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Student Upskilling and Industry Value in the INDUSAC Project: Evidence from Quick, Challenge-Driven Co-Creation Mechanism

The INDUSAC project, launched in 2022 under Horizon Europe, connected industry and academia by involving students in solving real-world problems. Coordinated by the Jožef Stefan Institute, INDUSAC paired companies with international, interdisciplinary teams of students for co-creation projects lasting 4–8 weeks, based on multiple calls for applications. This article evaluates student engagement across three call periods – February to May 2024, June to October 2024, and November 2024 to July 2025 – using surveys before and after the projects. Results showed high initial student confidence and measurable improvements in skills such as negotiation and international teamwork. Satisfaction with the process and online platform increased among both students and companies, indicating effective adaptation based on feedback. While companies appreciated student creativity, they expressed a need for greater market viability. These findings validate INDUSAC's co-creation mechanism, enhancing knowledge transfer while fostering an environment that prepares students for successful global careers.

Keywords: student upskilling, industry value, INDUSAC project

Izpopolnjevanje študentov in vrednost za industrijo v projektu INDUSAC: dokazi iz hitrega, izzivno usmerjenega mehanizma soustvarjanja

Projekt INDUSAC, vzpostavljen leta 2022 v okviru programa Obzorje Evropa, je povezoval industrijo in akademsko sfero z vključevanjem študentov v reševanje realnih problemov. Projekt, ki ga koordinira Institut »Jožef Stefan«, je podjetja povezoval z mednarodnimi, interdisciplinarnimi ekipami študentov za projekte soustvarjanja, ki so trajali 4–8 tednov in so temeljili na več razpisih za prijave. Prispevek preko analize anketnih odgovorov pred in po izvedbi projekta vrednoti vključenost študentov v treh razpisnih obdobjih od februarja do maja 2024, od junija do oktobra 2024 ter od novembra 2024 do julija 2025. Rezultati kažejo visoko začetno samozavest študentov ter merljive izboljšave veščin, kot sta pogajanje in mednarodno timsko delo. Zadovoljstvo s procesom in spletno platformo se je povečalo tako med študenti kot podjetji, kar kaže na učinkovito prilagajanje na podlagi povratnih informacij. Čeprav so podjetja cenila ustvarjalnost študentov, so izrazila potrebo po večji tržni izvedljivosti rešitev. Ugotovitve potrjujejo učinkovitost mehanizma soustvarjanja INDUSAC, ki krepi prenos znanja in hkrati vzpostavlja okolje, ki študente pripravlja na uspešne globalne kariere.

Ključne besede: izpopolnjevanje študentov, vrednost za industrijo, projekt INDUSAC



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Introduction

The collaboration between industry and academia is widely acknowledged as a key factor driving innovation, knowledge transfer, and competitiveness across Europe. Initiatives such as the EIT Knowledge and Innovation Communities (KICs) and Erasmus+ illustrate the benefits of integrating academic knowledge with practical industrial applications. Research highlights the importance of student involvement and persistent organisational challenges (Kempf et al. 2023; Bastian et al. 2024). Traditional collaboration models are time-consuming, resource-intensive, and less accessible to EU-widening countries. Evidence on short, challenge-driven projects and their evaluation remains limited, despite recognition that transversal skills (communication, negotiation, conflict management, analytical/critical thinking, teamwork, creativity, time management, international collaboration) are vital for employability and difficult to cultivate in classroom environments (Ejubovic et al. 2019). Furthermore, the evaluation of these short-term collaborations is not sufficiently developed, especially in measuring engagement and response rates (Rossoni et al. 2024). In addition to skill development, collaboration also promotes knowledge transfer through knowledge sharing, problem-solving, and cross-border learning. Prior research indicates that while both universities and industries value collaboration, students often participate only indirectly through workshops or mediated research initiatives, limiting their exposure to real-world industrial challenges (Morrison and Pattinson 2020; Ratten 2016). INDUSAC specifically addresses this issue by directly involving students in co-creation processes with industry, fostering not only skill development but also significant knowledge transfer (Cunningham and Link 2014).

In this context, research institutes and universities serve as key mediators of knowledge transfer and innovation, particularly through collaboration with industry on student-driven projects. Students serve as flexible carriers of emerging knowledge and methods, while institutions provide the structures and networks needed to translate their work into scalable solutions. Co-creation frameworks increasingly show how student participation helps transform disciplinary knowledge into applied, socially relevant outcomes, highlighting their central role in academia–industry collaboration.

This study assesses INDUSAC, a Horizon Eu-

rope project (2022–2025), arguing that brief, human-centered projects not only bolster students' skills but also yield innovative solutions for companies. By focusing on students' participation in these collaborations, the study contributes to theoretical and practical debates on how universities and research institutes promote knowledge transfer and social innovation. Our analysis contributes in two ways: first, by evaluating student skill development and company satisfaction with solutions through pre- and post-project surveys; and second, by placing INDUSAC within broader discussions of effective collaboration and knowledge transfer.

Project Context

Funded by Horizon Europe (Grant Agreement No. 101070297), INDUSAC fostered rapid, challenge-driven collaboration between academia and industry (Odić et al. 2023a; 2023b; 2024; Kunej et al. 2025). Coordinated by the Jožef Stefan Institute, the INDUSAC project consortium included universities, research institutes, clusters, and companies. International, interdisciplinary teams of 3–6 students and researchers addressed company challenges over 4–8 weeks, gaining practical experience while promoting cross-border cooperation. Attention was given to inclusiveness, gender balance, and the participation of both EU member states and associated countries, with a focus on EU widening countries. Financial support was provided by the Horizon Europe programme for students who successfully completed projects.

Throughout the three periods, companies published 251 challenges. Student and researcher teams submitted 232 motivation letters, and 159 projects were completed. This combination of student development and industrial collaboration highlights INDUSAC's dual contribution to employability and knowledge transfer.

Methods

The evaluation of the INDUSAC project utilized surveys administered to students and researchers before and after each co-creation project, as well as to companies after each project. The aim was to capture changes in skills, satisfaction with the process, and company evaluations of the solutions produced.

Survey design. In a single questionnaire administered pre- and post- co-creation projects, participants rated their soft skills (communication, negotiation, conflict management, analyt-

ical/critical thinking, teamwork, creativity, time management, international collaboration) on a 1–5 Likert scale and completed a method-proficiency checklist (SWOT, Personas, Trend/Scenario, Cost–Benefit, Product-Portfolio/BCG, White-Spot, Value Proposition, Marketing Strategy, Business Model Canvas, Business Plan, PSS design, idea detection, Empathy/Kano, and prototyping), recorded as Yes/No familiarity. After the co-creation project completion, participants filled the post-project questionnaire covering the INDUSAC process and platform (usability, clarity of instructions, and available support). In parallel, companies completed a post-solution survey assessing the delivered work on creativity/innovativeness, relevance and market potential, quality of work and teamwork, and their own satisfaction with the process and platform.

Participation and evaluability rate. Across the three INDUSAC call periods – February to May 2024, June to October 2024, and November 2024 to July 2025, more than 500 students and researchers participated. Students and researchers came from across the EU. We received 71, 61, and 430 valid pre-project responses, and 56, 44, and 431 valid post-project responses in the first, second, and third period, respectively. This corresponds to 86% pre-project and 67% post-project response rates in the first and second period, and 93% pre-project and 76% post-project in the third period, showing strong engagement at the outset and some attrition due to survey fatigue. Companies provided 9 valid responses in the first, 8 in the second, and 81 in the third period.

Data analysis. Survey responses were analysed with descriptive statistics. Improvements in competencies were calculated as percentage differences between average pre- and post-scores on a five-point Likert scale.

The mixed-survey methodology utilized in this study allowed for comparisons between student self-assessments and companies' feedback. This approach offers a comprehensive perspective on INDUSAC's effectiveness in promoting skill development and achieving beneficial outcomes.

Results

The analysis of the INDUSAC project involved examining survey data collected from participating students, researchers, and companies. This section presents results related to participant engagement, skill enhancement, proficiency with methods, satisfaction with the INDUSAC

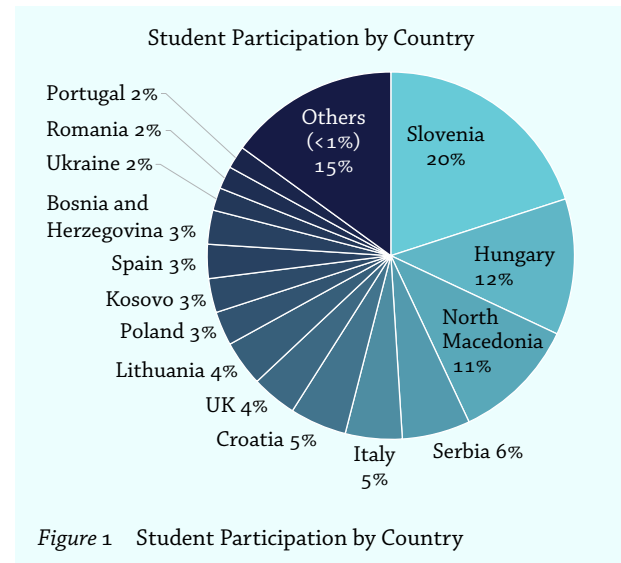
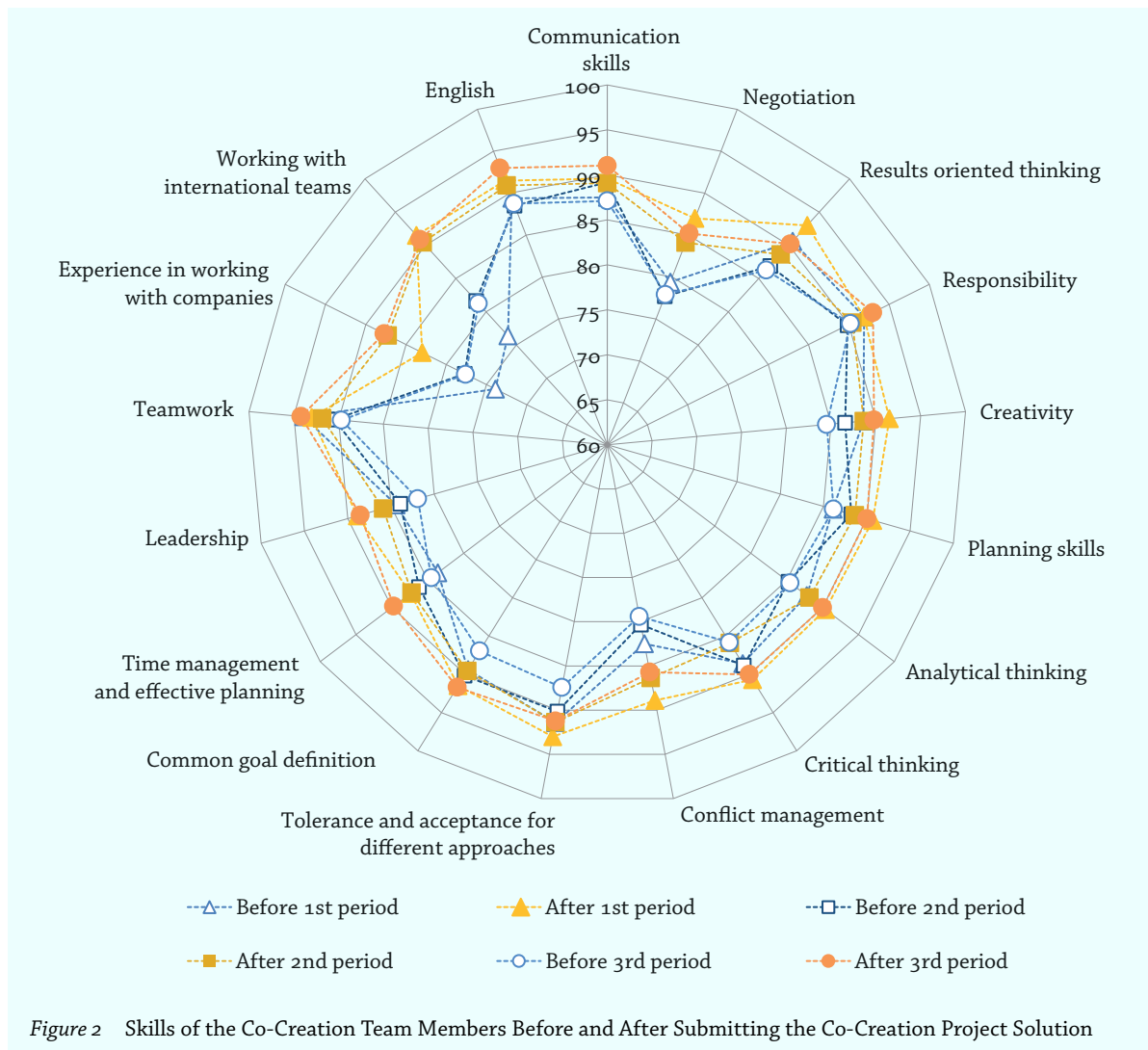


Figure 1 Student Participation by Country

platform and process, and company evaluations of delivered solutions. These factors collectively provide an assessment of the INDUSAC project's effectiveness in achieving its objectives of enhancing student capabilities, developing innovative solutions to industry challenges, and fostering collaborative relationships between academia and industry.

Participant engagement. Students from a broad range of countries participated in the project (fig. 1), with participation measured as the share of total participants by country of residence. The analysis reflects overall representation rather than the absolute number of students, as individuals could participate in up to three co-creation teams. The largest shares came from Slovenia ($\approx 20\%$), Hungary ($\approx 12\%$), North Macedonia ($\approx 11\%$), and Serbia ($\approx 6\%$), followed by contributions from Croatia, Italy, Lithuania, the UK, Bosnia and Herzegovina, Spain, Kosovo, and Poland. Countries with $\leq 1\%$ participation each – including Morocco, Albania, Cyprus, Georgia, Israel, Malta, Finland, France, Slovakia, the Netherlands, Austria, Belgium, Moldova, Tunisia, Greece, Ireland, Türkiye, Bulgaria, Czechia, Germany, and Montenegro – are grouped under 'Others'. Most participation originated from widening and associated countries, indicating that the mechanism's inclusivity criterion was effectively met.

Skill development. A core goal of the INDUSAC project was to strengthen transversal skills relevant to employability and collaborative innovation. Students and researchers assessed their own competencies in 17 areas, including communication, planning, analytical and critical thinking, teamwork, negotiation, conflict man-

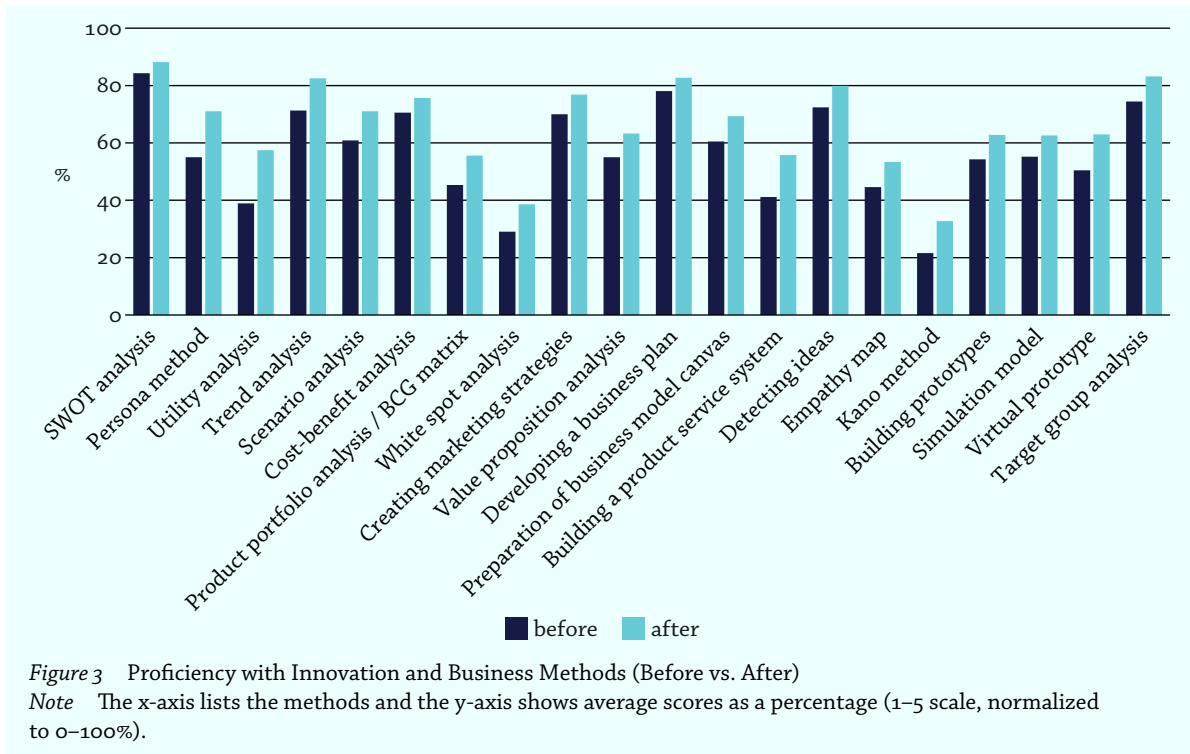


agement, leadership, time management, responsibility, international teamwork, and experience working with companies. Before participating in the co-creation projects, participants already rated themselves highly across most skills – typically around 85–90%, reflecting strong initial self-confidence. After completing the projects, self-assessed skill levels increased further across almost all areas in all three periods, with an overall average improvement of approximately 4%, as shown in figure 2. The most pronounced improvements were observed in negotiation (7 percentage points), conflict management (6 percentage points), experience in working with companies (9–10 percentage points), and working with international teams (up to 15 percentage points). These areas consistently showed visible gains from ‘Before’ to ‘After’ in each period (fig. 2). Such gains are directly aligned with INDUSAC’s design, which places participants in short (4–8-week) real-company challenges in international, gen-

der-balanced teams. Smaller increases were also observed in communication, time management, and leadership, indicating that participants not only contributed to the final solution but also practiced coordination, accountability, and planning under time pressure.

The radar chart shows self-assessed competence before and after participation across three periods. Skills are arranged around the rim; the axes indicate average values on a 1–5 scale expressed as percentages. Separating ‘Before’ and ‘After’ lines allows comparison of the change.

Proficiency with innovation and business methods. Beyond transversal skills, participants reported clear improvements in their proficiency in the methods used for innovation and business design, shown in figure 3. Baselines were typically ~50–70%, with some techniques lower (~20–45%). After participation, proficiency in most methods increased by ~10–20 percentage points, while proficiency in tools introduced through



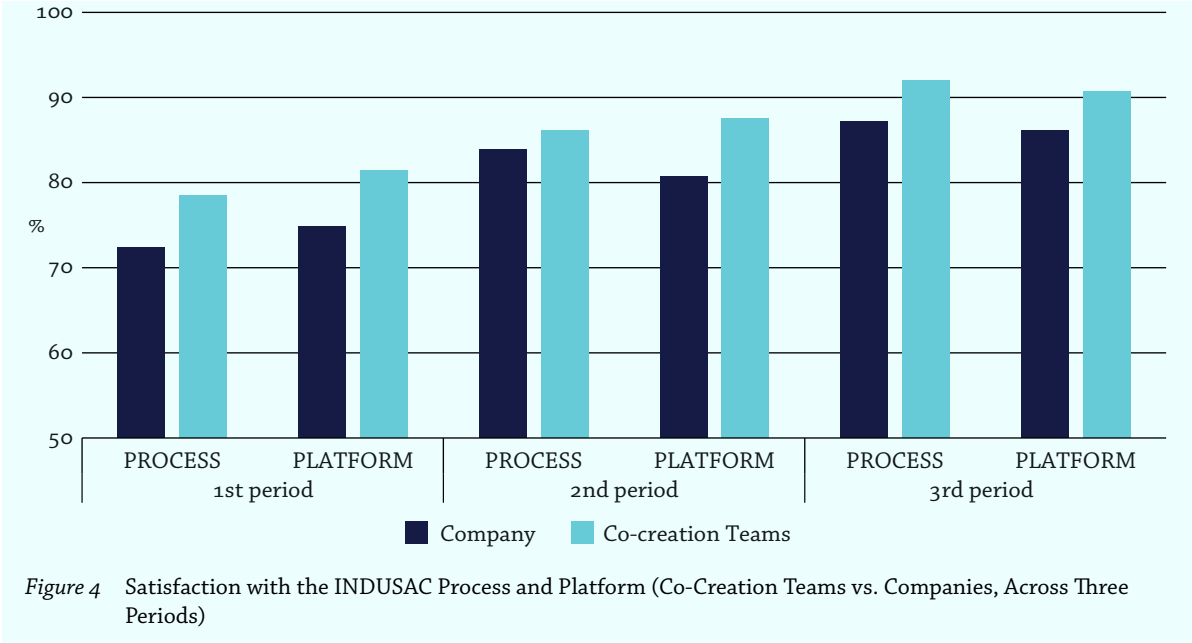
hands-on project work – such as white-spot analysis, Kano method, idea detection, and prototyping (physical/simulation/virtual), rose by ~20–35 percentage points. Proficiency in strategic and planning methods (SWOT, Scenario analysis, Value Proposition, Business Plan, Business Model Canvas) reached post-levels of 75–90%, and marketing/portfolio methods (Persona, Trend analysis, Creating marketing strategies, Product-portfolio/BCG) typically improved by 10–20 percentage points. These patterns indicate that INDUSAC strengthens both collaboration capabilities and the practical toolset needed to deliver company-valued outcomes within short project phases.

In a few skills, post-project scores were slightly lower than pre-project scores. Rather than indicating a loss of competence, this can reflect recalibration: participants may reassess themselves more realistically after exposure to real industrial expectations and multi-national teamwork. Overall, these results show that even in a short co-creation format, participants report meaningful development in company-facing and collaboration-facing skills, which are critical for transition into professional environments.

These results address a gap often noted in the literature (Kempf et al. 2023; Bastian et al. 2024; Ejubovic et al. 2019). Many industry-academia formats claim learning benefits, but few provide systematic pre- and post-evidence for short-

term interventions. Here, even compact 4–8-week projects yielded tangible, quantifiable improvements, most prominently in international teamwork and direct company interaction. These gains are not only educational outcomes; they are foundational to knowledge transfer, because negotiation, conflict resolution, and cross-cultural collaboration are the skills that enable students and researchers to translate academic insight into solutions organisations can adopt in practice.

Satisfaction with process and platform. Post-project results show a steady rise in satisfaction across three periods for both co-creation teams and companies (fig. 4). In the 1st period, teams reported ~78% (process) and ~81% (platform), while companies reported ~72% and ~75%, respectively. By the 2nd period, satisfaction increased to ~85–87% for teams and ~80–84% for companies. In the 3rd period, teams reached ~92% (process) and ~91% (platform), and companies reached ~87% and ~86%. Teams consistently rated satisfaction higher than companies, with gaps of about 5–7 percentage points, narrowing to ~5 percentage points by the final period. The upward trend indicates effective iterative improvements to both the process and the platform, particularly around usability, guidance, and overall support. These outcomes reinforce the importance of iterative refinement (Bastian et al. 2024). They also underline how digital platforms can serve as ena-



blers of knowledge transfer by keeping collaboration materials, feedback, and ideas accessible for later development.

In figure 4, the x-axis groups Process and Platform ratings for the 1st, 2nd, and 3rd periods; the y-axis shows the percentage of satisfied respondents. For each category, paired bars compare Co-creation Teams and Companies. Satisfaction rises from period 1 to period 3 for both participant groups, highlighting overall improvements.

Company evaluations. Company ratings of the co-creation team's solutions and work improved consistently across the three periods (fig. 5). In the 1st period, scores ranged 67–78%. The strongest items were relevance and quality of work (both 78%), indicating acceptable fit-to-brief and delivery quality at baseline, while innovativeness and market potential (both 67%) lagged, suggesting uneven novelty and limited commercial readiness. Overall satisfaction was 78%. In the 2nd period, a broad uplift moved most criteria into the mid- to upper-80s: innovativeness, creativity, soundness, quality of work, and satisfaction were 88%; improvement and market potential were 83%; and relevance was 80%. These gains point to clearer deliverables and closer alignment with company expectations, with notable jumps in novelty, methodological soundness, and execution quality. Overall satisfaction increased to 88%. By the 3rd period, ratings stabilized near 90% across most items: quality of work at 91%, satisfaction at 92%, relevance at 90%, and soundness at 89%. Innovativeness (87%) and creativity (88%) remained high, while market potential

(85%) improved further but continued to lag execution-focused criteria. Overall, the trajectory from period 1 → 2 shows a step-change improvement ($\approx +8$ –21 percentage points vs. period 1), followed by incremental gains from period 2 → 3 ($\approx +3$ –10 percentage points vs. period 2), consistent with a maturing mechanism. Market potential remains the most conservative dimension, indicating that earlier market testing and more robust feasibility framing are the primary levers for further progress.

Of the categories surveyed, Innovativeness, Creativity, Improvement over existing solutions, Market Potential, and Relevance refer to the solution delivered by the co-creation team, whereas Soundness, Quality of Work, and Satisfaction refer to the work done by the co-creation team. The x-axis shows company evaluations from the first, second, and third periods, while the y-axis shows the percentage of company representatives who expressed satisfaction.

These observations confirm earlier feasibility analyses (Odić et al. 2024; Kunej et al. 2025), which reported that while companies were enthusiastic about student creativity, they sought clearer communication and stronger connections to practical outcomes. The trend observed here – increased satisfaction after methodological refinements – indicates that INDUSAC has matured and better aligns with company expectations. Importantly, by providing innovative but not always fully market-ready solutions, INDUSAC lays the groundwork for knowledge transfer: student ideas and prototypes can be refined with compa-

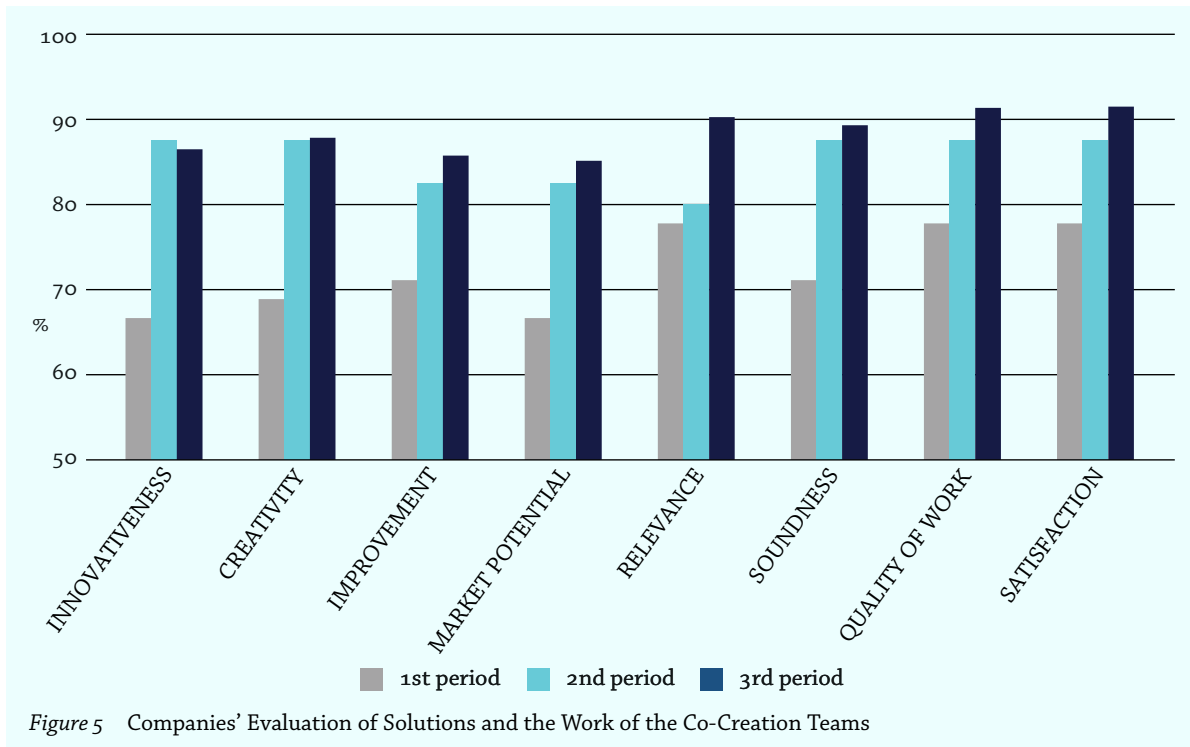


Figure 5 Companies' Evaluation of Solutions and the Work of the Co-Creation Teams

ny support into sustainable industrial outcomes.

Discussion

The findings of the INDUSAC project show that short, challenge-driven co-creation formats can effectively benefit both academic teams and companies. Although participants entered with high self-assessed competencies (86%), they still demonstrated meaningful gains – particularly in negotiation, conflict management, international teamwork, and experience working with companies – skills that typically require real-world engagement. These improvements confirm the value of experiential learning and show that the format supports development regardless of initial skill level.

Method proficiency advanced similarly. Most tools increased by 10–20 percentage points, while less familiar methods such as white-spot analysis, Kano, and prototyping rose by 20–35 points. This shows that short project phases can rapidly introduce and consolidate analytical and design-oriented methods, enabling students and early-career researchers to act as dynamic knowledge intermediaries capable of applying new tools in industrial contexts.

Company evaluations reinforce the effectiveness of the mechanism. Satisfaction rose steadily from Period 1 (67–78%) to the mid-80s in Period 2 and then stabilized around 90% in Period 3 for the relevance, soundness, and quality of work.

Companies repeatedly highlighted the clarity and usability of deliverables, analyses, canvases, prototypes, and business rationales, which served as actionable knowledge carriers beyond the project itself. Regular checkpoints and clear criteria supported insight absorption, ownership assignment, and next-step planning, helping transform co-creation from a one-off activity into a structured knowledge-transfer pipeline.

Interpersonal skill development also shaped project success. Improved negotiation, conflict resolution, and cross-cultural collaboration enabled teams to communicate constraints, justify trade-offs, and refine solutions jointly, behaviours that support the adoption of new ideas in organisational settings. These behaviours show that students contribute not only technical content but also the relational work needed for effective knowledge transfer.

While market potential improved into the mid-80% range, it remained the most conservative dimension. Companies pointed to the value of early validation activities, problem–solution fit interviews, quick competitor scans, and basic market sizing, to advance promising concepts toward implementable solutions. This gap reflects the complementary roles of universities/research institutes and industry partners: students provide creativity and analytical rigor, while companies contribute contextual feasibility and market insight.

Taken together, these observations show that the INDUSAC project strengthens not only student competencies but also the knowledge-transfer mission of universities and research institutes. Students' performance in real company challenges demonstrates the project's potential to teach new skills beyond university education and support structures, preparing them for applied innovation work. By enabling students to apply academic tools, methods, and theoretical knowledge in practice, universities contribute directly to socially and economically valuable outcomes. Overall, rapid, human-centered co-creation provides a scalable and inclusive model for university–industry collaboration. By involving students directly in real-world challenges, the mechanism supports innovation, enhances professional readiness, and advances the broader societal mission of universities and research institutes within contemporary innovation ecosystems.

Conclusions

This study shows that the INDUSAC project effectively engaged students in rapid, challenge-driven collaboration with companies, positioning them as key contributors to knowledge transfer and innovation. These outcomes also reflect the important role of universities and research institutes, whose educational and support structures enable students to apply emerging knowledge and methods in real industrial contexts. Students demonstrated notable gains in negotiation, conflict management, and international teamwork, confirming the value of experiential, real-world collaboration for developing skills essential to innovation processes. Companies' increasingly positive evaluations further show that student teams, supported by university-based training and frameworks, can deliver creative, relevant, and analytically robust outputs. Strong participation and high performance across the EU widening and associated countries highlight the model's inclusiveness and scalability. At the same time, iterative improvements to the process strengthened the translation of academic insights into usable industrial or social outcomes. Overall, the INDUSAC project offers a replicable approach in which short, student-centered collaboration strengthens both employability and the knowledge-transfer mission of universities and research institutes. By preparing students to address real-world company challenges, universities expand their impact within European innovation ecosystems and contribute directly to

innovation and the creation of industry-relevant knowledge.

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