Challenge4Impact

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FROM OUTPUT TO IMPACT
IN ENTREPRENEURSHIP AND SUSTAINABILITY EDUCATION

Guidelines for Evaluating and Improving
Student-Business-Challenges

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CONTENTS

1 INTRODUCTION

Universities are called upon to qualify students of all disciplines for global sustainable development. On the one hand, this means imparting specialist knowledge relevant to sustainability within the individual field of study, and on the other hand, promoting the willingness and ability **to take action** for transformation. One learning approach that supports these objectives is **Challenge-based Learning**.

The core idea of Challenge-based Learning (CBL) is to get students to learn on relevant real-world problems which need to be solved. Lecturers should enable them to analyze the overarching situation and to derive a challenge they want to solve ("to engage with the problem"). Elaborating solutions needs transdisciplinary knowledge and collaboration. One of the main skills students need to gain is the ability to find appropriate questions and research the answers ("to research the challenge"). Last phase in CBL is called "acting" and means students should implement their solutions and make the results public[1].

What is new about the CBL approach, however, is that multiple stakeholders instead of solely lecturers support students as co-researchers (or co-innovators) and that it is often embedded in actual innovation and entrepreneurial activities. The role of teaching staff is to coach and enable students to find good solutions

In the approaches pursued in Challenge4Impact, a concretisation is made to the effect that the stakeholders are, in particular, entrepreneurs and innovation managers of start-ups or of etablished companies of any size. Thus, the pure teaching-learning approach of CBL is extended by a transfer and innovation component. The learning approach described focuses on learning through entrepreneurship. By learning through entrepreneurship, students should be motivated and enabled to take action in innovation processes (either in the corporate environment or in their own start-up processes) that aim at solving real-world problems related to sustainability.

These formats are rather time-consuming and resource-intensive and depend on the commitment of teaching personnel involved. But, what are the effects of this approach to teaching and learning – both on the students and on the participating companies? What is the long-term impact beyond these groups?

In these guidelines we address the impact of student-business co-innovation in the in the field of sustainable entrepreneurship education.

The concept of collaborative innovation (co-innovation) between universities and business is still relatively new and requires substantial human and, in some cases, financial resources for teaching and transfer programmes. Nevertheless, enthusiastic teachers at various European universities are organising such programmes or extra-curricular activities. However, little is known about the impact of these activities[2]. This applies both to the medium-term effects (output) on the target group of students and participating practitioners, and to the longer-term system effects (impact) beyond these target groups. As CBL, and in particular the co-innovation formats studied here, claim to have an impact in the field of entrepreneurship and sustainable education, it is also necessary to examine the extent to which this impact claim can be fulfilled.

The guidelines should help those actors, which are responsible for or interested in:

- **Conceptualizing formats of co-innovation between students and business**
- **Conducting and teaching Student-Business Challenges**
- **Participating in Student-Business Challenges as challenge provider or innovation partner**
- **Organizing and scaling knowledge transfer at higher education institutions**
- **Learning more about the relevance, the conceptual foundation, needs and requirements of practitioners for impact monitoring and management.**

In this guide, we provide a conceptual basis and describe specific steps to get started.

Table 1: Potential benefits from impact management

How can all the different actors benefit specifically from engaging with and managing the effects of Student-Business Challenges?

For **university teachers** impact management

* helps to improve modules and teaching processes through evidence-/data-based learning
* supports the joint formulation of challenges and its goals with the innovation partner
* supports communication with innovation partners from acquisition to impact management
* supports coaching of students
* helps to prove what teaching (CBL) achieves

Students benefit from impact management because it

* supports project management and individual learning processes
* improves impact orientation of CBL projects
* provides a follow-up on what becomes of the innovation project

University and transfer management benefit form impact management because it

* provides data of transfer effects of CBL teaching activities, that supports university and sustainability reporting
* enables internal and cross-university benchmarking (learning from other formats and/or other universities)

Challenge providers / innovation partners benefit from impact management because it

* supports impact-oriented innovation management
* provides facts for acceleration of innovation
* improves understanding of the impact of innovative solutions as well as of co-innovation and collaboration with universities
* supports the co-innovation process with students
* supports the traceability of innovation ideas and cooperation projects
* provides data for integration into sustainability reports
* supports knowledge management.

How is this guide structured?

In Section 2, the stage is set and the concept of Challenge-based Learning and co-innovation in Student-Business Challenges is briefly explained. To ensure the practical relevance of our guidelines, we interviewed various stakeholders, who have run Student-Business Challenges. The results of this interview study are included in Section 3. Section 4 reflects on the question who benefits from monitoring the impact of Student-Business Challenges. In Section 5 different steps and methods for evaluating and improving outcomes and impacts are introduced. Section 6 deals with evaluation tools and possibilities for teachers to get support.

2   *FOUNDATIONS*

2.1   Challenge-based Learning

Challenge-based Learning (CBL) is a teaching-learning approach that "starts with wicked, open and sustainability-related real-life challenges that students, in cross-disciplinary teams, take on their own way and develop into innovative and creative solutions, presented in open forums" [3]

It was first described in a publication by and was later taken up and further developed by the Project "Apple Classrooms of Tomorrow - Today" [4]. Nichols et. al developed a framework for Challenge-based Learning that is used in its elementary basic components in many different shapes of CBL (2016). Core idea of the concept is that students learn to solve "real world problems" (that require real solutions) while asking good questions, exploring the subject by themselves and working together with different stakeholders. Students take "ownership" of the projects they are interested in, develop possible solutions, implement the solutions and evaluate them [6]. Expected outcomes are open, creative, contextual and innovative solutions.

A challenge in this sense is "an activity, task, or situation that represents an incentive and an obstacle to overcome and that requires the development and application of diverse, inter-, and multidisciplinary knowledge to be solved. The challenge triggers the generation and application of new knowledge and the necessary tools or resources" [6].

According to Nichols et al. (2016) CBL follows three generic phases:

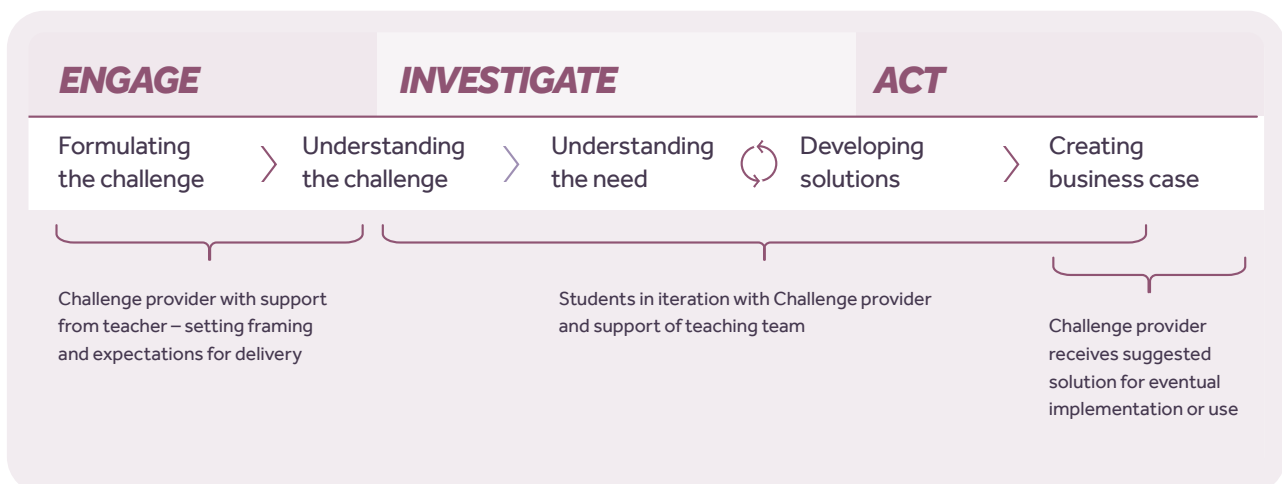1) *ENGAGE*
2) *INVESTIGATE*
3) *ACT*

Figure 1: Phases and roles of Challenge-based Learning (based on Eldebo & Hjelm, 2024)

While many scholars describe the learning potential of the approach (often the challenge is then defined by teachers), others deepen the understanding of the involvement of external stakeholders (challenge is defined and supported by external stakeholders, for instance by companies)[7].

The latter can be seen as a co-innovation process between students and companies. In this case, the external challenge provider formulates an actual challenge or an actual sustainability-related problem that is to be solved within an innovation process. The business partner usually intends to develop an innovative solution, which is then to be driven forward in an internal or joint process. In the best-case scenario, a business model is created. However, Challenge-based Learning goes beyond pure learning and entails the intention of ac-celerating and successfully implementing the business partner`s innovation project.

While conventional innovation processes within companies do not allow to include external actors into companies' research, the open innovation paradigm seeks actively for participation of external actors such as customers, researchers, suppliers or other stakeholders. Including students as a new actor into processes of idea generation and innovation helps to cross boundaries between Higher Education (and its up to date academia knowledge) and companies. Companies gain a fresh external perspective on their issues and not only learn from students' world views and values, but also gain access to potential future specialists. So CBL can be seen as a cross-border connection between the education and innovation systems (boundary spanning).

Eldebo, K. & Hjelm, O. (2024): **Handbook on Co-designing Student-Business Sustainability Challenges – Setup, Digitalization, and Internationalization.** Linköping.

The Challenge-based Learning framework www.challengebasedlearning.org

Ambrosi, G. & Hermsen, E. (2023): **Implementing Challenge-based Learning for university teachers.** University of Twente, ECIU University.

2.2   Student-Business Challenges as co-innovation

A **Student-Business Challenge** is a specific format of Challenge-based Learning in which **a business partner provides a real-world, innovation-related problem** or question (the challenge), which is then worked on by students who attempt to develop a solution or answer to the challenge.

The process of developing potential innovation solutions and testing them (customer feedback, economic feasibility etc.) is highly interactive and involves intensive dialogue and collaboration between the business partner and the students (workshops, interviews, pitches, etc.) and is facilitated by faculty who act as learning coaches and provide methodological and content skills.

The complex stakeholder system of Student-Business Challenges is presented in Figure 2 (next page).

In practice, different types of Student-Business Challenges can be found: Challenges that are an integral part of study programmes or modules (long-term challenge, lasting up to one semester or more, often integrated into curricula) and Student-Business Challenges that focus more on specific aspects of idea generation or the acquisition of specific competences (often short-term - up to two days, often extracurricular). Through the use of digital and web-based tools, the programme can also be conducted online, with international participation of students and teachers from different universities and countries.

Some, but not all Student-Business Challenges are organized or supported by university-internal or university-external intermediaries. These are university internal units (e.g. entrepreneurship center or transfer offices) or university external professionals, who support lecturers, students and business partners in many different ways.

A presentation of various good practice examples of support services can be found in Widrat & Fichter (2024).

Understanding challenge and needs, ideation, piloting, business model development etc.

TEACHING STAFF — Teaching / Coaching → **STUDENT TEAMS** — **CO-INNOVATION** to solve real-world sustainability challenges — **INNOVATION MANAGER** as challenge owner — Facilitating / Implementing → **BUSINESS PARTNER** as challenge provider

Formulating the challenge, aligning to students capabilities, expectation management and moderation

UNIVERSITY INTERNAL SPHERE
Entrepreneurship centre and transfer offices

General support
e.g. scouting & recruiting

Company-related support
Defining challenges, deliverables

Student & teacher-related support
e.g. matchmaking, evaluation

UNIVERSITY EXTERNAL SPHERE
Public and private service provider

General support
e.g. coordination, aligning interests

Student & teacher-related support
e.g. providing digital tools

Company-related support
Access to universities, talents

Figure 2: Stakeholders of Student-Business Challenges

2.3 Expansion of teaching evaluation to include outcome and impact

Teaching evaluation at universities typically focuses on analyzing teaching concepts and assessing student satisfaction and short-term learning outcomes at the end of the teaching unit. This is usually sufficient for traditional teaching formats. However, the **objectives of Challenge-based Learning go beyond** outputs and short-term learning outcomes and aim to empower students to become change agents and sustainable entrepreneurs in the future.

CBL also aims to support and accelerate innovations and transition processes that contribute to achieving the Sustainable Development Goals and have a positive impact on society and the environment. CBL combines two important requirements of European policy:

1) to promote green entrepreneurship in higher education, which will contribute to the modernisation of European higher education systems, and

2) to strengthen Europe's capacity for innovation and successful implementation of the Green Deal.

Against this background, we distinguish between the current practice of teaching evaluation and the assessment of the effects of CBL teaching units and programmes on the students, on the company partners and on the implementation of the innovation projects (outcome) and, in addition, the medium and long-term system effects on the market, society and the environment (impact).

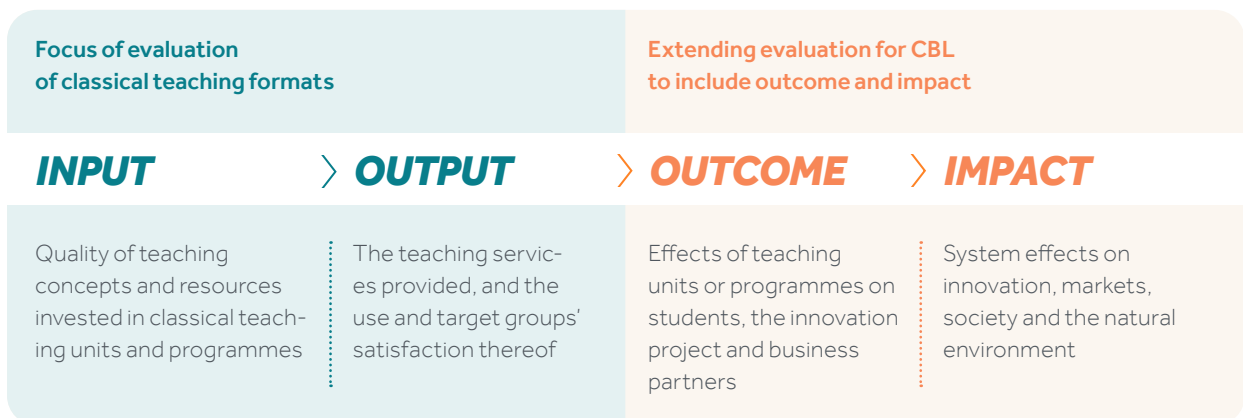| Focus of evaluation of classical teaching formats		Extending evaluation for CBL to include outcome and impact	
INPUT	**OUTPUT**	**OUTCOME**	**IMPACT**
Quality of teaching concepts and resources invested in classical teaching units and programmes	The teaching services provided, and the use and target groups' satisfaction thereof	Effects of teaching units or programmes on students, the innovation project and business partners	System effects on innovation, markets, society and the natural environment

Figure 3: Expansion of classical teaching evaluation to include outcome and impact.

2.4 Background of impact assessment in different disciplines

Impact assessment is currently under discussion in many places. Every planned action is linked to an intention or a goal - whether in companies, non-profit organisations, politics or individual actions. These goals are intended to help fulfil a mission or solve a problem.

But, to what extent are these objectives achieved? What were the intended effects? Are there unintended consequences? These and other questions are part of impact monitoring and impact assessment. There are many different concepts and approaches in different disciplines[8].

Evaluation research
Evaluation research, e.g. in the context of development cooperation, aims to determine the effectiveness of an intervention and has long made use of economic and non-economic impact analyses for this purpose. The basis for the identification and measurement of effects is the underlying logic model. This approach is particularly common in development cooperation. The aim of the impact analysis is to "know what works" [9].

Accounting
Legal accountability requirements in the area of sustainability have established this area of performance and impact assessment. The aim is to demonstrate the environmental, social and economic performance of the company's activities using appropriate metrics and to ensure that investors and other stakeholders have access to the information they need to assess the impact of companies on people and the environment. Sustainability reporting standards such as the Global Reporting Initiative (GRI) or EU laws such as the Corporate Sustainability Reporting Directive (CSRD) play an important role here.

Environmental impact assessment (EIA) and social impact assessment (SIA)
Environmental and social impact assessment can be traced back to the National Environmental Policy Act (NEPA) in the USA. This required federal agencies to demonstrate the impacts of environmentally significant projects using social science methods. The assessment was later expanded to include social impacts. The focus of the assessment is often a risk management view - to meet regulatory requirements or to avoid subsequent litigation.

Non-profit organisations
Non-profit organisations are increasingly required to demonstrate their efficiency and impact to public sector funders and other investors (such as foundations or donors). Indicator systems such as Social Return on Investment (SROI) are used in this context.

Social Entrepreneurship
Recent efforts to measure impact can be traced back to the development of social enterprises. The aim of social enterprises is to contribute to the transformation of society. The detailed analysis and reporting of this contribution is at the heart of impact measurement. The purpose of impact measurement is to help social enterprises secure the funding they need and to help investors make decisions about their investments.

2.5 Basic concept for evaluating outcome and impact

The recommendations in these guidelines are based on the **Theory of Change** and **logic models** and take into account the **basic dimensions of programme evaluation**.

Theory of Change (ToC) stems from programme theory and refers to the central mechanism by which intended changes of an intervention come about[10]. In general, the Theory of Change consists of the following elements:

INPUT
Resources going into the programme (financial and personnel resources, concepts, participants, activities) and the programme's activities that make use of the resources deployed. Input and activities represent an intervention aimed at achieving specific results and effects

OUTPUT
Direct results, occurring from the input and the activities

OUTCOME
Effects on the target groups of the programme, resulting from output and input (target group related effects)

IMPACT
Long-term effects on society (system level effects beyond the target groups)

Closely linked to the concept of Theory of Change are logic models. They describe how exactly the linear causality of the assumed ToC is supposed to develop the intended effects. Applied to a generic Student-Business Challenge the logic model could be the following:

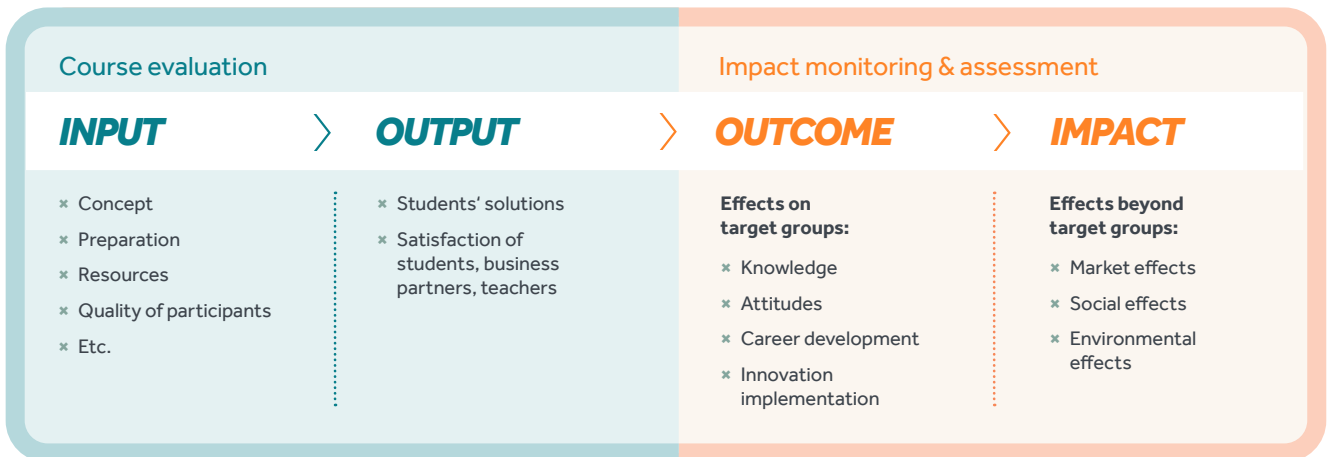| Course evaluation		Impact monitoring & assessment	
INPUT >	**OUTPUT** >	**OUTCOME** >	**IMPACT**
× Concept	× Students' solutions	**Effects on target groups:**	**Effects beyond target groups:**
× Preparation	× Satisfaction of students, business partners, teachers	× Knowledge	× Market effects
× Resources		× Attitudes	× Social effects
× Quality of participants		× Career development	× Environmental effects
× Etc.		× Innovation implementation	

Figure 4: The Theory of Change of a Student-Business Challenge (example).

Since the implementation of the Bologna reform, teaching evaluation has played an important role at universities. A central teaching evaluation forms the basis for quality assurance and ultimately for the accreditation of study programmes. The focus is on assessing the resources required for a module of study, the activities undertaken and the resulting output, usually in the form of student satisfaction with the programme. Outcomes and impacts have hardly been systematically surveyed and analysed to date.

Instead of using a linear presentation, the logic model could also be presented as a "staircase", highlighting the presumption that it is necessary to reach the underlying step in a sufficient extent to have some effects on the level of the next stair. The concept of the impact staircase was developed by Kurz and Kubek (2021) to support social entrepreneurs in planning and implementing impact. It could be easily adopted to other contexts of programme management or programme evaluation.

The monitoring, assessment and management of outcomes and impacts of teaching is still in its infancy at universities. Nevertheless, the evaluation of medium-term outcomes and long-term impacts of Student-Business Challenges extends beyond the scope of individual learning effects of students and the traditional teaching evaluation process. The set of stakeholders involved in co-innovative Student-Business Challenges is more complex than in traditional teaching programmes. Objectives and intended effects are diverse and can be considered on different levels and in different timescales (see Section 5.2).

2.6 Dimensions of programme assessment

In evaluation research and practice, five basic dimensions are distinguished for the study and assessment of programmes. Their influence should be taken into account in impact monitoring and management.

Conditions: These include the institutional, geographic and cultural context in which a programme is embedded, as well as the structural and procedural organisation of the institution, association or network that carries out the programme. However, the conditions of a programme are also shaped by the financial, human or other resources that are brought into the programme as resource inputs. The same applies to the qualifications with which students and business partners enter the CBL-programme. For example, these include the students' knowledge, attitudes, values and competencies. The participants' qualifications and the resources invested into the programme (e.g. teaching hours) can be considered as programme inputs.

INPUTS Resources, participants	OUTPUTS Services	OUTCOMES Effects at the target group level	IMPACTS Effects on higher system level
What is invested into the teaching and transfer programme.	What we offer and with what satisfaction it is used.	What we aim to achieve at the target group level.	What we offer and with what satisfaction it is used.

PLAN

1 Resources
Money, Time, Partners, Facilities

2 Participants
Experiences, knowledge, motivation and other attributes of students, business partners and teaching personnel

3 Services
Services provided and use of the offer

4 Use of the services
Number of participants, degree of use

5 Satisfaction
Participants and programme stakeholders' satisfaction

6 Innovation project
Clarification, acceleration and increase in long-term implementation success

7 Students
Competence development, career orientation and choice, transformational skills

8 Direct stakeholders
Changes in customers, market partners and other direct stakeholders

9 Market transformation
Emergence of new markets and change in existing markets

10 Society
Emergence of ecologiacal and societal effects

ALTERNATIVE CAUSES
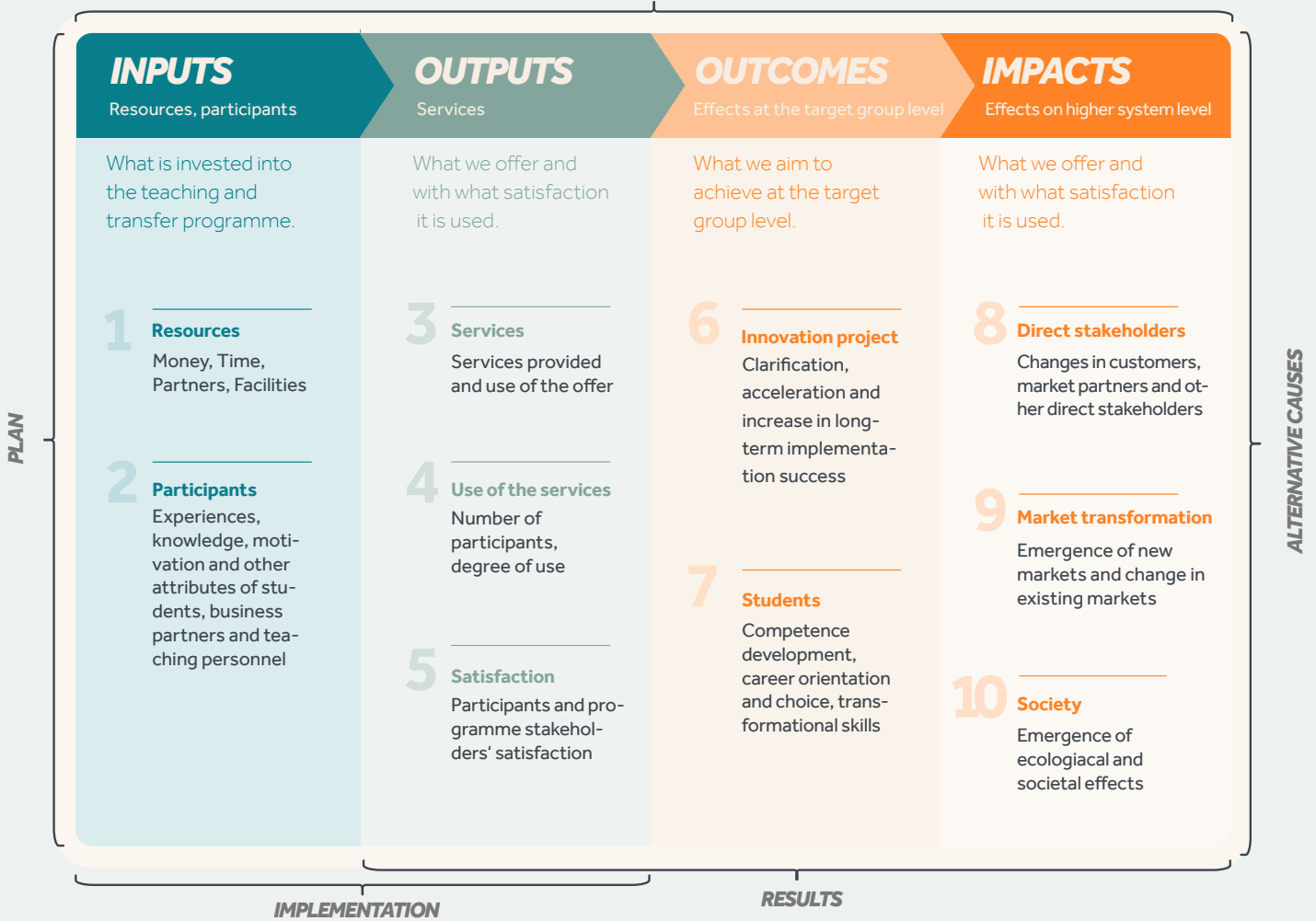
IMPLEMENTATION

RESULTS

Figure 5: Basic dimensions of programme evaluation (based on Fichter et al., 2021, p. 23 , Kurz & Kubek, 2016, p.35).

Plan: The concept that specifies the objectives and results are to be achieved by the programme by when/where/with whom and the activities are to be used to achieve these objectives. The programme concept can be understood as an "intervention plan". This is based on implicit or explicit impact assumptions.

Implementation: This includes the teaching and co-innovation activities carried out during programme and Student-Business Challenge implementation.

Results: On the one hand, there are the direct programme outputs generated by the interventions, the participation and usage figures as well as the satisfaction of students and business partners with the programme or challenge. On the other hand, results also refer to outcomes, i.e. the short- or medium-term changes achieved by the CBL programme in the target group (students, business partners), as well as the effects on the economy, society and the natural environment caused by the outcomes.

Alternative causes: Causes beyond the teaching or transfer programme under consideration must also be considered in a logic model. The impact of a Student-Business Challenge on students can also depend on personal circumstances and career influences, for example. The likelihood of an innovation idea that was the subject of the Student-Business Challenge being implemented may also be influenced by, for example, economic factors or a change in business strategy. These possible alternative causes for outcomes and impacts should then be explicitly included in the logic model.

Fichter, K., Widrat, A., and Olteanu, Y. 2021. **IMPACT Guide: Moving from evaluation to impact management of startup support programmes.** Berlin: Borderstep Institute.

Kurz, B., & Kubek, D. (2016). **Social Impact Navigator – the practical guide for organisations targeting better results.**

3 *WHY IT IS NECESSARY TO THINK ABOUT IMPACT*

A Student-Business Challenge is a teaching and learning format with special requirements:

- The challenges should be exciting and challenging. They should arouse curiosity and engagement in the students.

- The topics should be real and tangible, dealing with the major challenges of our time.

- The ideas and solutions that the students work on should be of such value that the challenge provider/innovation partner can and wants to implement the solution.

- These solutions should contribute to sustainable development.

- Students should learn to deal with issues of sustainable entrepreneurship and acquire skills to be active agents of change.

- For this to succeed, a wide range of experts needs to contribute their expertise and work with students on an equal footing.

- Teachers must therefore carefully select the innovation partners and their challenges, and closely support both the external partners and the students in the learning process.

- The formats should be enjoyable and beneficial for all involved.

All of this requires a high level of commitment from everyone involved. Although Student-Business Challenges are not standard practice at every university, some have already recognised their potential. Dedicated university staff across Europe are planning, organising and running such challenge formats.

What convinced these pioneers to put their commitment and passion into a format that often demands much more than traditional teaching formats?

Beyond the great stories arises the question if there are any insights into what Student-Business Challenges are already achieving? Challenge4Impact spoke to representatives of a wide range of Student-Business Challenges and asked for their opinions and experiences on comprehensive impact management.

What do they think, what are their results and impacts?

Challenge4Impact interview study on the interest in impact monitoring and management

When: 2022-2023

Design: Explorative interviews with 17 interviewees, additional material from short surveys from conferences, qualitative content analysis

Who was interviewed:
7 lecturers, 6 organizers from challenge programmes (4 persons internal to and 2 external to university), 4 business representatives from different European countries + USA

Research question:
What are the experiences, needs, constraints, resource demands and options of outcome and impact-related evaluation from the perspective of relevant stakeholders in Student-Business-Challenges?

First of all, there is a lot of interest in impact monitoring and impact management - but hardly anyone has practical experience of systematic monitoring. However, what impacts do practitioners expect? Table 2 shows answers from the interviews.

Table 2: Expected impacts, sorted by different stakeholder roles (results from interview study)

UNIVERSITY TEACHERS

The focus is on the impact on learners:

* **Competences, skills and attitudes of students should grow, as for example: self-confidence, collaboration skills, employability skills, the ability to engage people, project management skills, leadership skills for ambiguous and unstructured situations or tasks, learning to think "as a business manager, not as a student".**
* **Raise awareness for entrepreneurship as a career option, as for example: students who follow up the ideas after the challenge, developing impactful ideas, create impactful start-ups, students being hired by business partners.**
* **Application of theories on real-world problems / specific project results / ability to reflect learning.**

INNOVATION PARTNERS

The focus is on solving the innovation partner's problem, but also on the impact of Student Business Challenges on innovating and engaging with students:

* **Solutions for current challenges and implementation of solutions**
* **Finding graduates/ future employees**
* **Market effects, sustainability effects, network effects**
* **Change of perspectives in the organisation of the business partner**
* **Increased reputation of the business partner**

SUPPORT SERVICE PROVIDERS

The focus is on both sides - the learner and the company / society:

* **Transfer of ideas from university into society**
* **Acquiring knowledge and training for transformation for the own institution**
* **Transfer of knowledge. as start-ups might be created as an effect of the challenge programme**

The impact claim of the challenge programmes is frequently formulated in the programme itself - for example, through the thematic focus or existing evaluation criteria - let it be impact on sustainability transition, regional development or social impact that develops societies.

Many would like to, almost no one does

The stakeholders interviewed are all in a similar situation: They all have a strong interest in making a difference through their personal commitment. There is also a strong interest in continuous learning and improvement. At the same time, the workload is enormous. Impact monitoring, on the other hand, means developing a coherent monitoring concept "on the side", collecting data in the short, medium and long term, analysing it and drawing conclusions. Questions that have not yet been answered in this context are:

✕ What exactly are the impacts stakeholders want to achieve with a Student-Business Challenge, and what indicators can be used to measure them?

✕ Do all users apply the same indicators, so that comparisons can be made and learning from other Student-Business Challenges is possible?

✕ How can the necessary data be collected without making data collection too time-consuming?

✕ How can data be easily collected in the medium and long term, after the projects have finished and the students have left the university?

✕ How can data protection be ensured?

✕ What conclusions can be drawn from the monitoring and are those responsible prepared to draw consequences (e.g. regarding the content of the challenge, staffing)?

✕ Who or what can support impact monitoring in order to reduce the burden on teaching staff?

4   *BENEFITS OF IMPACT EVALUATION*

The evaluation of CBL teaching programmes and co-innovation projects and the measurement of impact have several clear benefits. The general benefits of evaluation that includes outcomes and impact are:

✕ It helps to make the costs, benefits and outputs as well as outcomes and impacts of CBL and student-business collaboration schemes transparent.

✕ It supports the identification of strengths and weaknesses of existing teaching and learning schemes in this field.

✕ It provides insights and data for the improvement of existing schemes and modules and to make them more effective.

✕ It stimulates innovative new learning units, modules or programmes in sustainable entrepreneurship education and collaborative student-business venturing.

Table 3 provides a more detailed overview of the potential benefits for each target group.

Table 3: Target group-related benefits of impact evaluation

Benefits for **university teachers**

- Outcome and impact evaluation supports the joint formulation of co-innovation projects and challenges and their objectives between lecturers and business partners.
- It provides facts and figures for communication with business partners, from acquisition to impact management.
- It supports the coaching of students.
- It documents what CBL teaching and co-innovation projects achieve.
- It helps to improve teaching (learning through data) and to make processes more efficient and effective.

Participating **students** could also benefit. Outcome and impact evaluation

- supports their project management with data and facts,
- improves the impact orientation when working on the challenges,
- could show learning progress in different areas of competence,
- helps them get to know their own strengths and effectiveness,
- supports career orientation and choice of professional field,
- creates transparency about what the innovation project could become (ex ante) or what it has become at a later point in time.

The specific benefits for **transfer managers** at universities are:

- It provides evidence of transfer effects.
- It enables internal and inter-university comparisons and benchmarking to learn from each other.
- It provides data for reporting on teaching and transfer as well as for sustainability reporting.

Business and innovation partners benefit as follows

- It supports impact-oriented innovation management.
- It improves the understanding of impact in transfer and innovation processes.
- It shows different innovation and impact paths for their innovative products and services.
- It provides data and facts for accelerating implementation.
- It supports the co-innovation process with students.
- It supports networking with students and subsequent collaboration (recruitment).

5 *METHOD* FOR EVALUATING AND IMPROVING IMPACTS

This manual supports teaching personnel and education and transfer managers of universities in formative evaluations and assessments of Challenge-based Learning approaches.

Formative evaluation is a process of gathering and analyzing feedback and data during the development or implementation of an educational programme or teaching unit:

* It comprises the collection of data on inputs, outputs, outcomes and impacts of CBL activities,

* identifies strengths, weaknesses, and areas for improvement,

* with the aim of making adjustments to improve the quality and effectiveness of the educational programme, teaching unit and co-innovation process.

The processes of impact measurement and management of CBL teaching programmes and teaching units can be understood as a cycle. In order to manage impact-oriented teaching programmes, impact must be taken into account from the outset. This means that the desired effects, expressed as concrete objectives, are ideally taken into account when planning or revising the teaching and co-innovation programme.

* **Impact planning** also includes the development of an impact philosophy and a logic model (see Section 5.1 and 5.2) - an important step in stating the intended impact of a programme and a prerequisite for the subsequent impact evaluation and management.

* Based on a set of indicators tailored to the teaching programme (see Section 5.3), both quantitative and qualitative information is measured and evaluated as part of the impact analysis.

* The final step in the impact cycle involves **improving** the programme on the basis of the evaluation results. This also includes external and internal communication of the results.

Based on the improvements and renewed impact planning, the impact cycle begins anew.
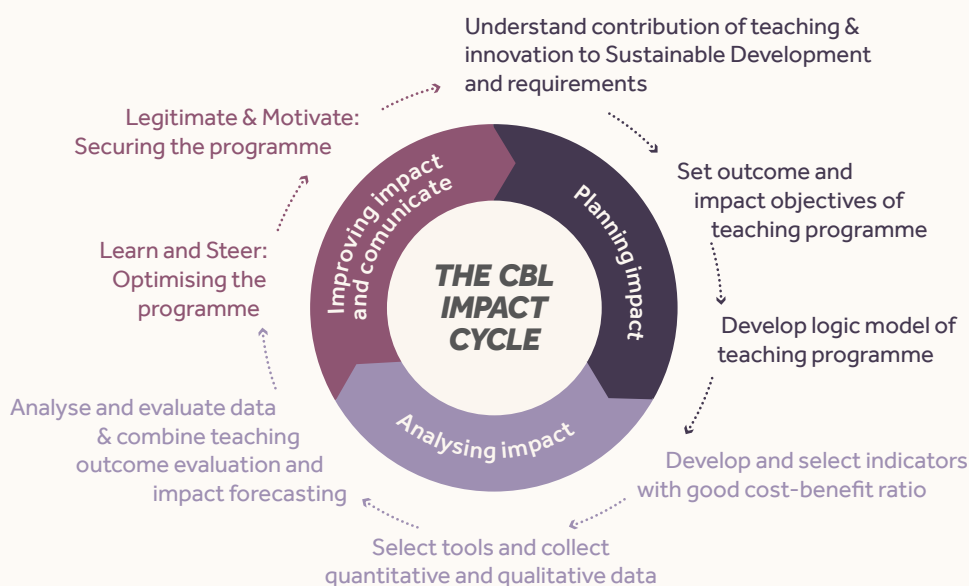

Figure 6: The Impact Cycle of Challenge-based Learning approaches. (based on Fichter et al., 2021, Kurz & Kubek, 2016).

In doing so, it can build on important foundations that were developed, for example, as part of the EU-Erasmus+-funded project ScaleUp4Sustainability. A number of important evaluation methods and tools are already available. It can also be drawn on findings on impact assessment and impact management from other fields such as social entrepreneurship and start-up support.

5.1 Set outcome and impact goals

Of central importance for impact planning is the **formulation of goals** and the regular reflection on goals already set, as this **is the prerequisite** for evidence-based impact evaluation and the management of CBL teaching programmes.

Accordingly, sufficient time and energy should be devoted to setting and adjusting objectives. The focus should be on setting programme objectives in a participatory process to create a shared understanding of the intended programme impact. Both students and business partners should be involved in this process. Various workshop formats can be used here. Ultimately, clearly defined impact goals also offer advantages for the public relations work of the programme, the

recruitment of colleagues and teaching staff for the scaling of programmes and the acquisition of new programme funding. When specifying the impact goals, it can be helpful to formulate the goals set at three levels: at the student level (individual level), at the innovation project and business partner level (innovation level) and at the system level (markets, society and natural environment).
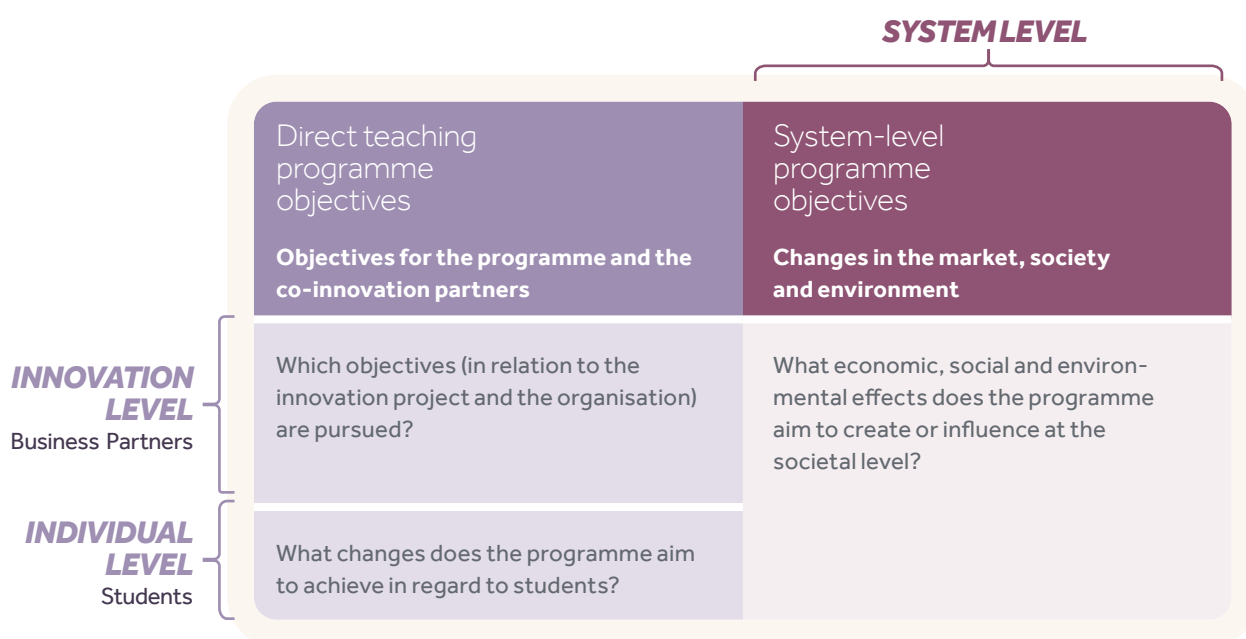
	Direct teaching programme objectives **Objectives for the programme and the co-innovation partners**	System-level programme objectives **Changes in the market, society and environment**
INNOVATION LEVEL Business Partners	Which objectives (in relation to the innovation project and the organisation) are pursued?	What economic, social and environmental effects does the programme aim to create or influence at the societal level?
INDIVIDUAL LEVEL Students	What changes does the programme aim to achieve in regard to students?	

SYSTEM LEVEL

Figure 7: Setting objectives for a CBL teaching programme at individual, innovation and system level. (based on Fichter et al., 2021)

5.2   Develop the logic model

An impact logic helps to present **cause-effect relationships** of a teaching or transfer programme in a simplified way and to distinguish between programme outputs and intended outcomes and impacts.

Logic models are commonly used to illustrate a programme's impact logic. They promote impact-oriented thinking and form the basis for the successfull implementation of all impact management processes:

* In impact planning, logic models are a transparent way of illustrating a teaching or transfer programme's impact logic and can thus contribute to creating an internal understanding of the intended effects of the support activities.

* They can also be used as a communication tool to reflect on planned impact mechanisms with other actors involved in the programme, such as business partners, transfer offices and network partners.

* In impact analysis, logic models are useful for developing and selecting relevant indicators for impact measurement.

* In terms of impact managing and optimising impact, logic models can support programme adjustments and can also be integrated into external and internal communication and reporting processes.

The logic model represents the inherent impact logic of teaching or co-innovation programmes by applying the Theory of Change (see Section 2.5). The general logic model of a teaching and co-innovation or transfer programme shown in Figure 6 draws on the idea of the causal chain and structures this chain according to the levels of the impact staircase (see Figure 8). Unlike in the impact staircase, the individual levels or elements are presented according to the input-output-outcome-impact logic of the Theory of Change.

The model can be read as both a linear and a multiple chain of effects with feedback loops. In addition, it considers alternative and multiple causal paths. When developing the logic model, it is important to clarify which cause-and effect relationships have already been "proven" and where one has to work with hypotheses that then have to be tested in the impact analysis.

In this way, the model can be continuously improved and it becomes more realistic.

IMPACT
- Programs achieve direct and indirect sustainability impact
- Challenge providers generate direct sustainability impact
- Graduates use the qualifications gained in their future careers

OUTCOME
- Challenge providers have positive effects (implementation of results, knowledge transfer...)
- Students have developed competences for sustainable entrepreneurship, which they use in their further career path for sustainable transformation.

OUTPUT
- Stakeholders involved are satisfied with the Challenge Program.
- Challenge providers receive a solution / contribution to the challenge submitted.
- Students provide an academic achievement / project result / solution to the challenge.

INPUT
- Sufficient students take part and complete the program.
- The resources provided (personnel, material resources, time, infrastructure, challenge provider, concept) are sufficient in type and number.

Figure 8: Impact staircase of Student-Business Challenges (based on Fichter et. al., 2021, p. 9, Kurz & Kubek, 2021, p. 5)

5.3 Select appropriate indicators with good cost-benefit ratio

For the continuous improvement of CBL teaching programmes and co-innovation formats, indicators that can be used to identify strengths and weaknesses as well as the need for improvement are key.

An indicator is understood as an "empirically measurable variable that gives an indication of a construct that is important for evaluation but not directly observable or measurable, and thus makes it accessible for qualitative or quantitative data collection"[11].

The selection of indicators for impact evaluation depends on the defined impact objectives for the respective teaching programme and the impact logic. The development and selection of qualitative and quantitative indicators for inputs, outputs, outcomes and impacts must also be based on the available resources and desired timing of the assessment.
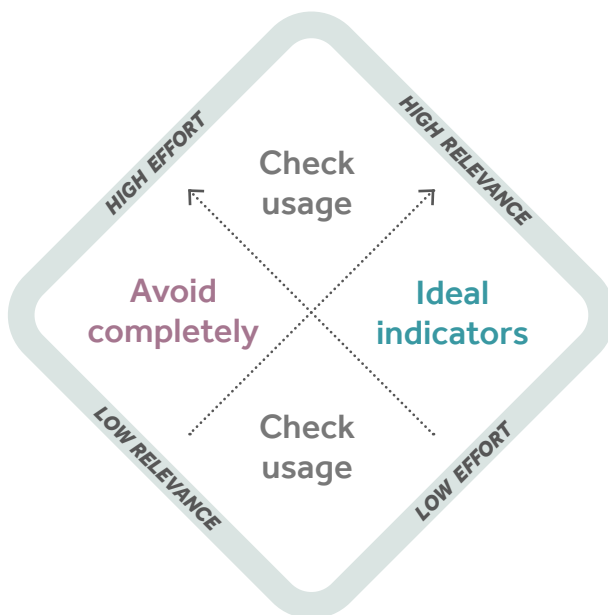
Figure 9: Considering the cost-benefit ratio of indicators (based on Fichter et. al., 2021, p. 30)

The key is to select indicators that are of central importance for programme development and communication and that can be collected and evaluated with the time and personnel resources available. The cost-benefit ratio of indicators is therefore the central selection criterion. The system shown in Figure 9 can help with the selection. A low effort among high relevance – ratio describes the ideal combination for choosing indicators.

There is no need to reinvent the wheel when developing and selecting indicators. Both teaching-related evaluation research investigating e.g. competences

for sustainable entrepreneurship[13] as well as business- and start-up related impact research[14] offer important foundations here. For the medium and long-term outcomes and especially the impacts, internationally established metrics and indicator concepts should be used. These include:

Global Reporting Initiative (GRI)
The GRI standards and guidelines for sustainability reporting formulate important principles for determining content and indicators (stakeholder involvement, materiality, etc.) and relevant principles for ensuring reporting quality (balance, comparability, etc.), but also propose comprehensive cross-sectoral and sector-specific indicators.

Corporate Sustainability Reporting Directive (CSRD) and European Sustainability Reporting Standards (ESRS)
Several harmonized European reporting standards that companies must apply when preparing their sustainability reports, most of which relate to sustainability topics in the areas of environment, social affairs and governance and two standards with overarching requirements.

Impact Reporting and Investment Standards (IRIS)
The IRIS network has developed a globally recognised system for measuring, managing and optimising impact. The current IRIS taxonomy comprises more than 600 impact indicators, from which the most relevant and target-oriented ones for the respective user can be selected.

Impact Management Platform (IMP)
The IMP is a collaboration between the leading providers of sustainability standards and guidance that are coordinating efforts to mainstream the practice of impact management. It brings together a community of over 2,000 practitioners to share best practices, explore technical issues in greater depth, and identify areas where further consensus is needed in measuring and managing impacts. The five impact dimensions identified by the IMP (see Table 3, Section 5.6) as well as the indicators that are useful for this purpose also provide important orientation for the impact evaluation of teaching programmes.

What is invested into the teaching/ transfer programme.

What we offer and with what satisfaction it is used.

1

Resources

×   Amount of the programme budget

×   Number of teaching staff in full-time positions

×   Number of actively participating programme partners

×   Committed/provided workload of teachers, students and business partners in working days

2

Participants

×   Proportion and number of selected business partners & challenges

×   Proportion and number of selected students

×   The programme team's experience in CBL teaching in number of years

3

Services

×   Attractiveness and suitability of selected challenges for the partici- pating students

×   Amount and quality of teaching material per module, programme or calendar year

×   Number of teaching and coaching hours provided by per module, challenge or calendar year

×   Number of meetings per challenge or module

4

Use of the services

×   Number of students participating in the programme per cohort, per year and/or overall

×   Number of business partners participating in the programme offerings

×   Number of challenges rated as attractive and suitable per module, year or in total

5

Satisfaction

×   Percentage of students who participat- ed in the course from start to finish.

×   Students' level of satisfaction with the programme or course offered

×   Degree of satisfaction of the practice partners with the organization of the course or the co-innovation project Degree of satisfaction of the teachers with the course.

×   Degree of satisfaction of other directly involved stakeholders with the teaching/transfer programme

Figure 10: Examples of indicators for input and output measurement. (based on Kurz & Kubek (2016, p. 62) and Fichter et al. (2021, p. 29).

What we aim to achieve at the individual and innovation level.

What we want to contribute to on a societal level.

6

Innovation project

- Degree of satisfaction of the practice partner with the analysis carried out and the solution developed

- The extent to which the analysis and developed solution promotes and accelerates the innovation project.

7

Students

- Scope and extent of improvement of Sustainable Entrepreneurship (SE) competencies, measured by the SE Index

- Contribution to clarifying career interests and career choices

- Degree of increased interest in taking on innovation and change tasks in the future

- Contribution to networking with relevant practice partners and access to interesting employers.

8

Effects on customers and stakeholders

- Contribution of innovation to customer satisfaction

- Sustainability empowerment of customers

- Energy/waste/water savings per customer

- Number of customers benefiting from this

- Proportion of suppliers with environmental/social standards

9

Market effects

- Contribution of innovation to transforming the market or the growth of environmentally friendly market segments

- Number/proportion of business partner with high market scaling of environmental innovations

- Contribution to the establishment of sustainable industry standards

10

Environmental effects

- Greenhouse gas reduction in tonnes of CO_2 equivalent p.a. & cumulative

- Number/proportion of climate-neutral/positive businesses

- Secondary raw material quota

- Energy/waste/water savings p.a. & cumulative

- Impact score: change/benchmarking

- Score contribution to individual SDGs: change/ benchmarking

Figure 11: Examples of indicators for outcomes and impact measurement. (based on Kurz & Kubek (2016, p. 62) and Fichter et al. (2021, p. 29)

5.4 Use the right approaches and tools for data collection and analysis

For selected indicator areas, methods and tools already exist for their collection and analysis.

For example, as part of the EU-Erasmus+ -funded project "ScaleUp4Sustainability", questionnaires were developed and tested to record the learning progress of the participating students in terms of sustainable entrepreneurship competencies, as well as interview guidelines for feedback discussions with students, business partners and other stakeholders. These are part of a comprehensive toolkit that is available free of charge at https://www.scaleup4sustainability.eu/toolkit/

Further impact-related evaluation approaches and tools were developed as part of the Challenge4Impact project. These include

 - Reflection forums
 - Impact forecasting
 - Learner reports
 - Innovation impact roadmaps

These and other approaches to support the evaluation of CBL teaching approaches and co-innovation projects are presented in Section 6.

5.5 Combine teaching outcome evaluation and impact forecasting

A key issue in recording medium- and long-term outcomes and impacts is the time lag between the implementation of the course or the Student-Business Challenge and the occurrence of an impact. It is therefore hardly possible for individual lecturers or universities to carry out this ex-post evaluation themselves.

This requires cross-university collaborative evaluation approaches and professional evaluation service providers. The options for such approaches are presented in Section 5.7. Another option for estimating the medium- and long-term effects is to carry out impact forecasting during or immediately after implementation of the challenge programme.

The idea of impact forecasting is that the participants make a well-founded and reflected assessment of what could happen in the medium and long term under certain conditions with the analyses and solutions developed as part of the challenge. To this end, the participants first make an individual assessment and justify it. The assessments are then prepared and discussed and checked for plausibility in a joint reflection round with all participants. The impact logic developed by the

teachers for the course is also used (see Sections 2.5 and 5.3). The dimensions and questions developed in impact research and practice, which are shown in Table 3, should be taken into account when assessing the medium- and long-term effects.

Bringing together different perspectives and reflecting together on an impact logic allows for an informed assessment of possible impact pathways and impacts. This process and approach can be called 'impact forecasting'. The results are documented, used to improve the teaching programme, communicated (see Section 5.7) and can be compared with ex-post analyses at a later stage. It is therefore advisable to combine the directly recordable outputs and outcomes of a course with impact forecasting.

Table 4: Five impact dimensions and related questions

IMPACT DIMENSION	IMPACT QUESTIONS TO BE ANSWERED PER DIMENSION
What	✕ What positive, actual effects has the teaching programme achieved in relation to its target groups (outcome) and on environment, society and market (impact)? ✕ What unintended, positive or negative effects has the teaching / co-innovation programme had on the target groups and on environment, society and market?
Who	✕ Did the teaching programme reach its primary target group (here: students, business partners) and which stakeholders were reached? ✕ To what extent do the changes that have occurred serve the target groups and stakeholders (outcome) and, beyond that, positive ecological, social and economic developments?
How much	✕ How big is the effect on the target groups (outcome) and on environment, society and market (impact) in terms of scale, depth and duration?
Contribution	✕ To what extent has the teaching / co-innovation programme contributed to the changes? Would these changes have occurred regardless of the programme or teaching activities? What improvements or deteriorations in the target groups, other stakeholders, and with regard to the environment, society and market would there be in the absence of the teaching / co-innovation programme?
Risk	✕ Is the achievement of effects being impeded or even prevented by certain influences or risks? If so, what are the risks and how can the influences be assessed?

Source: Based on DIN SPEC 90051-1 Specification for sustainability assessment of start-ups.

5.6 Improve and communicate the impact of the programme

Planning and designing teaching and co-innovation programmes in an impact-oriented way and using selected indicators to evaluate the achievement of the formulated impact objectives form the basis for establishing processes of continuous improvement to maximise impacts. Communicating these results and learning processes in a transparent manner also forms an important pillar of impact management.

The results of the impact analysis provide a good basis for impact-oriented programme and teaching management at strategic and operational levels. The data collection and evaluation concept with its selected indicators is therefore a key to make teaching and transfer objectives as well as its resulting changes visible. It also allows, on the basis of the evaluation results, to improve teaching and co-innovation projects aiming to achieve previously defined program and teaching objectives. Continuously collected data on input and output indicators are suitable for optimising operational programmes. By analysing the ratio of outputs

to inputs, the efficiency of the programme or individual teaching units can be reviewed and improved. In addition, output analysis provides essential information on the quality of the programme by providing information on beneficiaries' satisfaction with the services. On this basis, it can be determined whether the programme offerings need to be changed and, if necessary, existing offerings can be adapted and improved or completely new programme offerings can be planned and implemented.

In addition, the data collected as part of the impact evaluation on the outcome and impact indicators is suitable for strategic programme management and optimization. By analysing the results on the development of sustainable entrepreneurial skills and the innovation projects, the impact on the teaching programme itself and the transfer organisation as well as on the environment, society and the economy, the need for programme adjustments in line with the target concept can be identified. These findings can

be used to optimize the programme with regard to the objectives at the level of the students, the innovation projects and society. Ideally, the beneficiaries and other programme stakeholders should be involved in the improvement process. If the results suggest it, the programme can undergo a complete reorientation, including adjusting the programme's impact logic and reformulating the programme's objectives.

The presentation and communication of the evaluation results to the target groups is an important step in the programme's impact cycle. It enables the legitimization of the teaching and transfer approach among decision-makers and public stakeholders and creates external and internal understanding of the efficiency and effectiveness of the use of financial and teaching resources in the programme. In addition, credible and transparent communication serves as a role model for other lecturers and transfer managers in the teaching and transfer system, who can use this impact management approach as a guide for their own work.

5.7   Partner with other universities and professional support services

Challenge-based Learning and the combination of teaching and transfer in the form of co-innovation projects between students and companies is still a very young approach, used by only a few. This makes the exchange of experience between those who practice CBL and organize co-innovation projects all the more important when it comes to evaluation and the data and facts that these generate.

An evaluation approach that specifically incorporates outcomes and impacts enables cross-university learning processes. These can be supported by internal and external transfer and challenge service providers. As part of the Challenge4Impact project, we have identified and compiled such professional support services. The good practice examples of professional support services for challenge-driven student-business col-

laboration show that the entire field is still in its infancy, but steadily growing. The identified support services are differently suited for transnational and virtual formats of Challenge-based Learning.

A selection of university-internal, university-external and hybrid support services are shown in Figure 12.

| | university-internal support service | university-external support service | hybrid support service |

Suitability for transnational student-business challenges

	Services for local/ national student-business challenges only	Services for both, national and trans-national student-business challenges	Services with a specific focus on transnational student-business challenges
Services with a specific focus on virtual student-business challenges			*FRUITPUNCH AI* *WUR STUDENT CHALLENGES*
Services for both, physical and virtual student-business challenges		*DEMOLA* *EKIPA*	*ECIU UNIVERSITY*
Services for physical student-business challenges only	*MASTER CHALLENGE* *ALMI EAST SWEDEN & LINKÖPING UNIVERSITY*		*BBENG*

Suitability for virtual student-business challenges (vertical axis)

Figure 12: Examples of support services for transnational virtual Student-Business Challenges in sustainable entrepreneurship.
Source: (Widrat & Fichter, 2023, p. 59).

Widrat, A., Fichter, K. (2023): **Support services for student-business-collaboration. Good practice collection of support services for challenge-based student-business collaboration in sustainable entrepreneurship.** Oldenburg: Carl von Ossietzky Universität Oldenburg.

6 *EVALUATION **TOOLS AND SUPPORT***

As mentioned above, methods and tools for the collection and analysis of indicators already exist for a number of selected indicator areas.

The following table provides an overview of different evaluation methods, tools and services that can be used in the context of an impact-oriented evaluation of CBL teaching programmes and co-innovation projects between students and companies.

Table 5: Evaluation methods, tools and services for CBL

Type	Description	More information
QUESTIONNAIRES	Questionnaires for recording learning progress of the participating students in terms of sustainable entrepreneurship competencies, as well as interview guidelines for feedback discussions with students, business partners and other stakeholders.	Questionnaires, interview guidelines and various tools were developed as part of the EU Erasmus+ -funded project "ScaleUp4Sustainability". The toolkit is available at: https://www.scaleup4sustainability.eu
REFLECTION FORUMS	Reflection forums are a workshop format in which teachers, students and business partners jointly reflect on selected aspects and issues in the context of CBL and co-innovation projects and draw conclusions. These can also be used specifically to identify outcomes and impacts as well as for impact forecasting.	A playbook for designing and organizing reflection forums has been developed in the Challenge4Impact project. The manual is available here: https://www.challenge4impact.eu/results
IMPACT FORECASTING	Participants of CBL- and co-innovation projects make a well-founded assessment of what could happen in the medium and long term with the solutions developed as part of the challenge. To this end, the participants first make an individual assessment and justify it. The assessments are then prepared and discussed and checked for plausibility in a joint reflection round with all participants.	See Section 5.6.

Type	Description	More information
LEARNER REPORTS	Based on before/after surveys using questionnaires on sustainable entrepreneurship skills and other relevant learning aspects, e.g. career orientation, individual learning reports are created for students. For data protection reasons, the reports are only available to the individual students.	A software tool for this is being developed as part of the project "Wi-Ko-nova: Impact monitoring of co-innovation processes between students and companies". See "Software tools & databases".
INNOVATION IMPACT ROADMAPS	As part of the impact forecasting (see above), various possible development paths for the innovation project are outlined, important influencing factors of the impact are identified and potential outcomes and impacts are described.	Innovation impact roadmaps are being developed and tested as part of the Challenge4Impact project. Further information is available on https://www.challenge4impact.eu.
SOFTWARE TOOLS & DATABASES	Currently, there are no specific software tools and databases that can be used for the evaluation of CBL teaching programmes and co-innovation projects. However, these are in preparation. A software-as-a-service solution is being developed by Carl von Ossietzky University Oldenburg and TolaData GmbH.	As part of the "Wi-Ko-nova: Impact monitoring of co-innovation processes between students and companies" project funded by the German Federal Ministry of Education and Research, a specific software tool is under development and available by 2025/2026. More information at https://www.uni-oldenburg.de/innovation
PROFESSIONAL SUPPORT SERVICES	There is a growing number of HEI-internal, but also HEI-external professional services for the support of CBL, co-innovation and student business collaborations. They are not specialized evaluation services, but can support impact-oriented evaluation with various services.	See publication Widrat, A.; Fichter, K. (2023): Support services for student business collaboration. Good practice collection of support services for challenge-based student-business collaboration in sustainable entrepreneurship. Oldenburg: Carl von Ossietzky Universität Oldenburg. https://www.challenge4impact.eu/support-services-for-student-business-sustainability-challenges/

7 CONCLUSIONS

Challenge-based Learning and co-innovation projects in the form of Student-Business Challenges are a promising approach at the interface between the education and innovation systems.

By combining learning and innovation processes, previously separate fields or „pillars" are linked in a new way. This practice-oriented approach is not only aimed at individual learning progress for students, but also specifically at creating change agents and sustainable entrepreneurs for the future and specifically supporting and accelerating sustainability-oriented innovation projects. CBL combines two important demands called by European policy: 1) to promote green entrepreneurship in higher education, which will contribute to the modernization of Europe's higher education systems, and, 2) to strengthen Europe's capacity to innovate and successfully implement the Green Deal.

Challenge-based Learning and the combination of teaching and transfer in the form of co-innovation projects between students and companies is a very young approach that is still used by only a few.

In order to disseminate and scale this learning/ innovation approach, which is important for Europe's transformation into a sustainable and climate-neutral region, it is essential to prove its efficiency and effectiveness and to provide teachers with methods and tools to continuously improve the respective teaching programmes and modules. This requires an evaluation approach that is not limited to the usual recording of inputs and outputs of courses, but also includes outcomes and medium- and long-term impacts.

This guide provides important conceptual and methodological foundations for this and aims to encourage lecturers and transfer managers to try out Challenge-based Learning and incorporate it into their teaching and transfer programmes.

As part of the Challenge4Impact project, the evaluation approaches presented in these guidelines will be further developed, tested and applied to the formats of Challenge-based Learning and international and virtual formats of student-business cooperation implemented in the project. The results will be presented in a separate report.

8   ENDNOTES

1   Birol et al. (2002)

2   Fichter et al., 2020, Gallag-
    her and Savage, 2020, p. 10,
    van den Beemt et al., 2023

3   Norrman et al., 2022

4   Birol et. al 2002, Gallagher &
    Savage, 2020, p. 2

5   Nichols et al., 2016

6   van den Beemt et al., 2023,
    p. 234

7   Membrillo-Hernández et al.,
    2019.

8   Grünhaus & Rauscher, 2021

9   Deutsche Gesellschaft für
    Entwicklungszusammen-
    arbeit

10 Funnell and Rogers, 2011

11 DeGEval Gesellschaft für
    Evaluation e.V., 2017,
    p. 67

12 Diepolder et al., 2021

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