



D6.4

Exploration of intervention theories

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WHO WE ARE

The ECF consortium consists of ten partners. The project is coordinated by Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas-CIEMAT.

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ABOUT THE PROJECT

Through a multidisciplinary, transdisciplinary and participatory process, ECF4CLIM develops, tests and validates a European Competence Framework (ECF) for transformational change, which will empower the educational community to act against climate change and towards sustainable development.

Applying a novel hybrid participatory approach, rooted in participatory action research and citizen science, ECF4CLIM co-designs the ECF in selected schools and universities, by: 1) elaborating an initial ECF, supported by crowdsourcing of ideas and analysis of existing ECFs; 2) establishing the baseline of individual and collective competences, as well as environmental performance indicators; 3) implementing practical, replicable and context adapted technical, behavioural, and organisational interventions that foster the acquisition of competences; 4) evaluating the ability of the interventions to strengthen sustainability competences and environmental performance; and 5) validating the ECF.

The proposed ECF is unique in that it encompasses the interacting STEM (Science, Technology, Engineering, and Mathematics)-related, digital and social competences, and systematically explores individual, organisational and institutional factors that enable or constrain the desired change. The novel hybrid participatory approach provides the broad educational community with an ECF adaptable to a range of settings; new ways of collaboration between public, private and third-sector bodies; and innovative organisational models of engagement and action for sustainability (Sustainability Competence Teams and Committees).

To encourage learning by doing, several novel tools will be co-designed with and made available to citizens, including a digital platform for crowdsourcing, IoT solutions for real-time monitoring of selected parameters, and a digital learning space. Participation of various SMEs in the consortium maximises the broad adoption and applicability of the ECF for the required transformational change towards sustainability.



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Executive Summary

This deliverable provides an evaluation of the ECF4CLIM project and a selected interventions implemented as part of the project. The evaluation draws on evidence from questionnaire surveys, interviews, and discussions at SCT and SCC workshops. It analyses the expected and observed outcomes of the intervention on the one hand, and the expected and observed relationships between the intervention and its outcomes on the other. The overall assessment of both the project and its methodology by the informants of this evaluation was highly positive. In particular, the hybrid-participatory approach was considered effective in fostering empowerment, empathy, ownership, and collective learning among the participants.

The primary aim of the evaluation was to explore participants' intervention theories, that is, their implicit or explicit assumptions concerning how and why interventions would produce their expected and desired outcomes. By contrasting these expectations with the observed results, the exercise encouraged reflection on causal relationships between the project, its interventions, and the observed outcomes. This would also make it possible to explore the extent to which possible failures to achieve the intended outcomes resulted from errors in the initial planning (intervention theories) or failure to fully follow the plans at the implementation phase. The project demonstrably helped to improve the environmental performance and technical-material competences of the participating educational establishments. Such benefits included, among other things, enhanced waste collection, improved energy and water efficiency, and the creation of green spaces. More broadly, the project helped to strengthen both individual and collective sustainability competences, in particular by giving sustainability greater visibility, improving the awareness of its importance, and acting as a catalyst for further initiatives. In many cases, ECF4CLIM helped to further reinforce the processes and activities towards sustainability, which many of the participating educational institutions had initiated already prior to ECF4CLIM.

Identifying the intervention theories proved more difficult than anticipated, but valuable evidence was collected regarding the conditions that enabled or hindered progress. For instance, discussions in Portugal revealed divergent views on whether delays in the implementation of the selected intervention were caused by poor planning and preparation or by institutional factors (i.e., aspects related to the collective competences). The debates over the relative importance of the three competence dimensions (individual, collective, and technical-material) stimulated reflection on how different forms of competence contribute to sustainability in educational settings. In doing so, the debates fostered learning through the juxtaposition of and joint deliberation on the diverse intervention theories held by the participants.

The evaluation revealed that objectives of many interventions were not always very clearly spelled out at the outset. While this ambiguity complicated systematic evaluation, it also became a source of learning. Participants who initially assumed that interventions were designed solely to improve environmental performance and technical-material competences came to appreciate their broader functions and objectives of improving the individual and collective competences. The often lengthy discussions and the inability or unwillingness of the participants to prioritise one competence dimension over another reflected the project's success in highlighting the complexity of sustainability challenges and in fostering reflection on such complexities.

From the perspective of intervention theories, the SCT6 and SCC6 meetings triggered highly interesting debates concerning the priorities of distinct objectives of the project, and therefore on the relative importance of and the relationships between the three competence dimensions. A number of contrasts and divergences of view appeared, reflecting distinct hypotheses and intervention theories concerning the best ways of promoting sustainability. For example, at the Mioveni school in Romania, the students expressed diverging views on issues such as the relative importance of cognitive learning on the one hand and emotional/experiential learning on the other; between external communication aimed at promoting sustainability (towards society at large) and individual growth, reflection, visions, and courage to act; and between personal learning and group action. Similarly diverging perspectives were seen in the ranking exercise, where the ability of the project to help create “a cooperative work environment” and “strengthened self-reflection, collective analytical thinking, from multiple perspectives” emerged as the most highly valued contributions of ECF4CLIM. The teachers tended to emphasise the educational value of the project, whereas the administrative staff highlighted the importance of the practical and operational outcomes in terms of concrete improvements of environmental performance and technical-material competences.

At most DSs, there was a strong demand for curricular reform that would give sustainability greater weight and visibility. However, doubts were raised about whether the sustainability issues included in the curriculum would translate into concrete action (gap between normative and cultural-cognitive competences). Continuity would likewise be hampered by the high turnover of students, as well as by the kind of “project culture” evoked by some participants (e.g., in Finland): if sustainability is only or primarily promoted through projects, this hampers the continuity and institutionalisation that are needed to ensure the positive impacts persist over time.

The hybrid-participatory methodology was highly valued. It was seen to have fostered critical thinking, collaboration across multiple categories of actors (educational and administrative domains), and the creation of an inclusive atmosphere conducive to the free expression of views.

The process also had helped to improve time management and communication, link theory with practice, and support multiple learning styles, thereby enhancing participation and commitment. The evaluation identified several factors necessary for successful sustainability initiatives. Above all, collective competences (such as collaboration, teamwork, and the ability to mobilise diverse actors) were repeatedly emphasised. Enthusiasm and commitment among the often small student and teacher teams working on the interventions were also highlighted, although this was often contrasted with indifference among the wider community, both within and outside of the school or university in question. Other key factors were time and other resources, whose absence or scarcity often hampers sustainability efforts. Time constraints were seen as especially critical, as was the fact that engagement was often limited to individuals who were already predisposed towards sustainability. External institutional barriers and bureaucratic procedures further complicated implementation in several contexts.

Better communication to the outside world emerged as one among the most common suggestions and preconditions for success, with the conviction that it would help raise awareness and thereby ensure support from the community at large, to ensure that the interventions become institutionalised and have a lasting impact.

Contextual and cultural differences influenced perceptions of the project. In Spain, Portugal, and Romania, where the improvement of school infrastructure is often a priority, interventions largely aimed at strengthening technical-material competences through improved heating efficiency, reduced CO₂ emissions, better water supply, etc. In Finland, there is generally less room for improvement of the environmental quality of school infrastructure, the emphasis was on pedagogy, curricular reform, and fostering holistic sustainability understanding. These differences shaped both the objectives pursued and the criteria by which success and failure were judged. In Romania, careful advance planning ensured smooth implementation but left limited scope for adaptive learning, while in Spain and Portugal, less clearly articulated objectives and weaknesses in planning created challenges but also opportunities for critical reflection and learning.

Overall, the findings reconfirm the key assumption underpinning the project, that is, the interdependence between the different types of sustainability competences. Improvements in individual competences (such as those proposed by the GreenComp report) depend not only on individual engagement but also on collective capacities and the availability of adequate technical-material conditions. The participatory and iterative methodology of ECF4CLIM enabled diverse actors (students, teachers, parents, staff, municipalities, and external entities) to analyse their environment, elaborate proposals, and monitor their implementation. While the benefits were most pronounced among the directly engaged participants, the project succeeded in raising



awareness, stimulating debate, and strengthening sustainability competences at the participating educational institutions.

The evaluation revealed that the success of the interventions would have been greater if more importance had been given to early and sustained communication among the educational community in question, to wider engagement of stakeholders beyond the already committed, and to systematic networking across schools and external partners. Careful advance planning should be complemented with flexibility to adapt to unforeseen challenges, while ongoing monitoring and evaluation are essential to guide implementation. Together, these measures could help maximise both the depth and breadth of the positive impacts, ensuring that sustainability interventions extend beyond enthusiastic core groups to reach entire school communities.

1. Objectives

The main objective of deliverable D6.4 is to evaluate the operation of the interventions for promoting sustainability at all the demonstration sites (DS) involved in the ECF4CLIM project.

Through our hybrid participatory method, the ‘intervention theories’ of the people and institutions participating in the project have been explored, focusing on the relation between the expected and actually observed relationships between interventions and competences, asking questions such as: Did the intervention operate as expected? Did the basic assumptions hold? Which unanticipated factors constrained or facilitated the improvement of sustainability competences? Did the intervention and the evaluation process foster empowerment of the involved stakeholders, by helping them to better identify opportunities for and obstacles to desired changes towards sustainability?

The evaluation analyses on the one hand the expected and observed outcomes of the intervention, and on the other hand the expected and observed relationships between the intervention and its outcomes.

2. Exploration of intervention theories as a method for participatory evaluation

The exploration of intervention theories is a method applied as a key instrument by the theory-driven programme and policy evaluation approaches, such as “realist” evaluation.¹ A fundamental assumption underpinning this approach is that policymakers and stakeholders have implicit or explicit assumptions concerning the mechanisms through which a programme or policy is expected to operate and produce its desired outcomes. The set of assumptions, theories and expectations underpinning these policy interventions are called “intervention theories”, programme theories, or theories of change. An intervention typically has its “official” intervention theory (e.g. economic instruments are motivated and justified by assumptions about humans as economically rational maximisers of their economic well-being). However, participants and stakeholders can hold at least partly mutually contrasting intervention theories, i.e. assumptions and expectations concerning the ways in which an intervention will operate to produce its outcomes. The correspondence of these

¹ Pawson, R. and Tilley, N. (1997). *Realistic Evaluation*. London: Sage. Pawson, R. (2013). *The science of evaluation: a realist manifesto*. London: Sage.

theories with “reality” varies. Obviously, if an intervention is based on false assumptions concerning e.g. the responses of stakeholders to the policy (e.g. behaviour changes generated by a fiscal policy), then the intervention is unlikely to deliver its expected results.

In evaluation, the exploration of intervention theories plays several roles. First, before-and-after comparisons of the ways in which an intervention was expected to produce its impacts and how it actually turned out to operate can provide lessons that can help to improve interventions in the future. Second, exploration of the intervention theories can help to identify whether the possible failure of the intervention to produce its outcomes resulted from failures in implementation or whether the initial assumptions were incorrect. Third, joint deliberation among the involved parties concerning their respective intervention theories can foster learning and better mutual understanding, and thus improve governance.

The evaluation of the ECF4CLIM and its interventions was founded on three overarching questions:

- Which elements of the intervention or the context could explain the observed outcomes?
- Where the expected results were not observed, which elements of the intervention were those that did not work?
- Was the underlying theory guiding the intervention wrong, or was the problem in poor implementation?

To answer these questions, we sought information on the “success factors” and operating mechanisms such as assumptions concerning the elements that need to be in place for the intervention to succeed, and the mechanisms through which the intervention was expected to operate and produce its impacts.

When thinking through these success factors – the elements that would need to be in place for the intervention to produce its desired impacts – the participants were invited to consider factors at least under the following five partly overlapping categories:

- Individual competences
- Collective competences
- Technical-material competences
- Resources
- Responsibilities: who should do what?

A similar intervention theory approach was applied to the evaluation of ECF4CLIM as a whole. Although the project can hardly be considered a single “intervention”, the same logic based on the identification of the key preconditions for success and a comparison between the expected and observed presence and operation of those “success factors” was useful also for structuring the discussions concerning the success of the entire project.

3. Methodology

The results were obtained by analysing the documentation from the demonstration sites (13 educational establishments in four countries), as well as by conducting interviews and working group meetings with students, teachers and staff from these establishments. The resulting reports from the SCTs and SCCs at each demonstration site were analysed.

3.1 The sample of demonstration sites

The analysis was conducted based on a series of interventions in the 13 educational establishments (schools and universities) that have participated in the ECF4CLIM project from the beginning (Table 1).

Table 1: Characteristics of the schools and universities participating in the project.

Educational level	Name	Place	Crew
Basic schools	Juhannuskylän koulu	Tampere (Finland)	831 students 90 teachers
	EB 123 Bobadela	Bobadela (Portugal)	792 students 81 teachers
	Nicolae Balcescu school	Dragasani (Romania)	500 students 30 teachers
	Sercaia school	Sercaia (Romania)	200 students 12 teachers
	CEIP Mozart	Alcalá de Henares (Madrid, Spain)	670 students 42 teachers
Intermediate / high schools	Sammon keskuslukio (SAMKE)	Tampere (Finland)	1,017 students 50 teachers
	E.B.2,3 Camarate	Loures (Lisbon, Portugal)	741 students 102 teachers
	Iulia Zamfirescu school	Mioveni (Romania)	1,300 students 60 teachers
	IES Itaca	Tomares (Sevilla, Spain)	600 students 50 teachers
Universities	University of Jyväskylä (JYU). Faculty of Education	Jyväskylä (Finland)	14,000 students 7,000 employees
	University of Lisbon. Instituto Superior Técnico (IST)	Lisbon (Portugal)	11,000 students

			900 teachers and researchers
	University of Pitesti (UNSTPB). Faculty of Sciences	Pitesti (Romania)	9,000 students 700 teachers
	Universitat Autònoma de Barcelona (UAB). Faculty of Political Science and Sociology	Barcelona (Spain)	40.000 students 4,250 teachers and researchers

3.2 Analysis of SCTs and SCCs

Sessions 5 of our Sustainability Competence Teams and Committees focused on the evaluation of a set of selected interventions, while sessions 6 focused on the evaluation of the whole project.

- Sustainability Competence Teams Session 5 (SCT5):

In preparation for SCT5, each demonstration site (DS) collaborated closely with the research team to select one or two interventions for in-depth evaluation. Ideally, these interventions were chosen to address at least two of the three competence dimensions: individual, collective, and technical-material (this last dimension most directly conditioning the environmental performance of the establishment in question). Once the research team had presented the selected interventions, the participants took part in a role-play exercise. At the end of the session, the participants gathered in a plenary discussion addressing four questions: 1) Why did the intervention achieve its objectives or failed to do so? 2) Which unintended outcomes were observed and why? 3) What surprises or lessons emerged? and 4) Given the gained experience, what could be done to improve the outcomes and operation of the intervention if it were now to be redesigned from scratch? The participants shared their personal views, noting areas of agreement and disagreement.

- Sustainability Competence Committee Session 5 (SCC5):

In SCC5, the wider education community at each DS engaged in evaluating the interventions. The research team presented the key findings from the SCT5 session with a particular focus on failure and success factors, and the responsibilities of the various stakeholders. The moderator then invited each participant to reflect on their personal roles and responsibilities in light of the SCT5 outcomes, as well as any other aspects they wished to add. A summary of the SCT5 responses to the four evaluation questions (objectives achieved, unintended outcomes, surprises/learnings, and ideas for improvement) then provided the basis for a group debate on how to improve the interventions and identify other contextual factors that could drive change in the respective institutions.

- Sustainability Competence Team Session 6 (SCT6)

SCT6 focused on the evaluation of ECF4CLIM as a whole. To this end, after an overview of the main outputs of the project by the research teams at each DS, the participants reflected and deliberated on both the outcomes and the process of ECF4CLIM. A part of the debate focused on evaluating the outputs of our hybrid participatory approach and, more precisely, on whether it was successful in enhancing self-reflection and deliberation on sustainability competences. Using Problem Structuring Methods (PSM), participants individually identified the main contributions of ECF4CLIM originating from the hybrid participatory process and then engaged in a debate resulting in a priority ranking among its main contributions.

- Sustainability Competence Committee Session 6 (SCC6):

The SCC6 was devoted to the evaluation of the entire project, focusing on the experiences related to the Roadmap, and on the elaboration of policy recommendations aimed at various actor groups. The SCC included a roundtable where each participant presented his/her views, followed by a group discussion. The aim was to identify the main contributions of ECF4CLIM as a whole in light of the three SD competence dimensions (individual, collective and technical-material competences). Also the experiences from using the Roadmap at each DS were explored. This SCC meeting also included the preparation of recommendations for further actions by schools and universities, but also by municipal, regional, and national authorities, and other key involved actors.

SAMPLE:

A total of 49 meetings of the Sustainability Competence Teams (sessions 5 and 6) and Sustainability Competence Committees (session 5) were held at the different DSs, involving a total of 423 participants (including students, teachers, staff and other members of the wider educational community). Table 2 shows how many meetings were held in each series of SCTs and SCCs, and how many people participated in each.

Table 2: Meetings and participants in the deliberative workshops (SCT5, SCC5 and SCC6)

	<i>Meetings</i>	<i>Participants</i>
<i>SCT5</i>	23	191
<i>SCC5</i>	8	77
<i>SCT6</i>	18	155
<i>SCC6</i>	4 ^(**)	33
TOTAL	53	456^(*)

(*) Given that many of the members of SCT5 and SCC5 also participated in SCT6 and SCC6, the real number of individual participants was lower, but certainly close to 300.

(**) By the time of the analysis for this deliverable, information from only four SCC6 meetings were available. In Finland, the meeting was organised only at the Samke high school. In Romania, participants from all three DS schools and the university gathered in a single SCC6 meeting. In

Portugal, the SCC6 meetings were held after the data analysis period, whereas at the Ítaca school in Sevilla, no SCC6 meeting was held.

3.3 Interviews

To deepen our understanding of perceptions and experiences of the ECF4CLIM participants and encourage further reflection within our educational communities, we designed an interview protocol to be used with three to five representatives from each DS who had been involved in the project from the outset.

We designed two interview protocols: one for adult participants (secondary and university students, teachers, school staff, school management, etc.) and one for elemental school students. Both protocols are based on our analytical framework and initial roadmap, and consist of open-ended questions (20 for adults and 10 for children), as well as three background questions concerning the date, the participants' roles in the project, and their gender. The following five topic areas were explored in all interviews: engagement, expectations, technical-material competences, individual competences and collective competences. Details concerning the interview methodology can be found in ECF4CLIM deliverables D6.1 and D6.2.

A total of 71 interviews were conducted with individuals who had been involved in the project from the outset across the four countries. In particular, 34 students, 23 teachers, 7 researchers, 4 members of staff, and 3 principals have been interviewed in our DSs.

The analysis followed a thematic analysis procedure,² through which the different relevant topics of each interview were coded and compared with each other, in order to identify the similarities and differences in the arguments and nuances that each actor introduced in each topic.

² Terry, G., Hayfield, N., Clarke, V., & Braun, V. (2017). Thematic Analysis, p. 17-37. In C. Willig & W. Stainton-Rogers (eds.), *The SAGE Handbook of Qualitative Research in Psychology*. Los Angeles: Sage.

4. Objectives and results of the interventions

4.1. The intended objectives of the selected interventions

The interventions selected for the evaluation at each demonstration site (DS) contained objectives related to individual competences, collective competences and technical-material competences. In Finland, the interventions were interlinked and had the general objective of engaging the students in sustainability action. The specific SAMKE objective was to make sustainability visible and integrate it in all practices of the school.

Promoting individual competences is an objective for interventions in all four countries. For example, at the Bobadela school in Portugal, such objectives included promoting the correct separation of waste, and at the Mozart school in Spain, that of learning to plant and care for trees and shrubs, fostering positive attitudes toward plant maintenance, and understanding vegetation's importance for the environment.

Many interventions were also aimed at promoting collective competences, such as the awareness among the school community for the separation of garbage (Bobadela, Portugal), promoting cultural awareness of plants' role in providing numerous ecosystem services (e.g., carbon sequestration, climate change mitigation, oxygen production, biodiversity enhancement, soil conservation, and erosion prevention) through participatory learning (Mozart, Spain) and to improve the understanding of the interconnected economic, environmental, and social dimensions of sustainable development and their relations with technological advancement (Pitesti, Romania).

Examples of the objective of improved environmental performance (and therefore technical-material competences) included increasing the number of containers for waste separation (Bobadela, Portugal), improving the microclimate and sustainability within schools and urban areas (Mozart, Spain), reducing energy consumption (Mioveni, Romania), quantifying the energy savings achieved by reducing the need for cooling (Itaca, Spain), and introducing selective waste collection at the university campus (UAB, Spain).

The main objectives of the selected interventions are presented in the following.

Basic schools

Juhauskylä, Finland:

Title of the intervention: Engaging students and the whole school through awareness raising and positive behaviour campaigns (DS01-IN03).

Objectives: It aims to raise awareness, engage, and motivate students in acts of sustainability, while also making these sustainability acts and issues more visible in the school. At the primary school, the competition was held both between classes and among individuals. Another objective was to foster the creative skills of communication and influencing others' attitudes among the organising students, as well as to promote their agency.

Bobadela, Portugal:

Two waste management interventions were evaluated at the Bobadela school:

Title of the intervention: Implement more recycling bins inside the school (PT-DS02-IN08)

Objectives: Increase the number of available containers for waste separation. Awareness in the school community for the separation of garbage. Decrease the production of waste produced. Increase the separation of recyclable waste

Title of the intervention: Competition to promote an efficient waste separation (PT-DS01-IN09)

Objectives: Promote the correct separation of waste. Get more recycling equipment at school. Teach the community about recycling and its importance. Debunking myths about recycling. Decrease the amount of waste produced at school

Mozart, Spain:

Title of the intervention: Planting trees in the school and visit to the native plant greenhouse of ARBA (SP-DS02-IN07)

Objectives: Individual competences: learning to plant and care for various trees and bushes, fostering positive attitudes toward plant maintenance, and understanding vegetation's environmental significance. Collective competences: Promoting cultural awareness of plants' roles in carbon sequestration, climate change mitigation, oxygen production, biodiversity enhancement, soil conservation, and erosion prevention through participatory learning. Environmental performance: Plantations aimed at improving microclimate regulation and sustainability within schools and urban areas.

Dragasani, Romania:

Title of the intervention: Installation of solar panels (RM-DS01-IN01).

Objectives: To share how the solar energy may be easily harvested at school and household levels. To promote the use of renewable energy and to reduce the emissions and the costs. To stimulate the learning by communication of the results. To promote the energy shift from fossil fuel to green alternative and to improve the existing knowledge. To increase the awareness by understanding the impacts of the implemented measure. To create appropriate messages to spread the use of solar energy. To spread the information to the local community and other schools.

Sercaia, Romania:

Title of the intervention: Installation of solar panels for electricity (RM-DS02-IN01)

Objectives: To share how the solar energy may be easily harvested at school and household levels. To promote the use of renewable energy and to reduce the emissions and the costs. To promote the energy shift from fossil fuel to green alternative and to improve the existing knowledge. To stimulate the learning by communication of the results. To create appropriate messages to spread the use of solar heat to other schools, organisations, and households.

High schools

Samke, Finland:

Title of the intervention: Engagement of students: establishing a student sustainability action group (FN-DS02-IN06)

Objectives: To promote sustainable actions at school and positive attitudes among students. Integrating sustainability as a whole school approach in Samke high school, making sustainability visible.

Mioveni, Romania:

Title of the intervention: Infrastructure improvement - water sensors at the sanitary facilities (RM-DS03-IN01)

Objectives: To demonstrate the effectivity of water conservation by a simple measure, avoiding the excessive water wastage. Reduce energy consumption. Awareness-raising and spreading the information beyond the school.

Camarate, Portugal:

Title of the intervention: Reactivate the school's biological garden (PT-DS02-IN3)

Objectives: Reactivate the school's biological garden (called "Quinta do Charco"), making it a space for promoting sustainability, learning, and contributing to the community. The garden, in addition to providing biological products and sheltering animals, will have space for classes and training sessions.

Ítaca, Spain:

Title of the intervention: Measuring the impact of shading projected by trees (SP-DS01-IN01).

Objectives: To understand the influence of shade management on reducing school cooling demand. Quantify the potential energy savings by minimising the need for cooling. Identify the most effective trees in generating shade and their strategic location. Establish guidelines for tree maintenance and pruning based on their impact on shade. Create a regular reporting system for sustainable shade management on campus.



Universities

JYU, Finland:

Title of the intervention: Discussions and coaching on sustainability and curricula development with teachers and students (FN-DS03-IN01).

Objectives: To make sustainability visible, connected, and prioritised in the curriculum reform process of the university in 2021-24.

Pitesti, Romania:

Title of the intervention: Development of educational materials for sustainability (RM-DS04-IN02).

Objectives: To offer a thorough understanding of the economic, environmental, and social dimensions of sustainable development and how they intersect with technological advancements. To evaluate various green and renewable technologies and apply principles of sustainable engineering and resource management to real-world scenarios. To foster the ability to design and implement technological solutions that are ethically sound. To equip students with the knowledge and skills to create and adapt technologies that address the challenges of climate change and enhance community resilience. To promote interdisciplinary collaboration, preparing students to effectively engage in global sustainability projects and initiatives. To develop skills for effective stakeholder engagement, ensuring that technological solutions are inclusive, culturally sensitive, and meet the needs of diverse communities. To provide practical experience through the design and implementation of sustainable development projects, allowing students to apply theoretical knowledge in real-world contexts.

UAB, Spain:

Title of the intervention: Improve the waste system management at Faculty level (SP-DS03-IN06).

Objectives: The objective of this activity was to monitor the evolution of waste generated at the Faculty of Political Science and Sociology, in order to make its volume and typologies visible, with the aim of generating a reflection on the environmental impacts of the Faculty and on how to manage them. It was also intended to contribute to the replacement of the current waste garbage cans by selective collection points, more in line with current legislation and trends, as well as to provoke a debate on the issue of waste. The aim is to introduce a pilot program for selective waste collection at the faculty to identify challenges and improvements in the collection and sorting process, while encouraging students, teachers, and staff to adopt sustainable habits.

Title of the intervention: Facilitate transversal learning spaces (SP-DS03-IN07).

Objectives: The intervention consists of a training course on the ecosocial crisis, designed as a transversal teaching space, open to students from all backgrounds, and also to teachers, which allows for dealing with issues related to sustainability from a social science perspective, and which

also allows for various activities to collect and analyse environmental data from the campus, to be debated and interpreted in accordance with the contents of the course.

4.2. The success of the interventions in terms of their intended objectives

The analysis of the degree to which the interventions have achieved their intended objectives is a starting point for the exploration of intervention theories. In ECF4CLIM, these objectives were defined within WP5, in collaboration with the partners and stakeholders at the demonstration sites. The overall judgement of the success of the interventions was highly positive, but the evaluation also revealed several points of improvement and thereby generated useful lessons.

As part of SCT5 and SCC5 meetings, the objectives were not always defined and discussed in full detail, given the limited time available. Instead, an assumption was made that the participants were aware of the objectives on the basis of the previous SCT and SCC meetings and from implementing the interventions. The analysis of the degree of results-achievement revealed that a more thorough discussion and more rigorous definition of the objectives would have been useful, so as to maximise the learning from the interventions. On the other hand, the fact that the objectives remained somewhat implicit and left room for interpretation at the very beginning in itself facilitated learning, as the involved participants could discuss and confront their varying expectations and objectives at the SCT5 and SCC5 meetings. This was perhaps most clearly expressed in the questionnaire survey by a Spanish adult male respondent, who wrote: *“The project has taken a turn; the objectives set at the beginning have not been followed. (...) Initially, the focus was on infrastructure and then shifted to awareness and pedagogy – not a bad idea, as it has an impact on the educational community and on families.”*

4.2.1. Basic schools

The partners at our demonstration sites mentioned numerous benefits from the interventions, often however without reference to the initial objectives and intended outcomes of the intervention in question, or without describing the observed or supposed causal relationships between the intervention and its outcomes.

Oft-mentioned benefits were strengthened agency of the participating students, and greater visibility and awareness of sustainability within the school (e.g. **Juhannuskylä**). Longer-lasting impacts included the aim to continue the work within the SCTs, for example in a joint SCT for teachers and students at **Juhannuskylä**.

Other participants, such as those at **Dragasani** school, stressed the importance of improvements in technical-material competences (as well as to environmental performance) in terms of improved energy efficiency and cost savings, but also the ancillary benefits in terms of individual competences (sustainability education, improved knowledge on the school's energy consumption, improve teamwork skills among students), and further benefits for collective competences (the school obtained the statute of prosumer, allowing it to inject excess electricity from its solar panels to the grid), and the establishment of a model for the local community.

Weaknesses of the intervention at **Dragasani** included the failure to engage the broader student community beyond the committed few, partly because of the busy schedules of the students, who had little time for extracurricular activities. The difficulty of extending the experience beyond those that are already committed to sustainability work was a problem identified at all of our SDs, in relation to all of the interventions studied. At **Dragasani**, this also limited the awareness-raising impact of the intervention, as not all students recognised the importance of the project as a model for sustainability. Resource scarcity further hampered the intervention, because the maintenance of the equipment beyond their warranty period was not guaranteed by the externally-sourced specialised services. Moreover, the degree of skills retention among the students is likely to be variable and uncertain.

At **Bobadela** school, the intervention was described above all as a catalyst for change, which resulted in greater awareness of the importance of waste management for sustainability, and provided a practical and visible example that triggered conversations, idea-sharing, and recognition of good practices, leading to changes – albeit small – of practices. It provided to the participants a *sense of purpose*, encouraged *collaboration* amongst the different fractions of the school community (CC), and fostered reflection (at SCTs and SCCs) that would *empower the students* to potentially influence their peers, families, and community. The intervention helped to reveal gaps and inconsistencies in the school's sustainability work (weak connection between daily habits and classroom learning). The intervention underlined the importance of *collaboration* among the numerous involved parties, also outside of the school. As such, the intervention was a *testbed* for practices that could later be scaled up or incorporated into existing sustainability strategies.

At **Mozart** school, the intervention (tree planting and garden cultivation) was deemed to have improved both collective and individual competences. It was seen to help better coordinate work among the involved stakeholders (especially between CIEMAT, ARBA, the municipal council, and the Eco-schools network), while also strengthening the motivation among students and teachers, their commitment to sustainability practices, and their sense of belonging and environmental responsibility. Sustaining these impacts and the positive momentum beyond the duration of the project was recognised as a challenge.

4.2.2. Intermediate / high schools

At the Finnish **SAMKE** high school, the key objective of the intervention – engaging the students in action for sustainability was undermined by the small number of students willing to actively participate. Among the teachers, the intervention fostered a good and collegial atmosphere of mutual support in favour of joint sustainability action.

At **Camarate**, the participants agreed that it was too early to say much about the degree of success, because was still underway. Therefore, no direct changes in competences or environmental performance were visible yet. The intervention was met with enthusiasm, because it was expected to satisfy the long-standing demand for outdoor learning spaces. Already the very proposal and design phases of the intervention served as a catalyst for a change in attitudes. However, the slow advancement of the project and the lack of visible short-term results also fed frustration, as the initial high expectations remained unmet, at least for the moment. Despite the frustration, the project nurture a sense of responsibility and ownership among the participating students, and fostered critical thinking, empathy, teamwork, and consideration of environmental ethics.

At **Mioveni**, the intervention was seen to have reached its direct objectives. It was found to have produced tangible benefits such as reduced consumption of water and gas (for heating the water), better hygiene and convenience, as well as improved maintenance at reduced cost. The indirect benefits included improved image of the school, enhanced awareness of the importance of water conservation and management, as well as the ability of the experience to stimulate discussion about sustainability. Factors preventing the benefits of the intervention to reach even wider and be sustained over time included resource constraints (e.g., lack of sponsors), conservatism and resistance to change among the school community, limited technical competence especially among the administrative staff, and the low priority of sustainability at the institution as a whole and among the students (only a small number of highly committed students participated).

At the **Ítaca** school, the intervention had reached its primary objectives, resulting in a notable improvement in the school environment. The planted trees provided additional shading and thereby helped to reduce the demand for cooling and the associated CO₂ emissions. The high degree of commitment among the students was mentioned as a key enabling factor, whereas the lack of maintenance during the summer season and the resulting reduced growth rate of the trees were evoked as factors limiting the effectiveness of the intervention. Also some acts of vandalism were reported.

4.2.3. Universities

At **JYU**, the participants highlighted the merits of the project (not only the interventions) in that it provides platforms for discussion on sustainability, and thereby helps to raise awareness and visibility of the topic. One JYU interviewee considered that the ECF4CLIM project had indeed steered the process of curriculum reform towards greater appreciation of sustainability, or had at least significantly contributed to such a shift. At **Pitesti**, the informants mentioned the improvement of knowledge and skills, awareness, critical and innovative thinking, and enhancement of the study program's attractiveness as the main direct benefits of the new course on sustainability that could be introduced thanks to the resources provided by ECF4CLIM. Other, more indirect impacts, included improved partnerships and communication.

At the **UAB**, the students were found to be highly motivated to engage in selective sorting of waste, with an aim to change the university's waste management practices. However, the concrete results of the intervention in terms of reduced waste generation and selective collection of waste are not known yet, as the data is still missing. The **UAB** teachers agreed that the intervention had succeeded beyond expectations in that it has effectively spurred the university to create a functioning system of selective waste collection, and that the data generated on waste collection had been useful for creating awareness among students. Among the more indirect impacts of the intervention were its ability to engender debate concerning the effectiveness of different measures in stimulating change towards sustainability, notably the respective importance of regulative and normative competences: would mandatory regulation be needed to achieve more sustainable waste management practices, or would awareness-raising lead to more lasting effects?

No information was available from the Portuguese IST university.

4.3. The success of the project in terms of its intended objectives

Discussions concerning the successes and failures of the ECF4CLIM as a whole turned out to be more extensive than those on the individual interventions, and as such, apparently an easier topic for the participants to debate. These discussions also turned out to be the main venue for joint reflection on the intervention theories – the causal relationships between the project and the observed change or the absence of it. In particular, the participants were led to discuss and sometimes disagree on the relative importance of the three competence categories (individual, collective, and technical-material) in fostering change.

The overall judgement of the success of the project was highly positive. Indeed, from the perspective of evaluation, the discussions were probably excessively skewed in favour of positive outcomes from the project, while the criticism, as a potentially powerful source of learning, was relegated to a secondary position.

4.3.1. Basic schools

In Finland, the SCC6 session gathered participants from both the basic school **Juhannuskylä** and the **Samke** high school. The participants agreed that the SCC meetings had been conducive to encounters and discussions among a large number of involved actors. The project has shown the possibility of small changes at the level of individual schools. Among the Finnish schools, **Juhannuskylä** has been better able than **Samke** to benefit from the ECF4CLIM resources, which have allowed **Juhannuskylä** teachers to devote time to sustainability. At **Samke**, instead, teachers could not resort to the same solution, that is, employing substitute teachers to carry out the ordinary duties while the primary teacher is doing sustainability work within ECF4CLIM.

The students at **Juhannuskylä** concluded that ECF4CLIM's main contribution had been the greater **visibility** that it had offered to sustainability. This visibility, in turn, had changed attitudes towards sustainability among the school community, the students argued. For teachers, the main benefit was the ability to devote additional time for sustainability work that the project resources enabled. Also the teachers considered that the attitudes towards sustainability had become more favourable thanks to ECF4CLIM. However, the teachers also had some reservations, and considered that the SCT meetings have not always been truly useful, and remained an exercise somewhat isolated from the day-to-day work and life at the school. Another source of criticism was the "project culture" that the teachers saw as a threat to continuity and quality of schoolwork. The multiplication of projects in which teachers must participate risks leading to fragmentation and loss of focus, "of not being able to concentrate properly on anything". More resources, essentially time, would be needed if indeed the amount of project-based work increases.

The **Bobadela** participants underlined the value of the hybrid-participatory approach in motivating the school community and ensuring the active involvement of students, teachers, staff, and school leadership. The project thus promoted teamwork, beyond the traditional school hierarchies. Moreover, the participants did not perceive ECF4CLIM as an externally imposed obligation but instead as something built from within – a project that helped stimulate a culture of shared responsibility.

Similar appreciations were raised at **Dragasani**, where the four most significant benefits of ECF4CLIM were deemed to be those of 1) Encouraging open expression of ideas, b) effective

teamwork and collaboration; 3) improved understanding green energy and the operation of solar panels; and 4) better understanding of the respective roles of the participants within a school or a team. The hybrid-participatory process was appreciated for its ability to stimulate collaboration, teamwork, critical thinking, engagement, as well as its ability to articulate one's own views and understand those of the others. Along the same lines, the students at **Sercaia** identified the following as the top benefits from the project: 1) "We worked well together as a team; "Small actions can make big changes"; "I'm more aware of my impact"; and "I can explain why green energy matters". **Sercaia** teachers, in turn, ranked the power of teamwork as the main contribution of the project, followed by its ability to foster learning through practice, acquisition of transferable skills through the engagement with real-world problems, and the impact of the project on ""greening"" the school (e.g., better awareness and management of energy and resource use, integration of environmental topics into classroom activities, and the promotion of eco-friendly behaviours among students and staff).

At Mozart School, the students emphasised the importance of experiencing pleasure and joy, and of enjoying nature in peace at Umbralejo. They particularly emphasised the importance of participation, which, when coupled with enjoyment, provides agency, a voice and knowledge. Teachers at Mozart, in turn, stressed the value of participation and engagement. While tangible physical changes in the school area are vital, they must go hand-in-hand with the nurturing of sustainability values. The project succeeds, when it "delivers hardware with software", the teachers argued.

The hybrid-participatory methodology was very positively judged at all DSs. The **Sercaia** students particularly appreciated the benefits for collective learning, teamwork, and ownership, but also considered that the method had fostered closer links between the school and the wider community and society. The students felt that through the project, they had true impact on their community and even on global sustainability. Also the teachers at **Sercaia** stressed the value of the methodology and process in improving collaboration and interpersonal relationships, increasing the motivation and responsibility of the students, fostering inclusivity, helping to bridge the gap between theory and practice, and in supporting long-term personal growth.

The students at **Mozart** found the SCT meetings to have fostered engagement, strategic and critical thinking, and individual reflection, thus providing a platform for dialogue, empathy, and mutual understanding among the participants. The teachers cited terms such as participation, debates, "involvement of all actors," and the ability of the process to stimulate and "energise" activities.

From the perspective of intervention theories, the SCT6 and SCC6 meetings triggered highly interesting debates concerning **the priorities of distinct objectives of the project**, and therefore on

the relative importance of and the relationships between the three competence areas. These SCT and SCC meetings therefore turned out to be key venues for learning through the exploration of concepts and empirical experience. At **Mozart** school, the teachers debated the respective importance of the benefits of the hybrid-participatory process in 1) fostering dialogue for its own sake and its intrinsic value, 2) converting theory into action, and 3) enhancing the visibility of environmental issues in public debate and the public sphere. Similar discussions were conducted on the relationships (priorities) between the three competence categories: the participants agreed on the centrality of collective competences, with participatory practices, open debate and inclusive committees seen as the backbone of any successful intervention. Differences in perspectives were revealed by the distinct interpretations of the item “clarity of objectives and transparency of information” (identified as vital precondition of success). Some viewed such clarity in purely environmental terms (ensuring that environmental objectives are measurable, and that the responsible actors can thus be held accountable), while others associated clarity with collective learning processes.

Similarly, at **Sercaia** school, diverging views could be detected between those emphasising technical learning outcomes and others stressing social-emotional and collaborative learning; and between those who prioritised tangible and visible environmental outcomes (“The project helped make our school greener”), and others putting the emphasis on more subtle cognitive and behavioural changes at the individual level (e.g., “Small actions may demonstrate a huge potential”). The teachers at **Sercaia** agreed that the recipe for transformative change lies in the joint development of individual and collective competences, which produces the outcome, that is, improved environmental performance. Collective competences were to a large extent defined in terms of teamwork and group collaboration, while the broader structural and institutional issues (normative and regulative collective competences) received less attention

4.3.2. Intermediate / high schools

Both the students and teachers at **Samke** agreed that the environmental performance of the school had improved, thanks to the installation of a recycling system, bike racks, and bio-scale (to measure the volume/weight of the food-waste generated). However, as at the Finnish schools and university in general, what the **Samke** teachers and students valued the most was the greater **visibility** that ECF4CLIM gave to sustainability issues at the school. In the words of one participant, “the results of recycling are not as important as the visibility of recycling for all”.

At the **Itaca** school in Seville (Spain), the environmental improvements of an intervention dedicated to planting trees to provide shade in the schoolyard were also primarily valued, but it was noted

that there were continuity issues throughout the project that caused some of the trees to dry out “due to lack of monitoring or maintenance.” This reflects the importance of the institution efficiently assigning responsibilities for interventions to improve sustainability.

At **Mioveni** school, the students stressed the importance of communication, critical thinking, and shared responsibility – including towards the community at large – as the main positive results from the project. In a similar manner as at the basic schools in Romania, “teamwork” scored highest in the ranking among the most significant contributions of ECF4CLIM, followed by “lifestyle changes”, “demonstration as a relevant example for others”. The replies suggest that ECF4CLIM helped to sensitise the students to sustainability issues, as they aim to engage in sustainability work during their future careers, for instance by seeking opportunities to study and work at organisations where they can make a meaningful change in favour of sustainability. (This contrasts with the Finnish students’ trend to focus on success in exams, taking only the mandatory courses and those that would best help them to pass the graduation exam and obtain good notes).

The reflections by the **Mioveni** teachers were highly similar to those expressed by the students. Direct benefits in terms of environmental performance were highlighted (the reduction in water consumption at the school and the identification of tangible problems such as overconsumption of water), yet these were described in connection with other benefits, related to collective and individual competences: teamwork, collaboration, rigorous planning; shift in mindset of the school personnel towards greater awareness of sustainability challenges and need for action.

A number of contrasts and divergences of view appeared, reflecting distinct hypotheses and “intervention theories” concerning the best ways of promoting sustainability. Among the **Mioveni** students, these included the relative importance of intellectual/cognitive learning on the one hand and emotional/experiential learning on the other; between external communication aimed at promoting sustainability (towards society at large) and individual growth, reflection, visions, and courage to act; and between personal learning and group action. Similarly diverging perspectives were seen in the ranking exercise, where the ability of the project to help create “a cooperative work environment” and “strengthened self-reflection, collective analytical thinking, from multiple perspectives” emerged as the most highly valued contributions of ECF4CLIM. Among teachers and staff, perhaps unsurprisingly, the teachers tended to emphasise the educational value of the project, whereas the administrative staff highlighted the importance of the practical and operational outcomes in terms of concrete improvements of environmental performance.

While neither the students nor teachers at **Mioveni** were able to clearly point out one among the **three competence dimensions** as more important than the others, at the Portuguese **Camarate**, the teachers concluded on a joint view of the individual competences as the most important.

Transformative change is only possible when individuals are willing and able to act, the **Camarate** teachers argued.

Like at the basic schools, the **hybrid-participatory methodology** was highly valued. At **Mioveni**, it was seen to have fostered critical thinking, collaboration across multiple categories of actors (educational and administrative domains), and the creation of an inclusive atmosphere conducive to the free expression of views. The process also had helped to improve time management and communication, link theory with practice, and support multiple learning styles, thereby enhancing participation and commitment. The comments by the teachers at **Camarate** were similar. The highly inclusive methodology had fostered a sense of shared purpose, belonging, and empathy among the participants; had cultivated a culture of expression and voice; and helped maintain the momentum of the project, making it a continuous process rather than a one-off project. The whole process had fed optimism, strengthening the feeling among the participants that they can indeed do something concrete to advance sustainability.

No data was available from the Ítaca school in Sevilla.

4.3.3. Universities

The most extensive reflections concerning the virtues and shortcomings of ECF4CLIM took place at the universities. At **JYU**, the participants noted the difficulty of isolating the impact of the project from the other SD-related factors and processes underway at JYU simultaneously. But as a part of continuous development, the project had been very significant, the participants argued. Overall, the discussion at the SCT5 meeting fostered reflection on the complex pathways through which the project may have exerted its influence, although no concrete conclusions could be reached on the causal relationships. Despite this inability of pointing out clear cause-effect relationships, the participants listed several benefits brought about by ECF4CLIM:

- . Greater understanding of sustainability competences
- . Stimulated discussion on sustainability at the university (e.g., as part of the curriculum reform)
- . Helped to broaden the view on SD within the university, which has thus far primarily focused on the environmental dimension
- . Offered the students the possibility to participate in discussions on SD competences and take action
- . ECF4CLIM researchers' skills and the ECF4CLIM resources have assisted in the planning of the study module "multidisciplinary studies on sustainability transitions"
- . Fostered collaboration with other universities in the area of SD competences
- . Triggered further projects and research related to SD competences

While the **JYU** students stressed the value of discussions concerning sustainability, the teachers laid greater emphasis on the resources that ECF4CLIM had made available. Although the activities originally planned by ECF4CLIM could not be carried out as foreseen at the beginning – because of the busy schedule of the university teachers and students – the project nevertheless provided a space for highly inspiring discussions and joint deliberation on sustainability, the participants concluded. Moreover, the impacts will outlive ECF4CLIM, which has triggered new initiatives (such as a joint ERASMUS+ project with other faculties), and helped to consolidate the existing ones (the research group on ecosocial education will further pursue its activities).

At the **Pitesti** university, the engineering students valued ECF4CLIM for the ways in which it has helped them to understand better the essence of sustainability and the ways of integrating sustainability in their future careers. This was exemplified by objectives such as “joining sustainable companies” and “how my career can drive change”. The students also mentioned as benefits the enhanced sense of empowerment and belonging, ability to act as agents of change beyond the academia, and the promotion of interdisciplinary collaboration. When asked to rank the benefits of ECF4CLIM in an order of priority, these engineering students prioritised the following, rather concrete and practice-oriented aspects:

- . understanding the real impact of different technologies
- . working in an interdisciplinary manner
- . learning how to plan with sustainability in mind

The staff and teachers at **Pitesti** mentioned very similar benefits from ECF4CLIM as the students did. In addition, the staff and teachers underscored the benefits of the project for the **reputation and standing of the university** in international sustainability circles. The ranking exercise resulted in the following statements representing the most valued contributions of ECF4CLIM:

- . “Technical knowledge was linked to real environmental impact”
- . “Students learned to apply sustainability in technical projects”
- . “Interdisciplinary thinking and collaboration were clearly improved”
- . “Future engineers now consider both social and ecological outcomes”

The students at the **UAB** mentioned benefits along all three competence dimensions: tangible environmental benefits through the improvement of the university’s waste collection and management systems, strengthened individual competences through awareness-raising and knowledge-acquisition, and benefits for collective competences through the organisation of the ecosocial course, organisational change at the faculty, and data collection, which provides an information basis for the change of the waste collection system. Moreover, the project has initiated a process of continuous dialogue on sustainability between the students and the rest of the

university personnel. The students strongly emphasised the value of the process in helping to exert **pressure** on the university leadership in favour of a change towards sustainability. To keep up the pressure, a network of students and teachers committed to action in favour of sustainability at the university would be needed, the students reasoned.

However, the **UAB** students likewise pointed out a number of shortcomings and future challenges. Firstly, participation at the project was limited to the few who are already committed and “sold to the idea” of sustainability. As a result, the relatively quick turnover of students at the university makes it difficult to sustain over time a process so dependent on a handful of active individuals. Even during the ECF4CLIM, it was at times difficult for the students to maintain the momentum and motivation, because of the often long lapses of time between the project activities – for instance between the successive SCT meetings.

Just like their Finnish counterparts, the **UAB** teachers agreed that the main contribution of ECF4CLIM has been the enhanced visibility that it has given at the university to the theme of sustainability. The ads and announcements concerning the ECF4CLIM activities on campus brought the existence of the project to the knowledge of everyone and therefore raised awareness, the teachers argued. Awareness was improved also for instance on the sustainability impacts of the community eating habits. The teachers considered the long duration of the project and the hybrid-participatory process as a virtue, which helped to embed and integrate sustainability in the day-to-day activities at the faculty – something that a one-off event could not achieve.

The **hybrid-participatory methodology** received praise from the **Pitesti** students, who described it as a different, more active and engaging learning experience, which allowed the students to genuinely participate in planning and implementation, fostered teacher-student collaboration, and empowered the students who felt they got their voice heard. The SCT and SCC meetings had offered a venue for joint discussions and deliberation on the complexities of sustainability. The process had stimulated reflection on the tensions and dichotomies such as those between individual and collective responsibilities; between technical and ethical-societal aspects, and between practical skills, reflection and communication. The methodology had therefore fostered deeper reflection on the “intervention theories” behind sustainability. Likewise, the teachers and staff at **Pitesti** appreciated the hybrid-participatory methodology for its ability to foster student involvement and co-design, shared learning and dialogue, creativity, engagement, and flexibility, the acquisition of a holistic sustainability vision, the gathering of actionable feedback, and continuous refinement and improvement of the course.

As for the **priorities between the three sustainability competence dimensions**, the **Pitesti** students could not identify a clear winner, deeming all three equally important. Among the teachers and

staff, lively discussions ensued on these dimensions. Several dividing lines emerged, notably those between:

- . Competence-oriented and curriculum-oriented reflections: some staff are student-oriented, while others are institution-centred – the former emphasising individual competences and the latter prioritising collective competences. These distinctions often mirror the place and responsibilities of the person within the university structures.
- . Individual learning and group competences, that is, between personal learning and transformation on the one hand and team dynamics and collective creativity on the other.
- . Content and process: some valued the need to link technical knowledge with environmental impacts while others saw the process itself as the origin of change.
- . Short-term practical learning and long-term cultural change, again reflecting distinctions between individual and collective competences.

The **UAB** students displayed diverging views on the respective importance of the competence dimensions. The tensions and dilemmas involved were exemplified in debates between those who stressed the importance of collective competences, and others who were quick to question what would be the point of concrete interventions such as the introduction of selective collection of waste, if collective competences were all that mattered. Why not then just act at the collective level, by advocating for institutional change, for example? The **UAB** teachers found it difficult to prioritise between the competence dimensions, yet at the end they agreed on the pre-eminence of collective competences, seeing these as necessary for the development of individual competences, the improvement of environmental performance, and therefore for improved technical-material competences.

The SCC6 meeting of **UAB** brought to the fore the importance of aligning the technical-material competences with the collective competences, as a precondition for a successful implementation of the kind of interventions that were planned and carried out at the university. The participants at the **UAB** SCC6 also noted that the hard evidence generated by the intervention gave added momentum and credibility to the ECF4CLIM project in general and to the waste management intervention in particular. In other words, the improvement of the technical-material competences helped to strengthen the necessary credibility of the project in the eyes of key stakeholders. Lastly, the meeting participants underlined the importance of maintaining coherence between words and deeds – the normative collective competences must translate into the cultural-cognitive ones, if work towards sustainability is to produce its expected impacts and maintain support and credibility.

No data was available from the Portuguese IST university.³

³ A management change at IST resulted in the restructuring of all areas related to sustainability when the STC5 and STC6 workshops were due to be organised between March and May 2025. Consequently, the Portuguese research team lost the

5. Explaining the outcomes: success and failure factors

The key objectives of an *ex post* exploration of intervention theories is to promote reflection and learning by helping the participants to:

- Identify those factors that are necessary for the success of an intervention.
- Contrast their initial assumptions with the experience gained from the implementation of the intervention.
- Distinguish between the reasons for success/failure that were caused by erroneous assumptions from those that stemmed from implementation failures.
- Learn how other key stakeholders have thought the intervention could work and how those expectations have affected the intervention.

In the following, we report on the findings concerning the factors that the participants considered crucial for the success of the interventions. The presentation is structured under five headings: the three competence dimensions, resources, and the sharing of responsibilities among the key actors.

A word of caution is in order in interpreting the findings presented below. The distinction between success factors and failure factors caused some confusion among the ECF4CLIM partners and participants. While these were supposed to represent those factors that had turned out decisive in determining the outcomes of an intervention, some partners in fact reported on positive and negative outcomes of the intervention.

5.1. Collective competences

5.1.1 Basic schools

At **Juhannuskylä**, communication and advertising were highlighted as key collective competences determining success and failure. At **Bobadela**, the school's openness to change, its pre-existing commitment to sustainability, and the support from the school principal were mentioned as

key professors and students they had been working with and were left without any contacts. As a result, they were unable to reorganise their teams in time to complete the reports.

determinant in making the intervention a success. Thanks to the involvement of the school at the Eco-schools programme, sustainability themes were already on the school agenda prior to ECF4CLIM. However, missing in **Bobadela** was close collaboration between the school and the families. Likewise, the practices of the municipal waste collection company did not align well with those advocated by the school in its sustainability work.

At **Dragasani**, the participants praised the excellent collaboration between the school administration and the ECF4CLIM team as key to success, together with a careful selection of an experienced contractor for the installation of the solar panels.

Similar to Dragasani, the **Sercaia** participants likewise highlighted the role of competent renewable energy experts from outside the school community. Like Bobadela, Sercaia benefited from an existing culture of sustainability within the school. The close involvement of both the parents of the students, and local authorities were mentioned as further collective competences enabling success. Lastly, the increasing media and public attention to environmental issues in recent years had prepared the ground for the successful implementation of the intervention. The Sercaia experience highlighted the importance of sustainability visions (normative collective competence): the school should have a coherent vision and strategy of sustainability that would provide guidance for individual interventions and sustainability initiatives. At **Dragasani**, the durability and lasting impact of the project crucially depends on whether the intervention becomes integrated into the school's strategies and day-to-day practices.

At **Mozart** school, a number of factors were brought forward to explain the successes and shortcomings faced by the intervention. The conclusions were nuanced, with partly contrasting judgements concerning the role of collective competences. The long-term collaboration with ARBA (a tree nursery entity that works with schools) helped the intervention succeed, as did parental and community involvement, which provided critical external support and helped maintain support and societal interest. The difficulties faced by the intervention helped to identify other critical factors. Effective logistics and organisation are crucial.. Remarks were made about the at times insufficient institutional support from external entities, in particular the City Council.. Strong leadership and effective logistics and coordination were mentioned as positive aspects. The follow-up and plans for the future were seen as insufficient to guarantee the continued motivation and continuation of the activity, while the sometimes poor communication among the involved stakeholders were further shortcomings. The experience underscored the importance of careful planning, clear instructions and good organisation for the success of this type of interventions. The Mozart participants pinpointed the limited awareness and commitment of the community at large as an impediment to fully successful sustainability interventions.

A concern cutting across all of the basic schools was that of ensuring that the impacts spread beyond the already committed individuals within the school, and eventually to the wider community outside of the school. At **Juhannuskylä**, the question was associated with the need to engage for example the canteen personnel in efforts at reducing the environmental footprint of the school catering services. The **Bobadela** participants pondered on ways to engage a greater number of school classes in sustainability work, while at **Dragasani**, the participants noted that the broader student community remained largely indifferent to the intervention. The **Sercaia** experience provided a contrasting example of success, as the intervention had spurred the students to talk, at home and in their community, about the sustainable practices that they had learned at school. In both Dragasani and Sercaia, the long-term durability of the interventions were threatened by problems with the contracts and post-project maintenance, as the maintenance and repair after the expiration of the warranty period were not guaranteed. Finally, at **Bobadela**, the broader cultural aspects were brought up, namely resistance to change and the tendency to blame others.

5.1.2 Intermediate / high schools

At **Camarate**, the intervention faced a number of difficulties that help to illustrate the role of collective competences. During the planning of the intervention, insufficient attention was given to the role of actors outside of the school, whose contribution would be crucial for delivery. The durability of the positive impacts achieved is uncertain, for lack of integration of the intervention, for at least three reasons. First, the intervention has thus far not been adequately in the school's strategic plans and training programmes for students and staff. Second, there is a lack of a true plan for maintenance, which leaves uncertain the future of the green space created. Similar uncertainties were observed at the **Ítaca** school in Seville, where the lack of maintenance and care for the trees planted undermined their growth. Third, the intervention has not reached to a broader range of students, beyond the few active participating students. A gap therefore remains between the enthusiasm of the individuals engaged in the planning and implementation of the intervention on one hand and the institutions on the other. A key lesson from the **Camarate** experience is the need for realism in planning, which needs to carefully consider the roles and responsibilities of the actors beyond the school environment.

At **Samke**, the ECF4CLIM experience showed how even such a seemingly simple matter as improving the sustainability of school catering could not be truly fostered by the school alone, but would require the collaboration of a multitude of actors. The Samke participants saw impediments to sustainability in the collective competences that govern school activities. The curriculum enables disciplinary sustainability education, the participants argued, but is not conducive to enhancing holistic and systemic understandings of the complex sustainability challenges. At **Mioveni**, the experience was clearly more positive, with visions and promises operating as factors that motivate

actors to act for sustainability. These include the green vision of the school (normative CC), the possibility of reducing the water bills, and the promise of cleaner and more functional toilet facilities. However, like at the Portuguese basic school, **Bobadela**, the conservatism of the educational community and its resistance to change was pointed out as an impediment. Both at **Samke** and **Mioveni**, the participants evoked the pressures to perform in graduation exams and in mandatory subjects as a hinder to sustainability work, which still remains a marginal rather than a central element of the school's activities.

5.1.3 Universities

The institutional support by the university leadership was reminded by the participations of the intervention at the **IST**. The intervention was characterised as a success, provided that the university leadership continues its support. Furthermore, the planning of the intervention failed to involve multiple departments and units, which would be a precondition for the continued success of the intervention. Summing up, it is still uncertain whether the intervention will become a part of the university's overall strategies and plans, that is, whether it becomes institutionalised and become integrated as part of the normative collective competences of **IST**.

AT the **JYU**, the participants underlined the success of the collaboration with students, which has since then triggered other processes and activities striving towards sustainability. Wide publicity and communication were preconditions for the success of the interventions – the advertisements, bulletins, announcements, and platforms on which the curriculum reform was discussed were crucial in raising awareness and giving visibility to sustainability and the ECF4CLIM interventions. However, like at the **IST**, there were doubts about whether the sustainability issues included in the curriculum will translate into concrete action (gap between normative and cultural-cognitive competences). Continuity would likewise be hampered by the high turnover of students, as well as by the kind of “project culture” evoked by the **Samke** high school teachers: if sustainability is only or primarily promoted through projects, this hampers the continuity and institutionalisation, which are necessary if the positive impacts are to persist over time. The teachers were also sceptical regarding the ability of the relatively short international projects such as ECF4CLIM to truly promote sustainability, within the rigid structures of the university. The ECF4CLIM experience led the **JYU** teachers and students to discover the inertia of university bureaucracy and the large number of groups and collectives at the faculty, whose contribution would be needed for the implementation of this kind of an intervention. Similar experiences were shared by the **Pitesti** participants in Romania: because of bureaucratic impediments, it would take time and effort to integrate the sustainability course introduced as part of ECF4CLIM into the university curriculum. For this to happen, further support might be needed.

JYU participants also mentioned how importance of how sustainability is defined. Teachers from different faculties and disciplines have their own perception of what sustainability implies. If sustainability is defined as a mandatory element in the curriculum, it risks remaining mere rhetoric. This is because the teachers will be tempted to stretch the definition according to their own views and preferences, and carry on their teaching and other duties as before, but under the banner of sustainability.

The Finnish research team noted that while interaction with the students was satisfactory, the team encountered particular obstacles and “cultural clashes” in their interaction with other faculties, which often had no time or showed no interest in engaging with the ECF4CLIM team. Such problems were particularly pronounced with the business school, whose teacher staff seemed to misunderstand the objectives and intentions of the ECF4CLIM team. The business school representatives apparently thought the ECF4CLIM researchers were trying to use them as Guinea pigs and take advantage of them. One potential explanation for the problems was the high degree of autonomy among university teachers to decide upon their teaching methods and contents. Especially the teachers at the business school seemingly doubted whether the ECF4CLIM team had the needed competence to help them with sustainability work at the business school. While such difficulties were expected, their extent surprised the Finnish ECF4CLIM team.

5.2. Individual competences

5.2.1. *Basic schools*

In all of our schools, the importance of the attitudes and interests of students were highlighted as a key factor determining the success of the interventions and sustainability work at large. At **Bobadela** and **Mozart**, the research teams attributed the positive impacts of the interventions to the exceptionally motivated and engaged student teams involved. At **Dragasani**, the students indeed became active ambassadors of sustainability in their community. At least equally important was the commitment, enthusiasm and motivation of the participating teachers – mentioned as a success factor at **Bobadela**, and **Juhannuskylä**. The visibility of concrete environmental benefits was found to strengthen the motivation of the students to commit themselves to sustainability work at the **Mozart** school.

Among the problems were mentioned the difficulty of changing habits, especially when **parents** do not actively promote such a behaviour change at home. Attitudinal problems included those observed at the **Mozart** school, where some potential participants (teachers in particular) were

reluctant to engage in implementing the intervention, for fear that this might lead to an excessive work burden. Outright resistance came from some parents, who thought the intervention could undermine educational achievement, fearing that work on the intervention would reduce the time that the students would devote to ordinary schoolwork. Finally, vandalism – observed on a few occasions at **Ítaca** – was mentioned as a potential attitudinal and behavioural problem associated with planting and gardening interventions.

5.2.2. Intermediate / high schools

Only a few references were made to the role of individual competences at the intermediate and high schools. On the whole, the importance of active and committed teachers – and the fragility that such dependence on a handful of individuals – was recognised as a general phenomenon conditioning the success of the interventions. This was exemplified at **Camarate**, where the temporary absence of the teacher leading the intervention revealed the importance of such individual “champions”. Another limitation faced at **Camarate** was the lack of visible outcomes – an outcome of the unexpected delays in implementation – which threatened to undermine the motivation of the students. Finally, at **Mioveni**, the poor technical knowledge among the administrative staff was a potential hinder, as the staff feared the potential complications and additional work that the project might generate for them. Like at the **Ítaca** basic school, **Mioveni** participants mentioned acts of vandalism as a potential problem.

5.2.3. Universities

At our universities, references to individual competences were likewise scarce, beyond the observation common to all DSs about the reliance of the interventions on a few committed and exceptionally motivated students and teachers. Not only does such reliance risk undermining the implementation of the project if a key person for one reason or another leaves the project, even for a short period of time, but it also prevents the institutionalisation and broader dissemination of the benefits.

5.3. Technical-material competences

A few mentions were made about the role of technical-material competences in conditioning the success of interventions and the project as a whole. These included seemingly trivial but nevertheless crucial problems such as the difficulties with booking rooms for the events at the **Juhannuskylä** basic school, insufficient provisioning of essential materials (e.g. compost and plants) at **Mozart**, and the lack of waste bins in the common areas at **Bobadela**. In schools and universities

in Spain and Romania, there are reports of difficulties in introducing sustainability improvements due to poor infrastructure (very old buildings, outdated facilities, etc.). At the **UAB** university in Spain, the participants debated technical issues on where to place the bins and how to avoid excessive plastic generation, and whether the bins should be made of cardboard or a more solid material. Although technical, such details have tangible impacts on individual behaviour and attitudes, and are conditioned by collective competences (e.g., the organisation of the waste management system, provision of services). Indeed, at **Bobadela**, the waste collection was in the hands of a private company, whose practices it was near-impossible for the school to influence. At **Dragasani**, the maintenance of the installations after the expiry of the warranty period was a major concern and potential impediment to success. At the **Mioveni** high school, concerns emerged about the cost of maintenance, which at least some of the participants might be reluctant to accept. Yet, technical support and maintenance would be vital for the successful implementation of the intervention.

5.4. Resources

Among the resource issues, **time** limitations constituted by far the most prominent concern. Teachers are typically busy with a multitude of activities, and those committed to sustainability are often among the most active also in other fields of schoolwork. The time that teachers can devote to extracurricular activities is constrained by salary arrangements, in particular in Finland, where teachers are paid according to the hours of work conducted at school instead of their total working hours. Time constraints were the main reason why the series of SCT and SCC meetings could not be organised at the Finnish **JYU** university as originally planned. Ultimately, time constraints translate into a question of money: for instance, had more financing been available to hire external service providers, the teachers at **Samke** would not have had to take responsibility for tasks such as emptying the bottle recycling bins. Likewise, at **Camarate**, the garden project was not delivered on time, for lack of dedicated funding.

Not only teachers but also students lacked time to engage in ECF4CLIM activities. The students tend to have their schedules packed with ordinary school activities, and especially at high schools, success at the graduation exams is the major concern of both students and teachers. At **Samke**, the problem of time scarcity is compounded by the fact that many of the students are active in competitive sports, and therefore tend to have even less spare time than students on average. The issue of resource scarcity and time limitations extended even beyond the student and teacher community, as the support staff at some occasions feared the additional burden that the interventions and other ECF4CLIM activities would cause them. While not completely solving these resource problems, ECF4CLIM nevertheless helped – and was mentioned (e.g. at **Mioveni** and **JYU**) as indispensable for the successful realisation of many interventions.

5.5. Responsibilities

The fragmentation and dispersion of responsibilities between the waste companies, the municipality, and the school complicated the implementation of the waste management intervention at **Bobadela**. Likewise, at **Mozart**, the lack of clarity concerning the roles and duties among all involved parties caused problems. Also the **Camarate** intervention suffered from the lack of clarity of the responsibilities among the involved actors, and from the failure to engage the support staff early on, at the very start of the intervention. The **Camarate** teachers also underlined that the municipality must be held accountable for carrying out its duties that are necessary for the implementation of the intervention. The quick turnover of students and other key personnel was perceived as a persistent problem: clearly defining the responsibilities is of little help if the key persons responsible for the interventions and activities change often.

At the **JYU** university, the autonomy of the teachers was seen as an obstacle to the prospect of turning sustainability into a part of the everyday university teaching and other activities. This means that too much responsibility is vested on active individual teachers. Indeed, the teachers and lower-level administrative staff considered that the responsibility for broad sustainability reforms should lie upon the shoulders of the university leadership, not the teachers, who have plenty of other priorities and duties – and a lower salary and sometimes precarious employment situation compared with those in leadership positions.

On the positive side, the **Mozart** participants mentioned the presence and support of the school director as an additional source of motivation for those in charge of implementing the interventions. At **Samke** high school, the students, teachers, and the headmaster were all seen to play a vital role. The students would have the duty to communicate sustainability issues to their fellow students, teachers would act as gatekeepers of student participation, whereas the headmaster should provide the necessary support and resources and foster collaboration.

6. Lessons and learning

6.1. Surprises, changes in beliefs and assumptions

Surprises during the implementation of interventions or other project activities can be a significant source of learning. In particular, they can help to better understand the reasons for success and failure and identify whether possible problems were due to poorly well-thought intervention theories or failures to carry out the interventions according to the original plan.

Among the basic schools, our **Juhannuskylä** informants were surprised by the small number of students that expressed their interest in participating in the interventions. This contrasts with the experience at the Romanian schools of **Dragasani** and **Sercaia**, and at the **Pitesti** university, where the degree of commitment, motivation, and openness to learning shown by the students surprised the ECF4CLIM team. In particular at **Sercaia**, the dedication and patience of the student project team, their willingness to engage in discussions, address concerns, and work toward shared goals were praised for having fostered a collaborative and inclusive environment. Rather than simply following instructions, the students actively contributed by their own ideas, engaged in problem-solving discussions, and demonstrated a profound understanding of the project's objectives. These qualities of the team contributed to unexpectedly rapid installation of the solar panels and the associated equipment. Positive experience was also the unexpectedly close involvement of the architecture team (responsible for planning and designing the garden) at **Camarate**. Their ability to listen, adapt, and engage the community was described as having brought a sense of inclusion and helped to translate abstract ideas into concrete, inspiring proposals.

The **Bobadela** experience provided valuable lessons on the importance of **careful advance planning**. The rules of the waste competition were not thought through well enough in advance. Therefore, the team was taken by surprise as the students brought waste home, in order to reduce the amount of waste disposed of at school, and thereby improve their chances of winning the competition. The Bobadela participants concluded that many students were therefore motivated more by the desire to win the competition than by making a genuine contribution to sustainability. At the **UAB**, the experience from the selective waste collection intervention was highly similar. The implementation team was surprised to discover that a lot of the waste originating from the campus (e.g. take-away food containers) ended up being disposed of outside of the university. Hence, selective waste collection on campus might not produce all its expected outcomes in terms of reducing waste. At the UAB, surprises involved more technical questions such as the fact that the bags used for organic waste collection were so large that they would be regularly collected half empty. In doing so, the introduction of selective collection would end up increasing the generation of plastic waste.

Additionally, there was confusion and lack of knowledge about where products such as coffee cups should be deposited. Indeed, coffee cups could be found in all types of bins.

Similar planning difficulties were encountered at **Camarate**, where the implementation of the garden was delayed because of the complexities in coordinating with the actors outside of the school, whose contribution was necessary for the success of the intervention. The Camarate example also reminded the participants of the fact that even the best of plans will not suffice, if the necessary resources and operational follow-up are lacking. The experience at the **IST** university was similar, as unexpected bureaucratic hurdles gradually undermined and partly watered-down the original plan. Most participants were indeed highly surprised by the degree to which the original plans had to be readjusted, due to internal politics, changing leadership, and shifting priorities at the IST.

The **Dragasani** and **Sercaia** experiences in Romania offered a contrasting example of unexpectedly good planning and implementation exactly according to the plan and within schedule. At **Mioveni**, the installation of sensors exposed the students to the complex trade-offs associated with sustainability: the realisation that the sensors were powered by batteries triggered debates on the environmental impacts resulting from the battery production and the associated complex supply chains.

The team at the **IST** university experienced a positive surprise as one of the student designers won a university competition for innovative ideas. The prize provided unexpected addition to the resources available for sustainability work at IST.

6.2. Suggestions for improvement

The fact that the interventions had generated learning by doing was demonstrated by the wealth of suggestions for improving the interventions and the project as a whole, should the experience be repeated in the future. Indirectly, these recommendations provide evidence of the participants' intervention theories by indicating which factors they saw as the most crucial in determining whether the project and its interventions result in success or failure.

Among the recommendations primarily relating to the **collective competences**, better **communication** to the **outside world** emerged as one among the most common suggestions and preconditions for success. Better communication and "marketing" would help raise awareness and thereby ensure support from the community at large, to ensure that the interventions become institutionalised and have a lasting impact. Broad communication should also help to increase the

outreach beyond those already committed to sustainability, and attract more students and school/university personnel in these activities. Especially the universities also evoked the desire and need to consolidate their identity and international reputation as institutions dedicated to sustainability, through programmes such as Eco-Campus (<https://www.ecocampus.global/>).

Along similar lines, **collaboration and networking** with key partners and stakeholders outside of the school or university was mentioned as a means towards institutionalisation. Specific recommendations included networking to share experience with other schools (**Dragasani**), collaboration and awareness-raising with parents (**Juhannuskylä** and **Mozart**), efforts to engage the canteen personnel to work for sustainable school catering (**Juhannuskylä**), and the creation of a dedicated team of teachers and students, to maintain pressure and push the waste management company (**Bobadela**) and on the university leadership (**UAB**) to work for sustainability. The need to identify the key external stakeholders, engage with them, and clearly assign responsibilities from the very beginning was mentioned frequently (e.g., **Camarate** and **IST**), as well as that of expanding the project's reach through the curriculum, by including sustainability in a cross-cutting manner in teaching in diverse subject areas (e.g. **Pitesti**). The difficulties encountered in collaboration with other faculties spurred the **JYU** participants to suggest that instead of organising workshops with faculties, it would be more useful for a curriculum reform to produce good-quality materials that could be used in the reform process.

The need for careful **advance planning** was identified as vital, as a result of planning shortcomings at Camarate, IST, and Mozart, and as a success factor at the Romanian schools and university. The **Camarate** participants suggested reducing the level of ambition and breaking the interventions down to smaller steps and subprojects that would produce tangible outcomes within a short period of time and thereby help to maintain the momentum and the interest of the participants. At **Mozart**, the identified planning issues included details as simple as informing the students and their families early enough about the activities, to ensure they are adequately prepared and dressed for the activity, and are aware of the location in which the activities will take place. The Mozart participants also stressed the usefulness of planning for the worst-case scenarios, and preparing associated contingency plans. Planning should then be accompanied by continuous **monitoring, follow-up and communication** throughout the process, to help identify problems early on and improve implementation, the IST, Mozart, and Sercaia examples showed.

Some recommendations were targeted at improving the **individual competences** and adequately considering their role in shaping the interventions. The **Samke** participants thus underlined the need to consider the students' interests and link sustainability activities with the day-to-day work in a crosscutting manner. At **Pitesti**, specific career guidance was suggested to ensure that the students

have the skills and knowledge to translate their sustainability competences into practical work, in their future professional lives.

To alleviate the ever-present problem of **resource** scarcity, many DSs (e.g. **Dragasani**) suggested searching for additional funding from external sponsors. At **Juhannuskylä**, a plea was made to allocate more time to plan the team meetings for the students and thereby promote positive social relations among the participants.

The more technical suggestions, related mainly to the **technical-material competences**, included those expressed at **Sercaia**, to integrate and coordinate the solar panel installation with the upgrades of other technical equipment, to replicate the same interventions at other schools, and at **Mozart**, to optimise the space utilisation of the space available for planting. Such measures would obviously also help to optimise the use of resources and improve cost-effectiveness.

7. Conclusions: on intervention theories, causal relations, success factors and obstacles

This deliverable analysed the experience from the interventions and the ECF4CLIM project as a whole, on the basis of information gathered at the SCT and SCC meetings 5 and 6, interviews with selected participants, and survey questionnaires. The overall judgement by the participants of the interventions and the project as a whole was overwhelmingly positive. In particular, the hybrid-participatory methodology was described in very positive terms, as a process that had fostered learning, empowerment, empathy, and ownership amongst the participants.

The aim of the evaluation was to explore the often implicit intervention theories of the participants – that is, the assumptions concerning the elements and mechanisms through which the interventions and the project as a whole were expected to produce their outcomes – and discuss and examine these expectations with the participants now that evidence from the actual operation and outcomes of the interventions has been gathered. The exercise succeeded, to an extent, to trigger the desired reflection concerning the underlying causal relationships and the respective roles of the initial plans and the implementation in explaining success and failure. Many of the schools involved had already implemented other initiatives and practices in favour of sustainability, which operated in parallel, and often helped to reinforce the impact of the interventions and the ECF4CLIM project. However, the discussions at the SCT and SCC meetings allowed relatively little opportunities to truly explore the possible and observed causal relationships. To an extent, uncertainty prevails

concerning the degree to which the observed impacts can be attributed to the ECF4CLIM project, as opposed to being triggered by other, parallel or previous activities, especially in the area of sustainability. However, the evidence is sufficient to conclude that, apart from the concrete improvements in environmental performance (e.g. waste collection, water and energy supply, green spaces) at the demonstration sites, the interventions and the ECF4CLIM project as a whole helped raise awareness, give greater visibility to sustainability, and operate as a catalyst for further sustainability activities at the demonstration sites.

The exploration of intervention theories turned out to be more difficult than expected. For example, some informants equated the “success and failure factors” with “successes and failures”, whereas the objective was to identify factors that are likely to determine whether an intervention or the project as a whole succeeds or fails in delivering its benefits. However, thanks to the multiple sources of information, useful evidence was gathered on the success and failure factors, for instance through questions and discussions concerning the surprises that the participants may have encountered in the course of the project. Yet, the intervention theories were discussed, albeit indirectly. For instance, at the IST in Portugal, a debate ensued between those who said the delays and changes in the original plans were due to poor planning (insufficiently developed intervention theories prior to implementation) and others who considered these as a part of any project implemented within a broader institutional setting. As part of the SCT and SCC meetings, the discussion of the outcomes from project as a whole generated more in-depth discussion on the intervention theories than the debates on the interventions. In particular, the debate on the relative importance and respective weights of the three competence dimensions were illustrative. They spurred discussion and probably deeper thinking about the ways of fostering sustainability and, indirectly, the role of the different competences in efforts to promote sustainability. On the whole, we found evidence of cases in which the intervention theories clearly were not thought through well enough in advance, such as at the Mozart basic school in Spain and at the Portuguese schools. In Romania, by contrast, the advance planning was particularly careful, perhaps to an extent that it left little room for possibility and necessity to improvise in the face of unexpected challenges, and thereby generate learning.

Another complicating factor – and a useful finding as such – was that the objectives of the interventions were not always clearly spelled out. The discussions at SCT5, SCC5, SCT6, and SCC6, concerning the outcomes of the interventions (or the project as a whole) seldom contrasted these observed outcomes with the intended ones. Vague definition of the objectives is a common problem in policy and programme evaluation in general. However, in ECF4CLIM, as part of its hybrid-participatory process, such vagueness was also a source of learning: for example, participants that had initially expected the interventions to serve primarily or exclusively the purpose of improving environmental performance and technical-material competences came to discover the broader

objectives underlying the interventions – regardless of how vaguely these objectives may have been described at the beginning. Such learning was particularly visible in the discussions concerning the three competence dimensions. The participants held highly distinct perceptions concerning the relative importance of each dimension. The fact that the participants often failed to clearly prioritise one over the other suggests that the project may have reached the objective of spurring debate and enhancing the understanding of the complex nature of sustainability. Direct improvement of the environmental performance of the school/university was not seen as the only objective that mattered – unlike some participants may have thought at the beginning.

Among the factors determining the success/failure of the interventions and the project as a whole, the various types of collective competences stood out. Most of these were associated with collaboration, teamwork. The broader aspects relating to the role of actors and factors outside of the school community were evoked but not as frequently as in some earlier phases of the project. The key concern and obstacle to wider impacts from ECF4CLIM identified at all DSs was that participation was limited to those students and teachers who were already highly engaged in sustainability work before ECF4CLIM. To an extent, this applies to the schools and universities involved, many of them more sustainability-oriented than their counterparts in general. In addition, resource limitations occupied a key position among the success/failure factors. Time was highlighted as the most direct limiting factor, with financial resources in an indirect role, as a means of “buying time” necessary for sustainability activities.

The exploration of the surprises faced in the implementation of the interventions triggered useful reactions and comments that helped the research team and the participants to identify key factors in the planning and implementation that may have influenced the outcomes. The surprises had revealed to the involved participants gaps in their implicit intervention theories, and thereby helped to foster learning. The most salient positive surprises were the activeness, enthusiasm, and commitment of the student and teacher teams planning and implementing the interventions. The reverse side of the medal was that such enthusiasm was coupled with a corresponding indifference and lack of interest by the student and teacher communities at large. Especially in the Portuguese interventions, the participants were surprised by the weight of factors outside of the school or university – or the internal bureaucracy of the institution in question – in slowing down or hampering the implementation of the interventions. Such surprises spurred the participants to underline the importance of careful advance planning. In the Romanian cases, such careful planning and impeccable implementation according to the plan was highlighted as perhaps the most important factor explaining the success of the interventions. One might even ask whether the planning and implementation were “too perfect”, and as such left little room for learning and improvisation, which could have generated useful lessons for the future.

Several suggestions were made on ways that a similar project and similar interventions could be improved, should they be replicated elsewhere or on the same site in the future. Among these, the suggestions that stood out were communication, networking, early engagement with the wide range of actors needed for the successful implementation of the interventions, and careful advance planning accompanied by monitoring and evaluation.

Finally, the findings from the evaluation reflects differences stemming from cultural, educational, and professional backgrounds of both the ECF4CLIM members and the various participants at the DSs. The perceived benefits of an evaluation include, among other things, their role as a source of 1) constructive criticism and learning, or 2) promotion and “marketing”. Depending on the specific context, one or the other may be prioritised and deemed as the most useful. In the evaluation, the highly positive evaluations (esp. Romania) contrasted with the clearly more nuanced views expressed by the Finnish participants, in particular, but to an extent also those in Spain and Portugal. Such differences may have several roots. First, the contextual conditions in the case study countries vary widely: in Spain, Portugal, Romania, improving the environmental performance (efficiency of energy and water supply, creation of green spaces) of the school facilities is a key objective. For example, at the Mozart school in Spain, heating represents about 80 % of the school’s carbon footprint, and is therefore a major area of potential improvement. In Finland, the school infrastructure in general is of good quality, and the priorities of sustainability work lie elsewhere, most notably in the area of pedagogy.

Differences may also be attributable to disciplinary traditions and orientations of the schools and universities in question. The interventions in Romania were the most clearly “technical”, aimed at producing tangible improvements in the environmental performance and the technical-material competences of the educational establishments in question. In this regard, Finland stands at the other end of the spectrum, with the objectives of improved and holistic understanding of sustainability, and modification of the educational curricula, as the overwhelmingly dominant objectives, in an environment where sustainability has already gained a prominent role in school/university activities. Consequently, also the criteria for judging success and failure differed between the DSs in these countries. The diversity of educational backgrounds of the respective ECF4CLIM members and teams certainly also played a role, and may partly have explained the degree to which the evaluations were geared towards criticism or, alternatively, towards promotion.

Furthermore, Mozart teachers underlined the importance of the reduction of CO₂ emissions, given that heating represents about 80 % of the school’s carbon footprint. The relative centrality of the technical-material competences as opposed to collective competences and individual competences therefore reflects also the different contextual conditions in the case study countries: in Spain,

Portugal, Romania, the quality and the technical-material competences of the school facilities is key, but not so much in Finland (better infrastructure). Obviously, the difference reflects also the disciplinary backgrounds of the researchers, and the organisation of the school/university energy supply systems in the four countries.

The evaluation conducted showed that the interventions did not always work as expected and reach their intended objectives. When they did, their primary objective was often to achieve tangible environmental improvements. However, in most cases, the promoters of the interventions did not fully agree amongst themselves which if any of the competences to prioritise. This observation lends support to our theoretical and conceptual starting point, which highlights the interrelatedness and importance of all three types of competences (individual, collective, and technical-material) in any intervention designed to promote sustainability in educational institutions. The evaluation also revealed that the unforeseen or unexpected factors that had helped or hindered the improvement of sustainability competences were often in the realm of collective competences (time, resources, standards, organisation, institutions and groups outside of the school/university in question, etc.). The improvement of individual sustainability competences requires the existence of a conducive organisational and cultural environment within the institution, as well as the necessary technical and material conditions (equipment and infrastructure). In this sense, the methodology used in the ECF4CLIM project, based on iterative group discussions, has fostered greater awareness, knowledge, and recognition among the different actors (students, teachers, staff, parents, municipal authorities, etc.) involved in improving sustainability at schools and universities. The project has provided these stakeholders with the time and space where to meet and jointly explore their physical and educational environment, generate suggestions for improvement, and monitor the implementation of the interventions. While these opportunities have clearly benefited those who participated in the ECF4CLIM process, the impacts beyond this relatively small group of active participants have thus far been limited.