-oriented learning approaches in higher education. These approaches emphasize active participation, collaborative problem solving, and the application of knowledge within real-world contexts [6], [4]. Through collaboration with external actors, students engage with practical challenges that extend learning beyond traditional classroom settings. Such interactions may also expose organizations to alternative perspectives and forms of collaborative knowledge exchange. In addition, collaborative and practice-oriented activities involving regional actors may strengthen relationships between universities and their surrounding communities [16], [17]. At the same time, engagement with external stakeholders can help connect educational activities more closely with real-world challenges and societal needs [4].

One pedagogical approach associated with these developments is Challenge-Based Learning (CBL). CBL is a collaborative pedagogical approach that connects academic learning with real-world challenges and applied problem-solving activities. Developed through Apple’s initiative, the approach emphasizes active participation, interdisciplinary collaboration, and engagement with authentic problems. The CBL framework is commonly structured around three phases—engage, investigate, and act—through which students explore challenges and develop responses to complex issues [6], [8]. CBL has also been associated with



the evolving societal role of universities by supporting competencies such as collaboration, critical thinking, and interdisciplinary problem solving [18].

Because CBL frequently involves collaboration with external stakeholders, it can also strengthen connections between universities, industry, and society through engagement with applied and sustainability-related challenges [19]. In addition to supporting student learning, these collaborative activities may also provide organizations with access to new perspectives and collaborative knowledge exchange processes [3], [2].

Prior research on university–industry collaboration and CBL highlights three key dimensions: organizational experience, benefits, and challenges. Benefits include access to knowledge and innovation, while challenges relate to time constraints and feasibility [2], [3], [20]; interaction patterns further shape how organizations experience these collaborations [15].

2.3 Research Gap

Although previous studies have examined CBL primarily as a higher-education learning approach and have emphasized student learning, competencies, and collaboration with industry and community actors, comparatively less attention has been given to the perspectives of external stakeholders themselves [7], [4].

This study addresses this gap by examining how industry partners perceive their participation in CBL and how they evaluate the benefits and challenges associated with such collaboration. By focusing on the experiences of regional actors, the study contributes to understanding CBL not only as a pedagogical strategy but also as a collaborative mechanism within university–industry engagement.

3. Methodology

3.1 Research Design

This study adopts a qualitative exploratory research design to examine how industry partners perceive their participation in Challenge-Based Learning (CBL). A qualitative approach is appropriate for exploring the experiences, perceptions, and reflections of organizations involved in collaborative educational processes and university–industry interaction [21].

The study is guided by the following research question: How do organizations perceive the benefits and challenges associated with participation in Challenge-Based Learning collaborations?

3.2 Data Collection

Data were collected through semi-structured interviews with six organizations that participated as challenge providers in CBL projects. These organizations collaborated with the University of Stavanger and ECIU University initiatives and represented diverse sectors, including innovation, financial services, consulting, and sustainable development (Table 1). Additional respondent and organizational details are not reported at the individual level to preserve anonymity.

A purposive sampling strategy was used to recruit participants with direct experience in university–industry CBL collaboration. Interviews were conducted via Microsoft Teams in May 2023 and lasted between 20 and 35 minutes. All interviews were recorded and transcribed for analysis. Selection criteria included organizations that had participated in CBL collaborations with the University of Stavanger and individuals directly involved as challenge providers.

Table 1. Overview of interview participants and organizations
Source: Adapted from [22]

Code	Field of Activity	Date	Duration	Platform
CO1	Sustainable city development	03.05.2023	20 minutes	Microsoft Teams
CO2	Innovation	12.05.2023	35 minutes	Microsoft Teams
CO3	Financial services	16.05.2023	20 minutes	Microsoft Teams



CO4	Innovation	15.05.2023	24 minutes	Microsoft Teams
CO5	Autonomous solution	08.05.2023	20 minutes	Microsoft Teams
CO6	Business consulting	05.05.2023	20 minutes	Microsoft Teams

3.3 Data Analysis

The data were analyzed using thematic analysis. Interview transcripts were coded iteratively to identify recurring patterns and themes related to organizational experiences, perceived benefits, and challenges associated with CBL collaboration.

Thematic analysis followed an iterative coding process in which transcripts were read repeatedly to support familiarization with the data and identify recurring patterns in participants' descriptions of collaboration experiences. Initial codes were progressively grouped into broader thematic categories through comparison across the six cases, allowing common patterns and variations between organizational perspectives to be identified and refined.

The identified outcomes were grouped into themes such as access to knowledge, efficiency, reciprocity, and organizational reflection. Challenges were categorized into time constraints, feasibility, flexibility, and student motivation.

3.4 Ethical Considerations

Ethical guidelines were followed throughout the study, including informed consent and anonymization of participants. The study was approved by the relevant data protection authority.

4. Results And Discussion

4.1 Benefits and Outcomes of CBL Collaboration

The findings indicate that participation in Challenge-Based Learning (CBL) generate multiple forms of value for industry partners (Table 2). The most frequently reported outcome is access to new knowledge and perspectives, with four out of six organizations emphasizing the benefit of student contributions in approaching challenges from alternative viewpoints. This suggests that CBL can support exploratory thinking and idea generation within organizations, particularly during the early stages of problem identification.

A second key outcome is organizational reflection. Rather than producing immediately implementable solutions in all cases, CBL prompted companies to reassess internal processes, decision-making approaches, and strategic directions. Some participants reported that student contributions encouraged reconsideration of existing practices and assumptions, highlighting the role of CBL in facilitating reflection and dialogue within organizations. This finding aligns with broader perspectives on university–industry collaboration, which emphasize knowledge exchange and collaborative relationships between universities and industry partners [2].

In addition, participants identified benefits related to efficiency and human capital development. Student involvement supported preliminary analysis and idea generation, reducing the need for internal resource allocation. In some cases, participation also created opportunities for continued engagement and future collaboration (e.g., CO6), indicating the potential of CBL to support longer-term university–industry relationships. Similar patterns have been discussed in university–industry collaboration literature emphasizing knowledge exchange and collaborative relationships between universities and external organizations [3].

These findings suggest that the value of CBL lies not only in tangible outputs but also in cognitive and organizational effects, particularly reflection, learning, and collaborative interaction.

Table 2. Outcomes/Benefits of CBL collaboration for industry

Outcomes/Benefits	CO1	CO2	CO3	CO4	CO5	CO6	Cited frequency	Cited frequency (n=6) (%)	Most frequent (>60%)
Strategic institutional policy				X			1	17	



Access to students for internship or hiring					X		1	17	
Shortening product life cycle				X			1	17	
Human capital development	X	X			X		3	50	
Access to new knowledge	X	X	X	X			4	67	X
Solutions to specific problems	X	X	X		X		4	67	X
Access to research networks					X	X	2	33	

Source: Adapted from [22]

4.2 Challenges of CBL Collaboration

Despite these benefits, several challenges were identified (Table 3). The most significant limitation is time constraints, as organizations reported that the duration of a single academic semester is often insufficient for in-depth analysis and implementation. This highlights a structural mismatch between academic timelines and organizational expectations.

A second challenge concerns the feasibility of student-generated solutions. While student contributions were often creative, some organizations found them difficult to implement due to practical or resource-related constraints. This was particularly evident in cases where proposed solutions did not align with operational realities (e.g., CO3), reflecting the tension between exploratory learning processes and organizational implementation requirements.

Participants also noted issues related to flexibility and alignment. For example, some organizations expressed concern that the structured nature of CBL limits adaptability when challenges evolve over time (e.g., CO1). In addition, variability in student motivation and communication was identified as a factor influencing the quality of collaboration, with some participants reporting inconsistent levels of engagement. Similar implementation-related challenges have been discussed in previous CBL research, particularly in multidisciplinary and practice-oriented learning environments [20]. These findings suggest that while CBL facilitates interaction between universities and industry, its effectiveness depends on alignment between project design, organizational expectations, and student engagement.

Table 3. Challenges of CBL collaboration for industry

Source: Adapted from [22]

Challenges	CO1	CO2	CO3	CO4	CO5	CO6	Cited frequency	Cited frequency (n=6) (%)	Most frequent (>60%)
Time constraints	X	X					2	33	
Flexibility	X						1	17	
Feasibility			X				1	17	
Student motivation	X		X				2	33	
Lack of communication				X			1	17	

4.3 Balancing Benefits and Limitations

Across all cases, organizations generally perceived the benefits of CBL as outweighing its limitations, particularly when evaluated from a long-term perspective. Participants recognized that CBL is embedded within an educational context and therefore assessed its value not only in terms of immediate outputs but also in relation to future collaboration, knowledge exchange, and recruitment opportunities.

Importantly, the perceived value of CBL was influenced by the scale and nature of the challenge. Smaller, well-defined problems were more likely to produce actionable outcomes, whereas broader challenges tended to generate conceptual insights and reflective value. Some participants emphasized that large or complex challenges resulted in useful perspectives rather than direct solutions, while more focused tasks allowed for more tangible outcomes.

These findings indicate that the effectiveness of CBL depends on careful alignment between challenge scope, stakeholder expectations, and the structure of the learning process. This is consistent with previous

CBL research emphasizing the importance of challenge design, collaboration, and structured learning processes within practice-oriented environments [8].

5. Conclusion and Implications

5.1 Conclusion

This study examined the role of Challenge-Based Learning (CBL) in university–industry collaboration by focusing on the perspectives of organizations acting as challenge providers. The findings indicate that participation in CBL may generate value for industry partners primarily through access to new knowledge and perspectives, support for early-stage problem exploration, and opportunities for organizational reflection. While these outcomes do not always lead to directly implementable solutions, they contribute to broader learning and collaborative processes within organizations [2], [3].

At the same time, several challenges were identified, including time constraints, feasibility of student-generated solutions, and variability in student engagement. These challenges reflect structural differences between academic contexts and organizational expectations. Despite these limitations, all participating organizations perceived the overall value of CBL positively, particularly from a long-term perspective related to knowledge exchange and future collaboration.

Overall, the findings highlight the dual role of CBL as both a pedagogical approach and a collaborative mechanism that supports interaction between universities and external stakeholders.

5.2 Theoretical Implications

This study contributes to the literature on university–industry collaboration by extending the understanding of Challenge-Based Learning beyond its traditional focus on student learning outcomes. While previous research has primarily emphasized educational benefits, the present study highlights the role of CBL as a mechanism for collaborative knowledge exchange and interaction between universities and industry partners [4], [7].

By focusing on the perspectives of external stakeholders, the study provides empirical insight into how CBL can facilitate organizational reflection and early-stage innovation processes. The findings also emphasize the role of students as active contributors to knowledge exchange, aligning with broader perspectives on collaborative and practice-oriented learning environments [6], [8].

In this way, the study positions CBL as an integrative approach that connects education, collaboration, and innovation, contributing to the evolving societal role of higher education institutions.

5.3 Practical Implications

The findings offer practical insights for both universities and industry partners involved in CBL initiatives. For universities, the results highlight the importance of designing clearly defined and manageable challenges that align with both educational objectives and organizational needs. Structured coordination, clear communication, and alignment of expectations are essential to enhance collaboration effectiveness. For industry partners, participation in CBL can provide access to new perspectives, support exploratory thinking, and create opportunities for engagement with future talent. However, organizations should view CBL primarily as a process that supports reflection, learning, and idea development, rather than immediate implementation of solutions.

Furthermore, the findings suggest that the effectiveness of CBL depends on the scope and complexity of the challenge. Smaller and well-defined challenges are more likely to result in actionable outcomes, while broader challenges tend to generate conceptual insights and support strategic reflection [8].

5.4 Limitations and Future Research

This study has several limitations. First, the empirical sample is limited to six organizations, which may affect the transferability of the findings. Second, the study is conducted within a specific collaborative context, which may limit generalizability to other settings. Additionally, the findings rely on self-reported perceptions, which may introduce subjective bias.

Future research could extend this study by including a larger and more diverse sample across different industries and geographical contexts. Further studies could also incorporate perspectives from additional stakeholders, such as students and academic staff, to provide a more comprehensive understanding of CBL as a collaborative approach. In addition, quantitative or mixed-method research designs could be applied to assess the broader impact of CBL on university–industry collaboration outcomes.

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APPENDIX A INTERVIEW GUIDE

1. Warming up/Engagement questions:
 - Introduction of researchers, supervisor, co-supervisor, topic, and main question of the research
 - Asking the interviewees to introduce their organization (challenge provider), professional background, title, and date of CBL program, their role, and tasks in the CBL
 - Terminological clarifications: CBL (challenge-based learning), UIC (university industry collaborations), etc.
 - Explaining different stakeholders/actors of CBL: industry, educational part (academia and students), and society
2. Exploration of present aspects:
 - How did you identify the challenge? Was it a predefined challenge or did CBL learners help you to recognize it? Ask follow-up questions about the limitations/facts while finalizing the challenge.
 - Tell us more about your experience in CBL as a challenge provider. What was the motive behind engaging in a CBL collaboration?
 - Tell us more about the exchange of resources on the company side.
 - What were the benefits/outcomes of CBL for you at an institutional level? Asking follow-up questions to be able to categorize the benefits in one of the main groups
 - What were the benefits/outcomes of CBL for you on an individual level? Asking follow-up questions to be able to categorize the benefits in one of the main groups
 - What were the negatives of CBL for you on an institutional level? Asking follow-up questions to be able to categorize the benefits in one of the main groups
 - What were the negatives of CBL for you on an individual level? Asking follow-up questions to be able to categorize the benefits in one of the main groups
 - What is your thought or plan with the solution you have got from the students?
 - All in all, do you think the benefits outweigh the negatives?
3. Exploration of future aspects and exit questions:
 - What could be done to improve the negatives and increase the positive outcomes
 - Would you or your organization prefer to participate in CBL going forward?
 - Summarization and asking if any other point remains to be mentioned?

Thank you very much for your time indeed