D8.5

Transdisciplinary Dialogue Strategy

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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.

Name	Country	Logo
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas – CIEMAT	ES	
Instituto Superior Técnico. University of Lisbon. IST	PT	
Universidad de Sevilla USE	ES	
University of Jyväskylä JYU	FI	
Universitat Autònoma de Barcelona UAB	ES	
Meda Research Ltd MedaResearch	RO	
Instituto de Soldadura e Qualidade ISQ	PT	
Trebag Szellemi Tulajdon Es Projektmenedzser Korlatolt Felelossegu Tarsasag TREBAG	HU	
Smartwatt Energy Sercuces SA Smartwatt	PT	
Que Technologies Kefalaiouchiki Etaireia QUE	GR	

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 take action 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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1. EXECUTIVE SUMMARY

This deliverable presents the results of the Transdisciplinary Dialogue Strategy (TDS) of the ECF4CLIM project, aimed at discussing the challenges and opportunities of multi-, inter- and trans-disciplinarity in defining, developing, and practicing sustainability competences.

A participatory deliberation procedure was designed to discuss the key concepts and identify the gaps and misunderstandings that may exist between different disciplines regarding sustainability and its application in educational settings. With this aim, two webinars were organised to facilitate the dialogue and the exchange of expertise and information between experts representing a wide range of disciplines and fields of expertise (environmental sciences, ecology, biology, industrial engineering, mathematics, educational sciences, psycho-pedagogy, geography, political science, economics, philosophy, and sociology).

Twenty experts were invited to discuss the sustainability concepts and competences and their interrelationships, the individual and institutional factors enabling or constraining the education for sustainability initiatives, the knowledge and resources needed to design inter- and transdisciplinary solutions able to enhance sustainability competences, and the ways for translating the concepts and competences into the day-to-day practices of the learners.

The first webinar was mainly designed to stimulate reflection, within the ECF4CLIM project team and beyond, on the challenges, opportunities and needs of inter- and transdisciplinarity (collaboration between disciplines, and between the academia, the policy world, and society). The thirteen participants were experts in sustainability.

The second webinar addressed the feasibility, likely difficulties, and resources needed to implement sustainability measures in educational contexts. In doing so, the webinar sought to identify ways of translating the sustainability competences into practice, and the associated obstacles and barriers. The nine participants were experts from the educational community, that is, people whose work focuses on promoting sustainability in the educational sector, as teachers, expert advisors, and providers of various services to educational institutions.

The main results and findings can be summarised as follows:

- ***Limitations and usefulness of the concept of sustainable development***

The participants in the two Webinars tended to clearly distinguish between the concepts of ‘sustainable development’ and ‘sustainability’, showing preference for the latter.

The participants considered sustainable development (SD) as a concept that is excessively narrow, contains internal contradictions, too anthropocentric, with a certain economic bias, and too reliant on the ability of technological progress to solve the conflicts between society and nature.

Furthermore, the experts argued that SD can easily be instrumentalised and used as a tool of 'greenwashing', and therefore hampering progress towards true sustainability.

'Sustainability', instead, was portrayed as a much broader concept that does not implicitly postulate the primacy of the economic dimension, which the participants argued was the dominant trend in the current debates on SD.

However, the experts recognised that the concept of SD could in current debates nevertheless be useful at least as a transitory concept, which would help to advance transitions towards sustainability. SD might therefore be needed today, but could be abandoned as useless in the future, when sustainability debates, policies, and transitions would have reached a certain maturity.

The participants related the concept of sustainability to long-term cohabitation between humans and other living species and life forms on our planet. This constitutes a cultural challenge. However, the participants recognised that while the concept of planetary wellbeing is indeed less anthropocentric than SD and sustainability, it risks leaving vital social and societal aspects (e.g. human suffering) out of focus.

For this reason, participants proposed to distinguish between weak and strong sustainability (distinguished by the extent to which different types of capital are considered substitutable with each other), and argued that educational systems should be able to explain different degrees of sustainability, from the highly anthropocentric concept of SD towards the more transformative concepts of sustainability and planetary wellbeing.

There were significant convergence of views between the two webinar groups, i.e., between the sustainability experts and education practitioners. Both groups considered, the concept of SD as outdated and too restrictive to account for the problems and solutions to the society/nature divide. At the same time, the participants in both groups were aware that standard current policies, even in educational settings, tend to promote diagnosis and actions mainly based on the concept of DS, and are not able to capture the required holistic complexity built in the sustainability concept.

- ***The challenge of multidimensionality***

The experts in both groups were well aware of the different dimensions of SD, but considered that these are rarely interconnected in practice. One of the difficulties with the concept of SD is its multidimensionality, because experts and policymakers often use it by focusing only on one dimension. Some participants argued that the environmental dimension is always predominant, while others considered SD debates are dominated by economic considerations. The participants underlined the difficulties stemming from the inherent complexity and interconnectedness of sustainability problems.

The need for holistic approaches that do justice to the complexity and multidimensionality of sustainability led some participants (particularly those of the practitioner Webinar) to question the

underlying logic of the UN Sustainable Development Goals (SDGs), arguing that SDGs overlook the crucial interconnections between different aspects of sustainability. On the one hand, the SDGs can be useful by helping teachers to render SD concrete and tangible to students, for example through concrete and practical projects in the local community. On the other hand, this approach risk may conceal the complex interconnections between the different SDGs.

Concepts such as ecosystem services, lifecycle thinking, 'donut economy', and planetary wellbeing can be useful in fostering holistic understanding of sustainability. These can be powerful education tools, but they need be part of a more general education framework.

- ***The desired interdisciplinarity***

The participants considered that expert and academic debates on SD can engender potentially fruitful inter- and transdisciplinary initiatives. However, they also evoked as one of the main problems the lack of interdisciplinarity in SD debates. Some experts seem unable to appreciate the views from experts with a different disciplinary background and integrate knowledge from outside their own field.

One of the barriers to interdisciplinarity (among experts) is the rules prevailing in the academia and scientific community. These include the difficulty to find journals willing to publish interdisciplinary articles, and the lack of resources (e.g., time and money) to carry out truly interdisciplinary projects. The experts noted that reaching mutual understanding requires time and effort, which the academic institutions are seldom prepared to provide.

Shared arenas for interaction between disciplines would be needed, the participants argued. These could include co-working spaces and time dedicated for interaction between people with distinct disciplinary backgrounds. This would help individuals to open their minds to other concepts and methodologies.

- ***The key role of educational institutions***

Participants considered that there has been a modest yet continuous progress towards greater collaboration between disciplines. The educational institutions can play a key role in facilitating such transformation. The participants stressed that schools and universities must teach the highly interconnected nature of SD dimensions, and integrate such a perspective in their organisation's practical day-to-day activities.

The practitioners identified as one of the main weaknesses of sustainability education the poor integration of sustainability considerations in the day-to-day activities of schools and universities. Often, SD activities are introduced as ad hoc one-off exercises. Sometimes the teachers do not have the indispensable knowledge to properly teach sustainability, while often sustainability is introduced merely as an additional burden for teachers, on the top of their ordinary duties.

Moreover, there are discontinuity in sustainability teaching between the stages of the education system. Students are aware and knowledgeable of SD in primary and secondary schools, but are frustrated once they embark on their university studies, by the lack of attention for sustainability. The participants argued that universities seem to be weak in educating students for sustainability. The internal organisms responsible for sustainability (e.g., environmental management of the school or university infrastructure) have little if any influence on what is taught and learned in the classroom. Furthermore, for reasons such as lack of time, division of labour within the institution, and distinct disciplinary backgrounds, it is often difficult to even get faculty members to sit around the same table, to tackle the interrelated sustainability problems.

- ***Expanding the debate beyond the academia***

Transdisciplinarity implies dialogue that goes beyond the academia – dialogue amongst experts and other actors such policymakers, social movement, business, and civil society actors. To succeed, transdisciplinarity requires building common ground by agreeing upon shared terms and concepts. However, as the participants underlined, the practical conditions for such processes are not always there.

A Transdisciplinary approach stresses the importance of communication, education, engagement, and participation, which can also help to reduce the risk of SD being used merely for greenwashing. Social sciences can help in engaging and bringing citizen's voices into sustainability processes.

According to the participants, this common ground could be generated through practical small-scale projects. Rather than with big theoretical debates, transdisciplinarity would be better served by experiences and experiments at local level, where creating the optimal conditions for dialogue between actors and sharing meanings and goals is the easiest.

However, participants in both groups warned that, although shared objectives would be ideal, this is not always possible because of the often very distinct and mutually conflicting interests involved. People tend to favour a definition that best suits their interests. Power relations are therefore an essential element of dimension of the debate. In these cases, conflicts cannot be avoided, but instead, it would be vital to make the divergences visible and develop strategies to manage them in a fair manner.

In the practitioner Webinar, the participants highlighted the potential discrepancies between theory and practice. They evoked differences between what students learn and experience in the school and what they do at home, between what is taught and what is done, and between the economy and the environment (themes that are taught in different subjects at school, not always in a congruent manner). This underscores the importance of the design and organisation of educational programmes and curricula, as well as the need to embrace sustainability in all its complexity and involve actors outside the school or university in question.

The conclusions and recommendations by the experts have **clear implications for the design of our Strategy for Transdisciplinary Dialogue** (STD).

The findings from our Webinars suggest that both our conceptual approach to the ECF, that is, the Roadmap, and its operationalisation through concrete interventions at the various demonstration sites exhibit significant potential to foster multi-, inter- and transdisciplinarity dialogue.

In the light of these considerations, we **suggest two parallel strategies for monitoring and evaluating multi-, inter- and transdisciplinarity dialogue in ECF4CLIM**: a) Incorporating in WP6 (evaluation) indicators designed to measure progress towards multi-, inter- and transdisciplinarity dialogue through the diverse interventions implemented at the demonstration sites; and b) Generate shared arenas for interaction between disciplines and devote time and effort to reach mutual understanding within the multiple activities of the project consortium.

2. OBJECTIVES

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

We are looking for a set of sustainability competences to feed into education programmes to help learners develop knowledge, skills and attitudes that promote ways to think, plan and act with empathy, responsibility, and care for our planet and for public health. These sustainability competences should help the various actors to reflect and embrace sustainability in their daily lives as students, consumers, producers, professionals, activists, policymakers, neighbours, employees, teachers, trainers, organisations, communities, and society at large.

Our initial version of the ECF (D3.3) (Heikkinen & al. 2022) is based on and further develops the sustainability competences outlined in GreenComp - the European sustainability competence framework developed by the Joint Research Center of the European Commission (Bianchi & al. 2022). The ECF is structured as a roadmap aiming to provide tools for different stakeholders to map and foster the enablers and overcome the constraints of sustainability in various educational contexts.

In this context, we developed a Transdisciplinary Dialogue Strategy (TDS), to facilitate the exchange of expertise and information between the teams, disciplines, and experts involved in the development, testing, and validation of the ECF.

The aim of the TDS is to facilitate a dialogue between individuals representing a range of disciplines and fields of expertise (physics, geography, ecology, biology, chemistry, mathematics, data management, education, behavioural sciences, etc.), in order to discuss the sustainability competences as defined by GreenComp, the mutual interrelationships between the various competences (e.g., the STEM-related, digital and social competences), and the individual, organisational and institutional factors that enable or constrain the desired changes. The estimated knowledge and resources needed to design appropriate inter- and transdisciplinary solutions for enhancing sustainability competences will be discussed. Special attention was paid to the new knowledge to be created, and also to the translation of knowledge into the day-to-day practices of the learners.

3. METHODOLOGY

Two webinars were organised to discuss challenges and opportunities of multi-, inter- and transdisciplinarity in defining, developing, and practicing sustainability competences.

The first webinar was held in October 2022 (M13), and the second in December 2022(M15). Both webinars lasted about 2 hours.

The first webinar explored the 'sustainability competence' concepts and the GreenComp definitions, in order to identify the various discipline-dependent definitions of sustainability and thereby bring clarity to the discussions between disciplines on sustainability competences. The focus was hence on exploring gaps and problems of mutual understanding between disciplines. The participants to this webinar were academic and scientific experts with diverse disciplinary backgrounds.

The second webinar discussed the ways of translating the sustainability competences into practice. It focused on drivers for and barriers to transdisciplinarity, as well as the resources needed to cope with the typical misunderstandings between disciplines and between the different "worlds" – in simple terms, science, politics, and society. These participants were education-sector experts and professionals.

3.1. Design of the webinars

Each partner sent (to the UAB team) a list of possible candidates. Each partner then contacted selected candidates and invite them to participate.

Webinar 1

A participatory deliberation procedure was designed to discuss the key concepts and identify the gaps and misunderstandings that may exist between different disciplines. The main aim of the first webinar was to stimulate reflexion, within the ECF4CLIM project and beyond, on the challenges, opportunities and needs of inter- and transdisciplinarity (collaboration between disciplines, and between the academia, policy world, and society). Our project concentrates on sustainability in the education sector, but given that many if not most challenges of inter- and transdisciplinarity are generic rather than context-specific, we believe that the webinar discussions can be useful and stimulating to all type of experts, regardless of their field of expertise. No prior preparation was requested from the attendees, neither were they promised financial reward for their participation. However, the invited participants were asked to think in advance about the following questions that would be addressed at the webinar:

- Which misunderstandings and contrasting interpretations of the notion of sustainable development have you found in your collaboration with experts and practitioners from disciplines other than yours?

- Which challenges and obstacles associated with work that crosses disciplinary boundaries and the academia-society divide do you consider the most significant for further inter- and transdisciplinary work?
- What are the key opportunities and benefits of inter- and transdisciplinary work, especially in the area of education for sustainable development?
- How to overcome the obstacles and foster inter- and transdisciplinarity in practice?

Webinar 2

Like the first one, this webinar addressed the feasibility, likely difficulties, and resources needed to implement sustainability measures in educational contexts. The participants were asked to suggest ways of transferring the sustainability competences into practice, with the following questions as general guidance:

- Which misunderstandings and contrasting interpretations of the notion of sustainable development have you found in your collaboration with experts and practitioners from disciplines other than yours?
- Which challenges and obstacles for inter- and transdisciplinary work do you consider the most significant in the education sector?
- What are the key opportunities and benefits of inter- and transdisciplinary work in the area of education for sustainable development?
- How to overcome the obstacles and foster inter- and transdisciplinarity in practice?

The two webinar sessions were recorded for analysis.

3.2. Selection of the experts

A call was made to all partners to provide a list of potential experts and participants, based on their expertise and networks. A long list of more than 40 experts was drawn up, most of them belonging to the EU Green Deal Cluster and to the ECF4CLIM advisory board.

After an initial screening, a sample of experts were invited to participate in the webinars. These were experts from diverse disciplines, with a recognized track record in the field of sustainability and/or education for sustainability.

In the first Webinar there were 13 participants, while in the second there were 9 (Tables 1 and 2). One person repeated in both meetings.

Table 1: Participants in the first Webinar (2022, November, 3)

Expert	Institution
Petri Tapio	FFRC (Finland Futures Research Centre) (University of Turku, Finland)
Idoia Arellano	ADEAC (Asociación Educación Ambiental y del Consumidor) & Ecoescuelas (Madrid, Spain)
Ionut Procop	GWP (Romania)
Luiza Florea	Universitatea Dunarea de Jos galati (Romania)
Tiago Faria	IST (ECF4CLIM) (Portugal)
Marian Constantin	MedaResearch (ECF4CLIM) (Romania)
Agustín Bastida	Teachers' training Center for Environmental (Centro de Formación Ambiental, Consejería de Educación) (Madrid, Spain)
Anna Lehtonen	University of Jyväskylä (ECF4CLIM) (Finland)
Ilkka Raittinen	Lapin Ilyopisto (University of Lapland, Finland)
Melanie Mbah	Oeko-Institut (Institute for Applied Ecology) (Freiburg, Germany)
Pedro Piedras	Universidad Pontificia de Comillas (Madrid, Spain)
Irina Serban-Atanasiu	Fundatia Comunitara Galati - ONG (Romania)
Ana Delicado	Instituto de Ciencias Sociais, Universidade de Lisboa (Lisbon, Portugal)

Table 2: Participants in the second Webinar (2022, December, 2)

Expert	Institution
Mikael Puurtinen	University of Jyväskylä (Finland)
María José Gil-Delgado	International Training Center & United Nations Institute for Training and Research (CIFAL) (Málaga, Spain)
Laura González	Fundación Vida Sostenible (Madrid, Spain)
Jenni Skaffari	Nature School Korento (Tampere, Finland)
Katja Lembidakis	Vantaa Nature School (Sotunki, Finland)
Olli Viding	Vantaa Nature School (Sotunki, Finland)
Maija Ihantola	The Finnish Association of Nature and Environment Schools (Tampere, Finland)
Paloma Martín García	Instituto Superior Madrileño de Innovación Educativa (Madrid, Spain)
Marian Constantin	MedaResearch (ECF4CLIM) (Romania)

Tables 3 and 4 show the disciplinary background of the participants in each webinar. Both Webinars were moderated by Markku Lehtonen and Josep Espluga, with support from Maria Marcet (UAB).

Table 3: Disciplinary background of the expert panel for Webinar 1.

Code	Training	Background
W1_EES_1	Environmental Sciences	Engineering & Environmental Sciences (EES)
W1_EES_2	Environmental Sciences	
W1_EES_3	Environmental Engineering	
W1_EES_4	Ecology – Biology – Ichthyology	
W1_EES_5	Industrial engineering	
W1_EES_6	Industrial engineering	
W1_SSH_7	Educational sciences	Social Sciences & Humanities (SSH)
W1_SSH_8	Educational sciences	
W1_SSH_9	Physical geography & educational sciences	
W1_SSH_10	Geography & Political Science	
W1_SSH_11	Economy and Social Sciences	
W1_SSH_12	Philosophy - Sociology	
W1_SSH_13	Sociology	

Table 3: Disciplinary background of the expert panel for Webinar 2.

Code	Training	Background
W2_EES_1	Biology & Mathematics	Engineering and Natural/ Environmental Sciences (EES)
W2_EES_2	Biology & Geography	
W2_EES_3	Biology	
W2_EES_4	Biology	
W2_EES_5	Industrial engineering	
W2_SSH_6	Education & Sustainable development	Social Sciences and Humanities (SSH)
W2_SSH_7	Education & Human ecology	
W2_SSH_8	Environmental Education	
W2_SSH_9	Education & Psychopedagogy	

The webinars were recorded for analysis, which was done through an inductive thematic analysis. Next sections include the results of the analysis. Throughout the text we have indicated who the ideas expressed come from, using the codes in tables 3 and 4.

4. RESULTS AND DISCUSSION

4.1. Webinar 1: Dealing with the concept of 'sustainable development'

As stated above, the first webinar was devoted to identify the various discipline-dependent definitions of sustainability and thereby bring clarity to the discussions between disciplines on sustainability competences. The participants to this webinar were academic and scientific experts with diverse disciplinary backgrounds, and the focus was hence on exploring gaps and problems of mutual understanding between disciplines.

a) Limitations and usefulness of the concept of 'sustainable development'

The participants in Webinar 1 were asked to discuss the content and meaning of the concept of sustainable development and its usefulness for educational contexts.

The first thing to highlight is the ambiguity attributed by the participants to the concept of Sustainable Development (SD). It is seen as a concept that has changed its meaning since its formulation in the "Brundtland Report" (1987), as development that satisfies the needs of the present generation without compromising the ability of the future generations to satisfy theirs. Over time, the concept has acquired a more economistic interpretation, progressively understood as a way to guaranteeing economic growth compatible with environmental protection and the ecological limits.

The participants tended to clearly distinguish between the concepts of 'sustainable development' (SD) and 'sustainability', arguing that the first was too narrow, while the latter would not implicitly postulate the need for economic growth (W1_EES_2).

Following this line of argumentation, one of the main criticisms expressed by the participants towards the concept of SD was that it seemed as a futile attempt to "square the circle", that is, establishing an adequate balance between economic development, environmental protection, and respect for human and social rights. From the participants point of view, it would not be possible to achieve sustainable economic development within planetary boundaries (W1_SSH_13). For this reason, they preferred to speak of 'sustainability', a much broader concept that goes beyond the merely economic dimension dominating the current debates on SD (W1_SSH_7).

Nevertheless, the participants perceived that the concept of SD continues to be predominant in the political agenda but also in the thinking and argumentation of many scientific experts, to the detriment of sustainability or other concepts that could be more useful and transformational (such as resilience or planetary wellbeing).

b) Technological solutions for SD

One of the factors that according to the participants lies behind the predominance of the concept of 'sustainable development' is the blind faith in the ability of technology to solve the problems between society and nature. Experts often tend to believe in technological solutions to SD problems. In this way, SD would function as a tool at the service of “greenwashing” strategies (W1_SSH_13). According to the Webinar 1 participants, such blind faith in technology could be an obstacle to real progress towards sustainability.

> Blind trust in progress still prevails in our societies, and tends to prevent true advancement towards sustainability. (W1_SSH_11)

According to this, the concept of DS has mutated since its beginnings in the 80s, along with the political and societal context, to the point that today SD can be considered an "old-fashioned" concept (W1_SSH_7).

> The more I study the concept (SD), the more concerned I am about how can we use it to live better, because I find less sense in it (W1_SSH_9).

c) Why maintain the SD concept?

However, some participants argued that there would be no dilemma, because although ultimately the notion of SD should be replaced by novel concepts that would be better able to address the formidable challenges of the future, it could still be useful (albeit temporarily) for current debates.

Some participants considered that, instead of trying to promote SD, ways to achieve wellbeing in the absence of (economic) development should be searched and promoted. Our society needs a debate on how to live well without development, at least as we know it today (W1_SSH_13). In this context, the concept of sustainability becomes essential and requires a broad and inclusive definition that embraces all its complexity.

> Sustainability relates to living in harmony with the rules of nature. If you exploit all the resources on an island, the island sinks. If we extrapolate this idea to our planet, if we abuse the planet, we will have to leave it. (W1_EES_3)

> Sustainability is something that should be part of our daily life, it is a philosophy, a way of doing things – a lifestyle (W1_SSH_7)

At the same time, the participants believed that the SD concept could still be useful as a kind of conceptual tool that could help to push the transition towards sustainability.

> We are facing a controversy: now we know that we need to decrease, but what do we do in the meantime? Some people are really thinking critically about this, but others are looking for somewhere else. It is difficult to reach an agreement. Probably we need to keep on

> building the road towards degrowth, but in the meantime many concepts are to be challenged (e.g., GDP and SD) (W1_SSH_11).

In this sense, the philosopher Frederik Jameson's ideas of a "vanishing mediator" are highly valuable for understanding the challenges: SD is something needed today, but that will make no sense in the future (W1_SSH_11).

The participants found the concept of SD useful for explaining the historical evolution of socio-environmental issues, helping thus to better frame and understand the current socio-environmental crisis.

> I use the Brundtland definition to introduce the SD concept to our students, it is about our attitude towards the future and our possible action. Then I explain the advancement towards approaches such as that of the planetary boundaries (the idea of limits posed by nature and the environment) and the possible evolution of the system in the future. The economic dimension is also important (the limitations of economic growth; probably something will change…) (W1_EES_6).

d) The challenge of multidimensionality

One of the problems with both SD and sustainability as concepts is that, although they are intrinsically multidimensional, experts and policymakers often use them by focusing only on one dimension (environmental, economic, etc.) (W1_SSH_10). Thus, for example, one expert noted that people (e.g. students) tend to associate sustainability only with environmental protection (W1_EES_4), or that since sustainability is a concept invented and used by humans, the socioeconomic dimension is essential (W1_EES_4). Another expert remarked that policymakers, in turn, tend to focus mainly on the economic dimension.

> Policymakers' use of sustainability… they sometimes evoke the sustainability of a single project. Politicians often emphasise the economic dimension, at the cost of the other dimensions. (W1_EES_6)

The participants highlighted the inextricable links between all dimensions of sustainability. Working on and researching SD always means transformations in various thematic fields (such as mobility, economy, and energy). Achieving these transformations always requires social innovations (W1_SSH_10), so the social and economic dimensions should always be taken into account, together with the environmental ones.

> SD is essentially about transformation: given that we have to transform various areas of economy and society, what is needed are not only technical solutions and innovations, but also and above all social innovations. (W1_SSH_10)

e) The concept of SD is more useful for academic discussion than for debate with society

The participants considered that the concept of SD can be useful for discussion among experts and academics, but due to its ambiguities (such as those mentioned above), at least at present it has limited ability to articulate a fruitful conversation with society. For such a societal debate, new concepts and terms would be needed, the participants argued (W1_SSH_12).

In order to debate with society, more critical thinking and more reflection on the role of society on the planet should be encouraged.

> We need to develop critical thinking, incite people to ask themselves questions (what impact will my work or activity have in some years' time?) (W1_SSH_12)

The participants therefore suggested that more reflection and debate was needed within society about the very concepts of SD and sustainability. This statement has major implications for the educational system, which is one of the spaces where this debate should take place.

In any case, although the concept of SD remains problematic, its use in expert and academic circles seems to engender increasingly interesting and potentially fruitful inter- and transdisciplinary experiments.

> I am pessimist regarding SD concept, but very optimist about transdisciplinary innovations. (W1_SSH_13)

f) Is SD a useful concept in efforts to foster inter- and transdisciplinary collaboration?

The participants argued that engineers tend to believe in "techno-solutions" and overlook the human and social aspects of change. Focusing on technological solutions, they do not pay enough attention to social aspects and requirements. Yet, social aspects are crucial and their role is often misunderstood (W1_SSH_10).

These observations seem to indicate a lack of interdisciplinarity, as some experts are unable to appreciate other (expert) views or integrate knowledge from outside their own field. Difficulties in integrating social science knowledge into natural and engineering sciences as well as into concrete technology projects seem to be common.

> I am teaching these subjects to engineers (sustainability, ethics, etc.) and I do realize sometimes we lack a way to talk about that. I need to start explaining the relevance of ideas. (W1_SSH_11)
>
> As a social science partner, I often find myself in the position that there is a misunderstanding of what social sciences are there for (W1_SSH_13).
>
> Often my environmental science colleagues are reluctant to accept alternative ideas and to do truly interdisciplinary work. Instead, they are all too willing to believe that there is a technological solution to every problem (W1_SSH_13).

> As a social scientist, I'm annoyed and frustrated when people from other backgrounds understand the role of social sciences as merely that of improving the acceptability and acceptance of given technologies or solutions (W1_SSH_13)
>
> I don't like engineers doing social science without any training or background. In interdisciplinary work you need to rely on the expertise from diverse disciplines (W1_SSH_8).

One of the misunderstandings concerning the social sciences stems from the fact that they cannot make predictions in the same way as natural sciences do. Because society is complex and can change very rapidly, in a way what is true today may not be so tomorrow, an expert argued. Although there are long-term tendencies and continuities, ultimately social events are not predictable. Social science always deals with lot of uncertainty, complexity, and change, and predicting future is not its primary function – this is difficult to explain to other scientists (W1_SSH_13).

At the same time, a potential weakness of social sciences is the arrogance that social scientists sometimes exhibit when working on sociotechnical issues, especially in their relations with and attitudes towards other sciences.

> We also need other fields of expertise; sometimes we use scientific terms whose meaning and implications we do not in fact fully understand. We need an understanding of how (technical) things work in practice, otherwise we (finally) also make assumptions. There is a need for social scientists to take "the technical" seriously (W1_SSH_13).

Often, scientific communities are ignorant of each other's methods and concepts. This can be an obstacle to the efforts to move from SD towards a broader understanding of sustainability.

> We all work with different methods and standards. We need to share knowledge between disciplines on such methods/standards. (W1_SSH_10)
>
> In my view this is one of the most important things in interdisciplinarity: to acknowledge other aspects of the problems you are dealing with. You can get perspective. (W1_SSH_11)

There is a great lack of experience and tradition in interdisciplinary collaboration within some disciplines. To foster such enhanced mutual understanding, shared arenas for interaction between disciplines are needed, such as co-working spaces that facilitate interaction between people with distinct disciplinary backgrounds (W1_SSH_10). Time is another major limiting factor, because true dialogue requires time (W1_SSH_8).

Some participants consider that the essential obstacle is not at the disciplinary level, but rather in the individuals lacking respect and openness towards different views and understandings.

> Discipline matters, indeed, but I do think it really depends on the people, whether they are open, recognize each other's expertise … or if they come with presumptions and stereotypes, and entrenched ideas about what the others can do (W1_SSH_8).

However, the participants identified a trend towards greater openness, also and above all in the technical sciences community, where an increasing number of experts tend to understand and accept both the limitations and value of social sciences (W1_SSH_13).

> Interdisciplinarity requires more openness in scientific disciplines and practitioners to respect each expertise. This is the future. I am optimistic about interdisciplinary collaboration. (W1_SSH_13)

> Indeed, there's greater openness among the engineering and natural and technical scientists to value social sciences, with all their weaknesses and imperfections. (W1_SSH_13)

This openness seems to be greater in the field of sustainability sciences than in other research fields.

> In the field of sustainability, luckily there is much more openness to interdisciplinary work than in other fields (W1_SSH_8).

g) Expanding the debate beyond the academia (transdisciplinarity)

Expanding the debate beyond experts and academics implies dialogue with other actors, such as policymakers, social movements, and business, among others. Working with other actors on sustainability issues would require a common ground (terms, concepts, etc.), which is not always available. It should be built together, but the preconditions for this to happen are not always present.

> Working together between disciplines and other actors beyond the academia is very important. We need a common understanding of terms and concepts, and must have common goals (about the shared goals and how we would like to collaborate). These questions should be discussed first. This is a prerequisite for successful inter- and transdisciplinary action (W1_SSH_10)

> Policymakers are not so willing to act, to really do what is really needed. We have different paradigms and objectives. I do think we should focus on strong sustainability rather than on weak sustainability (W1_SSH_9).

> Concepts are important. Talking about sustainability, ecology… we do not have shared concepts. We are lost, and there is another world outside the academia. (W1_SSH_11)

Citizens' voices are needed and social sciences can work as a bridge between researchers, experts, and the citizens, in their roles as consumers, service users, voters, etc.

> The value of indigenous knowledge should be highlighted. We need to bring the voices of the community into the discussion (W1_SSH_8).

In order to move towards a dialogue with the other actors, communication and education become essential.

> We need to improve communication between disciplines and between academia and society. (W1_SSH_11)
>
> Education is crucial. It is difficult to make changes in our current structures, but if we change communication in education, we may have better prospects for the future. We have to build new bridges between academia and society. (W1_SSH_11)

In this sense, the debate on sustainable development has spurred the participants to seek means and strategies for involving the public.

> We need to think about practical solutions and proposals in our work, and involve them (other professionals, and citizens) in finding solutions. (W1_SSH_12)

Without these kinds of ideas and approaches, the concept of SD would risk becoming useless, or only useful for greenwashing.

h) Creating common grounds through practical small-scale projects

While the participants called for a common language and shared positions, the participants recognised there will always exist different approaches to interpret (and advance towards) sustainability. Hence, there was a debate on how to manage conflicts between different approaches.

> Different people use different languages when talking about sustainable development. We need to move towards a common language. I do not know how to do this, but it is very important. (W1_SSH_9)
>
> The concept of 'resilience' takes quite a different meaning, depending on the discipline. In ecology, it does not mean quite the same thing as in social sciences (W1_SSH_9).
>
> It is very relevant to go for a constructive conflict approach, accept conflicts and name them. (W1_SSH_8)
>
> There are conflicts in us and in the others, people or disciplines. It is essential to identify differences and respect the different needs. We should not silence the conflict. We should capture this through education (W1_SSH_8).

A key challenge is how to create opportunities for experts, stakeholders, and the public, to truly collaborate and encounter each other in a respectful atmosphere. Although unifying objectives would be ideal, the participants doubted whether such a thing will be possible, because of the diverging needs and interests of different actors. It was therefore seen as necessary to find a way to make these divergences visible and decide how to manage them.

> Common goals and objectives are needed, but there doesn't have to be a 100% agreement even on the objectives. (W1_SSH_8)

Some participants suggested that instead of attempting to reach a broad agreement on theoretical concepts and approaches, a more feasible way forward would be to start from more micro and pragmatic positions. They maintained that even a highly diverse and heterogeneous group of people can find unity in action when addressing concrete practical problems. Pragmatic and practical solutions can be applied in concrete situations at a relatively small scale, and this would be a good way of fostering collaboration and advancing step by step towards sustainability (W1_EES_1).

The concrete small-scale problems would be the ideal context for trans- and interdisciplinary action. From this point of view, conceptualisation is not crucial, and it would not be necessary to reach broad theoretical agreement on concepts and terminology. Joint work on practical issues would suffice.

> Interdisciplinary collaboration will be easier in practice. We need to deal with practical issues, conceptualisation is not so crucial. (W1_EES_1)
>
> Sustainability thinking is different in different communities; and then the national, the international, the multinational level... they all exist and further complicate things. But I do think it is not impossible to change some daily practices. My field is in transport and this is where there are choices to be made. Most political decisions deal with day-to-day practices and action. Here I think that small steps can work. When trying to address practical issues, perspectives can be combined, although indeed, not always. (W1_EES_1)

i) Barriers to inter- and transdisciplinarity

Interdisciplinarity (among experts) faces several obstacles due to the structure of rules prevailing in the academia and scientific community. For instance, the rules of publication of scientific articles make it difficult to find the right journal for inter-and transdisciplinary articles. This makes it difficult to develop and nurture the interdisciplinary and holistic thinking that true sustainability would require.

> The need to generate “impact” (in academia) is one of the obstacles to the kind of holistic thinking needed for SD. (W1_SSH_10)
>
> When we propose projects, interdisciplinarity is a merit, but when you want to publish, it is a problem, you cannot find the suitable journal. There is nothing wrong with these papers but still they don’t get it. Academic journals should also be involved in discussions. (W1_EES_1)
>
> There’s a curious paradox in scientific publishing and research funding: on the one hand, interdisciplinarity is what funders require and credit you for, but once we try to publish our results from interdisciplinary research, we are confronted with the disciplinary boundaries: very few journals accept truly interdisciplinary papers. (W1_EES_1)

Both inter- and transdisciplinarity face obstacles and challenges. Individually, an expert typically seeks to master her own discipline, and hence few experts are able to link natural, economic and social sciences. Time and effort are essential here (which, as stated above) are one of the main lacking resources.

> Time is a key limiting factor, collaboration needs time! (W1_SSH_12)

Collectively, reaching mutual understanding requires again time and efforts.

Moreover, it is sometimes difficulties to keep interdisciplinarity in the curricula, as sustainability in a broad and holistic sense is not a priority in most research and educative programs.

> You need to convince the senior manager of its relevance in the longer term (W1_EES_6).

Finally, an additional major obstacle to interdisciplinarity stems from the national and EU requirements and rules of data management, privacy, and ethics. These make it very difficult to combine different disciplines, each one with their data collection and data protection practices, within a joint effort (W1_EES_1).

Summing up, the participants pointed out at least three problems that impede progress towards sustainability:

- Extreme specialisation

- Distance between universities (centres of creating knowledge) and society;

- Communication: we need to frame things in a way that facilitates dialogue among disciplines and then between academia and society. We need to communicate inside within the academia but also externally, with the outside world. (W1_SSH_11)

4.2. Webinar 2: Sustainability into educational practices

As mentioned above, the second webinar gathered experts from the educational community – people whose work focuses on promoting sustainability in the educational field, as teachers, expert advisors or in charge of providing services to schools.

a) The limits of the concept of sustainable development for educational purposes: anthropocentrism and ambiguity

When asked about the concept of sustainable development (SD), the Webinar participants tended to consider the concept as not very useful. They found the concept to be somewhat outdated and to entail too many internal contradictions.

> The concept of sustainable development (SD) has to a large extent been abandoned, in favour of notions such as sustainability or, in the case of the University of Jyväskylä, planetary wellbeing. It is now widely recognised that SD is a vague concept, full of internal contradictions, and as such just about useless. (W2_SSH_6)
>
> The concept of SD has lost much of its importance and has become rather a meaningless marketing tool or a catch-all word. SD is an economics-oriented concept used by companies and administrations for greenwashing and/or as a tick-box exercise designed to show "we have done our bit" to foster SD. (W2_SSH_8)
>
> SD has become a vague concept without a real meaning, it's only included in everybody's work but because of a discursive necessity (W2_SSH_8).

Instead, the participants found the notion of sustainability much more useful and relevant, especially the distinction between weak and strong sustainability, which relates to the extent to which different types of capital (natural, social, human, manufactured/financial) are substitutable with each other (W2_SSH_6). Weak sustainability postulates full substitutability, whereas the idea of strong sustainability entails the notion that there is a certain amount of capital (especially natural capital) that cannot be substituted by investments in the other types of capital (W2_SSH_6).

Some participants observed that sustainability is about a long-term cohabitation humans and other living species on our planet (W2_EES_3). From this perspective, it is essential to consider not only humans but also other life forms (birds, insects, other animals, plants, etc.) in the debates on sustainability. In this sense, great educational effort should be done to install in the minds of children and students that we as humans are part of nature, and not apart from it (W2_EES_3). This is truly a cultural challenge.

We should consider the diverse trade-offs and synergies between social and environmental dimensions of sustainability. In a way, SD as a concept reflects an anthropocentric worldview and development model. The degree of anthropocentricity, in a declining order, would be: 1) SD, 2) sustainability, 3) planetary wellbeing. The educational systems should take this hierarchy into

account and develop strategies to integrate it in teaching, to ensure that broader and transformative concepts such as sustainability and planetary wellbeing are not overlooked.

However, some participants warned that a concept such as planetary wellbeing, while less indeed less anthropocentric than SD and sustainability, risks leaving vital social and societal aspects out of focus. Here we find a latent tension between the supporters of distinct concepts.

> I agree with the notion of planetary wellbeing, but at the moment, human suffering is what the society should be worried about. At least it is my priority (W2_EES_5).

b) The disjointed dimensions of SD

The experts considered that the three dimensions of SD are widely known but rarely interconnected in practice. Some participants argued that the social dimension often gets overlooked by SD debates, which nevertheless provides a basis for work on the environmental dimension of sustainability (W2_SSH_7). Others, by contrast, considered that SD usually overlooks the environmental dimension, while the economic dimension tends to predominate (W2_SSH_8). Yet others noted that the economic and social dimensions of SD are important but usually neglected (W2_EES_4).

> Often, there's a tendency to reduce SD/sustainability into only one dimension (economic, social, or environmental). The very complexity of the notion SD means that there is a need to simplify, when we teach the topic to students. However, with simplification comes the risk and the downside that the environmental dimension comes to dominate, and SD is reduced to things like "love of the nature" (W2_EES_5).

For instance, at the school level, the concept of SD is usually linked to 'recycling', and teachers find it hard to move beyond such a narrow conception. A wider, more complex, and better-defined concept would be necessary.

> Recycling is what always comes up as the first thing in discussions concerning SD. It is very difficult to get past this focus on recycling, to issues that really matter for SD (W2_SSH_8).

Some participants (W2_SSH_6) were critical towards the conceptualisation of SD through the three (or four or five…) dimensions, because this would not allow us to address SD as a complex whole of interconnected problems, and would therefore overlook the synergies and trade-offs between the various aspects.

Participants tend to consider that SD is an excessively ambiguous concept, which must be rendered more concrete and integrated in practical day-to-day activities (W2_SSH_8). However, only through such concrete experiences will it be possible to advance in education for sustainability.

> We should concrete the concept into something that can be "taken" and taught by teachers, etc. It is difficult to build something new in the area of sustainability education in the absence of a consensus about the concept (W2_SSH_8).

In conclusion, most of the participants perceived that a simplistic and one-dimensional concept of SD is the most usual, and there is a need to reflect upon and show the full complexity and interrelationship of all dimensions of the concept. However, the participant did not agree on which one is currently the most commonly privileged dimension. In any case, the participants considered it important that teachers and students understand the highly interconnected nature of SD dimensions and the associated challenges (W2_EES_2). They also agreed that integrating SD in practical day-to-day activities is necessary to improve education for sustainability.

c) Do we need a shared understanding of SD for training?

The need of concreteness and contextualisation of the SD concept seems to be a shared concern among the participants. For them, it is important to be able to explain what a sustainable school is and what it means. A shared understanding of the concept, at least for its application in educational contexts, is needed, both for teaching and for generating a culture of sustainability at the school or university in question.

> We have to know what sustainability and ODS are, if we are to teach them (W2_SSH_9).

> There's a need to create a sustainability culture at the school (W2_SSH_9).

Some participants considered that the school system has the duty to transmit and teach the concept of SD, so that all people can obtain a basic knowledge about an aspect that significantly conditions their lives. This approach implies the need for an agreement among teachers about what they should include in their SD teaching.

> Sometimes people don't have a sufficient understanding and knowledge needed to understand SD. Hence, our key duty is to explain the meaning of the concept of SD to the various involved actors (W2_EES_4).

> We have to address the scientific language about sustainability so that people do not leave aside SD, which is an important question for people's everyday lives (W2_EES_4).

> The "taxonomy" is important. The basics of SD must be explained to the students: that the concept is composed of (three) interacting key dimensions, etc. (W2_SSH_7).

In some ways, these arguments reflect a unidirectional vision of sustainability, as something in the hands of experts, to be transmitted to the population (to students). This perspective tends to exclude a more interactive and participatory vision, in which definitions are co-created by various actors.

d) A contradictory concept in a contradictory institution (education)

The participants debated on the extent to which the concept of SD is compatible with our current knowledge about climate change. Some participants believed that there is a conceptual discrepancy

between the two phenomena (W2_SSH_7). Moreover, the participants noted a gap between expert knowledge about sustainability and popular knowledge about what sustainability can be in people's daily lives.

> The need to get out of the "bubble": knowledge about climate change does not match the SD knowledge (W2_SSH_7).

The participants also highlighted the discrepancies between theory and practice at schools and universities. For instance, in recruitment processes, educational institutions tend not to include sustainability considerations, although sustainability is a topic that teachers will then be required to teach. Hence, there is a discrepancy between what is taught to the students and the actual demands by the employers (W2_SSH_7). Therefore, it would be important to include the employers in designing school and university curricula.

Environmental education teachers thought that it would be very important to maintain the momentum as well as children's interest in and commitment to sustainability (W2_EES_3). Often children tend to go "back to normal" after having studied the basics of environmental education, instead of integrating the learnings in their daily lives and practices. In this regard, the context has a great influence. We may be teaching and practicing sustainability in the classroom, but when students change context, they may put that knowledge and practice aside. In other words, the degree to which sustainability becomes part of a student's daily lives does not depend on that students' individual will alone.

Teachers of a 'nature school' perceived that what is taught in that type of schools remains too distant from what is taught at and expected from a "normal" school (W2_EES_3). This reflects the separation between nature and society, something that students experience very clearly. It is said that the school should build bridges between these two social worlds, and thus rebuild the lost unity. This also reflects a view that sees the environment and the economy as contradictory to each other, and illustrates how the social concerns about nature tend to have economic roots.

> We try to save water and energy but not because we worry about "nature" but because of an economic worry (W2_EES_3).

The school should promote an environmental perspective that is manifested in everyday choices. This should not mean living more "in the wild", but instead demonstrating that economy and ecology are not ultimately opposite choices.

Some participants shared the view that the economy and the environment always go hand in hand, and that therefore, teachers must explain how protecting the environment actually provides economic benefits (W2_EES_2).

> Economics and the environment go hand in hand: environmental protection moves forward when it brings you money. This is why we should underline the win-win solutions and approaches between environment and economy (W2_SSH_8).

However, highlighting such win-win opportunities is not easy in the current educational systems. One problem is that economics and the environment are separated into different disciplines: environmental topics are dealt with in biology and geography classes, whereas economics is addressed in other classes (e.g., maths, history). Each subject has its specialised teachers, and the dialogue between the disciplines is not easy (W2_EES_1). Again, this is not only because of a lack of individual will but is conditioned by institutional and structural factors, such as the design and organisation of school and university systems.

The existence of diverging visions of what sustainability is all about also reflects the distinct interests of the actors involved. People tend to favour a definition that best suits their interests. Power relations are therefore an essential element of dimension of the debate.

> There are various discourses and interests in society… Everyone understands sustainability from the perspective of their own circumstances and interests (W2_EES_5).

e) The usefulness of SDGs as a means of introducing sustainability into teaching

One participant (W2_SSH_9) described a theoretical model for including SD in the school curriculum based on the UN Sustainable Development Goals (SDGs). The model is widely applied in Latin America and is currently being adopted in 14 schools in Spain. The model is based on good-practice examples, as well as competence-based and practice-oriented work. The teachers are involved in the design of the curriculum and in planning and organising teaching, to ensure they have the needed time and other resources. For example, teachers can start by working on a selected SDG and thereby render the notion of SD concrete and tangible to students. Participation and inclusion of teachers is essential.

The participants agreed that the SDGs can be a useful tool for developing sustainability teaching and learning, and as a practical way of organising activities at schools and universities.

> Students should decide which area (regarding SDG) they want to work on, so that teachers can adapt their teaching accordingly (W2_SSH_7).

One proposal for introducing sustainability in the educational projects was through good-practice examples, such as interdisciplinary projects, or action(-research) projects that engage students in practical work for SD. This could include helping students to engage in political advocacy in their communities, and to become “agents of change” or “champions” of SD in their communities (W2_SSH_7). SD teaching should aim at influencing the students, the local community, and the international community (the student should understand the impacts and challenges involved at all these three levels) (W2_SSH_9).

The idea of engaging with the local community for developing sustainability projects was highly valued by the participants.

> Leadership is important, and so is the commitment of key local people. A good-practice example was the recent 20-year anniversary of our association: we invited to the event the deputy mayor and the manager of education and culture of the city of Tampere, to help them understand, through first-hand experience, what our work consists of. This type of personal experience and contacts are very important in generating the needed understanding, motivation, and commitment among key decision-makers and stakeholders (W2_SSH_8).

f) Criticisms against SDGs

On the other hand, some participants expressed criticism towards the SDGs as a tool, arguing that these do not help in addressing SD as a complex whole of problems (W2_SSH_6). Those expressing such views criticised the idea of taking a single SDG and treating it without ever addressing the connections (trade-offs and synergies) with the other SDGs although these interactions are what makes SD truly a challenge.

Some participants also criticised the SDGs for implicitly assuming continuous economic expansion, which they considered would be in a fundamental contradiction with the environmental limits (W2_SSH_6). From this point of view, the educational system should help the students to understand the physical realities (the environmental limits), and the inevitable environmental consequences from any economic expansion. From this perspective, the notions of SD and SDGs are inherently problematic.

Some participants also blamed the SDGs for leaving little room for democracy. Sustainability should focus on decision-making and democracy, whereas the SDGs seem to contribute to narrowing down the debate.

> Summing up, SDGs rather prevent than help us to ask “big questions”, which should be at the heart of SD (W2_SSH_6).

In any case, while recognising the risk of not capturing sustainability in its full complexity, the participants agreed that the SDGs can help in identifying the key issues of SD, but underlined the need to enhance the students’ understanding of the interconnections lying at the heart of SD (W2_SSH_7). To challenge the prevailing realities and practices, it would be necessary to adopt a holistic perspective and engage in an inclusive and participative work.

g) Shaping individual and societal values

Values were a central concern for several participants, who argued that any social change would require changes in societal values. The participants considered it important to make explicit the implicit choices we make in our daily activities. Concepts such as ecosystem services, lifecycle analysis, “donut economics”, etc., can serve as useful educational tools.

For example, we can compare the gains from selling a forest for exploitation by a pulp and paper company on the one hand and from protecting the forest, which provides vital ecosystem services, on the other. Ecosystem services allow us to think about the society's dependencies in non-monetary terms, and thereby challenge the notion of a monetary economy and spur us to think about nature in other terms (W2_SSH_8).

Degrowth is often evoked as an issue, but not really dealt with in any detail. However, JYU has recently introduced an economics course that adopts the "donut economics" as its underlying framework (W2_SSH_6).

h) Intermittences in sustainability education

The participants noted that schools often have little knowledge about SD issues, and therefore see SD activities as something punctual, ad hoc (W2_SSH_7). At the school level, it would be necessary to ensure that the school headmaster provides the teachers with the necessary resources to oversee sustainability teaching. This would require allocating sufficient human resources and ensure adequate scheduling of the activities, to avoid overburdening the teachers, if SD becomes merely an additional task on the top of the existing ones.

This way, it could also be ensured that the necessary resources are allocated to SD work. For instance, if teachers are to teach SD, then it must be ensured that this does not simply come on top of their existing duties, but that additional resources (substitute teachers, for example) are provided to cover the time that teachers spend on preparing and delivering SD teaching (W2_SSH_8).

The participants stressed that the school leaders must take responsibility for SD teaching (W2_SSH_9). Internal organisation at the school is important, including the methods for evaluating SD teaching and its impacts and effectiveness (W2_SSH_9).

i) Discontinuities between stages of education

The participants also noted that sometimes students are aware and knowledgeable of SD, but that they are then frustrated by the lack of attention to SD by the institutions at the subsequent stage in their education. Indeed, sometimes primary and secondary schools are more engaged in and prepared to integrate SD in their teaching than universities are.

For example, high-school students may be well educated and knowledgeable in SD but then, at the beginning of their university studies, discover a nearly complete lack of attention to SD in the university curricula. This can be true for medical schools, for example: the future physicians (medical doctors) learn just about nothing about SD during their university studies (W2_SSH_7).

> The understanding of SD issues goes down as one moves up on the educational ladder, from primary, through secondary to university education. So, the problems are largely structural (W2_SSH_6).

j) Universities as places of weak sustainability

One of the identified obstacles to SD work at universities was their tendency to have a unit dedicated to sustainability of the university premises and infrastructures, but the activities of these units rarely have any bearing on what is being taught in the classrooms (W2_SSH_7).

Universities seem to be a weak in educating the students for sustainability. More generally, it is hard to address the broad and cross-cutting questions related to sustainability in universities. It is often difficult to even get faculty members to sit around the same table, to tackle these interrelated problems. This is not only due to lacking interest but also to a lack of basic knowledge and conceptual understanding of the challenges. The difficulties also stem from the narrow field of specialisation by most university teachers and researchers, which makes it difficult for teachers to understand each other (which remind of the problem of interdisciplinarity stated above).

> As a biologist, I needed more than two years to understand basic social science concepts such as what was understood by the term “normative” (W2_SSH_6).

5. CONCLUSIONS

The analysis carried out allows us to reach the following conclusions, which can be structured by different themes.

Limitations and usefulness of the concept of sustainable development

The participants in the two Webinars tended to clearly distinguish between the concepts of 'sustainable development' and 'sustainability', showing preference for the latter.

The participants considered sustainable development (SD) as a concept that is excessively narrow, contains internal contradictions, too anthropocentric, with a certain economic bias, and too reliant on the ability of technological progress to solve the conflicts between society and nature. Furthermore, the experts argued that SD can easily be instrumentalised and used as a tool of 'greenwashing', and therefore hampering progress towards true sustainability.

'Sustainability', instead, was portrayed as a much broader concept that does not implicitly postulate the primacy of the economic dimension, which the participants argued was the dominant trend in the current debates on SD.

However, the experts recognised that the concept of SD could in current debates nevertheless be useful at least as a transitory concept, which would help to advance transitions towards sustainability. SD might therefore be needed today, but could be abandoned as useless in the future, when sustainability debates, policies, and transitions would have reached a certain maturity.

The participants related the concept of sustainability to long-term cohabitation between humans and other living species and life forms on our planet. This constitutes a cultural challenge. However, the participants recognised that while the concept of planetary wellbeing is indeed less anthropocentric than SD and sustainability, it risks leaving vital social and societal aspects (e.g. human suffering) out of focus.

For this reason, participants proposed to distinguish between weak and strong sustainability (distinguished by the extent to which different types of capital are considered substitutable with each other), and argued that educational systems should be able to explain different degrees of sustainability, from the highly anthropocentric concept of SD towards the more transformative concepts of sustainability and planetary wellbeing.

There was significant convergence of views between the two webinar groups, i.e., between the sustainability experts and education practitioners. Both groups considered, the concept of SD as outdated and too restrictive to account for the problems and solutions to the society/nature divide. At the same time, the participants in both groups were aware that standard current policies, even in educational settings, tend to promote diagnosis and actions mainly based on the concept of DS, and are not able to capture the required holistic complexity built in the sustainability concept.

The challenge of multidimensionality

The experts in both groups were well aware of the different dimensions of SD, but considered that these are rarely interconnected in practice. One of the difficulties with the concept of SD is its multidimensionality, because experts and policymakers often use it by focusing only on one dimension. Some participants argued that the environmental dimension is always predominant, while others considered SD debates are dominated by economic considerations. The participants underlined the difficulties stemming from the inherent complexity and interconnectedness of sustainability problems.

The need for holistic approaches that do justice to the complexity and multidimensionality of sustainability led some participants (particularly those of the practitioner Webinar) to question the underlying logic of the UN Sustainable Development Goals (SDGs), arguing that SDGs overlook the crucial interconnections between different aspects of sustainability. On the one hand, the SDGs can be useful by helping teachers to render SD concrete and tangible to students, for example through concrete and practical projects in the local community. On the other hand, this approach risk may conceal the complex interconnections between the different SDGs.

Concepts such as ecosystem services, lifecycle thinking, 'donut economy', and planetary wellbeing can be useful in fostering holistic understanding of sustainability. These can be powerful education tools, but they need be part of a more general education framework.

The desired interdisciplinarity

The participants considered that expert and academic debates on SD can engender potentially fruitful inter- and transdisciplinary initiatives. However, they also evoked as one of the main problems the lack of interdisciplinarity in SD debates. Some experts seem unable to appreciate the views from experts with a different disciplinary background and integrate knowledge from outside their own field.

One of the barriers to interdisciplinarity (among experts) is the rules prevailing in the academia and scientific community. These include the difficulty to find journals willing to publish interdisciplinary articles, and the lack of resources (e.g., time and money) to carry out truly interdisciplinary projects. The experts noted that reaching mutual understanding requires time and effort, which the academic institutions are seldom prepared to provide.

Shared arenas for interaction between disciplines would be needed, the participants argued. These could include co-working spaces and time dedicated for interaction between people with distinct disciplinary backgrounds. This would help individuals to open their minds to other concepts and methodologies.

The key role of educational institutions

Participants considered that there has been a modest yet continuous progress towards greater collaboration between disciplines. The educational institutions can play a key role in facilitating such transformation. The participants stressed that schools and universities must teach the highly interconnected nature of SD dimensions, and integrate such a perspective in their organisation's practical day-to-day activities.

The practitioners identified as one of the main weaknesses of sustainability education the poor integration of sustainability considerations in the day-to-day activities of schools and universities. Often, SD activities are introduced as ad hoc one-off exercises. Sometimes the teachers do not have the indispensable knowledge to properly teach sustainability, while often sustainability is introduced merely as an additional burden for teachers, on the top of their ordinary duties.

Moreover, there are discontinuity in sustainability teaching between the stages of the education system. Students are aware and knowledgeable of SD in primary and secondary schools, but are frustrated once they embark on their university studies, by the lack of attention for sustainability. The participants argued that universities seem to be weak in educating students for sustainability. The internal organisms responsible for sustainability (e.g., environmental management of the school or university infrastructure) have little if any influence on what is taught and learned in the classroom. Furthermore, for reasons such as lack of time, division of labour within the institution, and distinct disciplinary backgrounds, it is often difficult to even get faculty members to sit around the same table, to tackle the interrelated sustainability problems.

Expanding the debate beyond the academia

Transdisciplinarity implies dialogue that goes beyond the academia – dialogue amongst experts and other actors such policymakers, social movement, business, and civil society actors. To succeed, transdisciplinarity requires building common ground by agreeing upon shared terms and concepts. However, as the participants underlined, the practical conditions for such processes are not always there.

A Transdisciplinary approach stresses the importance of communication and education, engagement and participation, which can also help to reduce the risk of SD being used merely for greenwashing. Social sciences can help in engaging and bringing citizen's voices into sustainability processes.

According to the participants, this common ground could be generated through practical small-scale projects. Rather than with big theoretical debates, transdisciplinarity would be better served by experiences and experiments at local level, where creating the optimal conditions for dialogue between actors and sharing meanings and goals is the easiest.

However, participants in both groups warned that, although shared objectives would be ideal, this is not always possible because of the often very distinct and mutually conflicting interests involved.

People tend to favour a definition that best suits their interests. Power relations are therefore an essential element of dimension of the debate. In these cases, conflicts cannot be avoided, but instead, it would be vital to make the divergences visible and develop strategies to manage them in a fair manner.

In the practitioner Webinar, the participants highlighted the potential discrepancies between theory and practice. They evoked differences between what students learn and experience in the school and what they do at home, between what is taught and what is done, and between economy and the environment (themes that are taught in different subjects at school, not always in a congruent manner). This underscores the importance of the design and organisation of educational programmes and curricula, as well as the need to embrace sustainability in all its complexity and involve actors outside the school or university in question.

6. IMPLICATIONS

The conclusions and recommendations by the experts have clear implications for the design of our Strategy for Transdisciplinary Dialogue (STD).

Firstly, the expert conclusions and recommendations confirm that **our Roadmap can help foster multi-, inter- and transdisciplinarity in practice.**

The phases of the Roadmap highlight the need to consider and apply many of the measures suggested by the experts. In the following, we will present a number of examples to illustrate the links between the expert recommendations and selected elements of our Roadmap. The analysis is neither systematic nor exhaustive, but merely seeks to show the congruence between the recommendations and the Roadmap.

Recommendations from the Webinars	**ECF4CLIM Roadmap Step 1. Engagement** 
Limitations and usefulness of the concept of sustainable development and the need to distinguish between: - sustainable development and sustainability - weak and strong sustainability (distinguished by the extent to which different types of capital are considered substitutable with each other)	- Sustainability knowledge as a **common ground for discussion**.

Recommendations from the Webinars	**ECF4CLIM Roadmap Step 2. Connections** 
The challenge of multidimensionality and the need to/for: - consider the different dimensions of SD and how they are (rarely) interconnected in practice; - holistic approaches that do justice to the complexity and multidimensionality of sustainability. - consider concepts such as ecosystem services, lifecycle thinking, 'donut economy', and planetary wellbeing **The key role of educational institutions** and the need for schools and universities to teach the highly interconnected nature of SD dimensions, and integrate such a perspective in their organisation's practical day-to-day activities.	- find **connection**s between everyday life of school or other educational organisation, other actors, learning contents, disciplines, and the state of the environment. - mapping the **root causes:** systemic, structural, human and cultural issues behind unsustainable activity and culture. - how to better understand the **complexity of sustainability problems** and assess the available information.

Recommendations from the Webinars	ECF4CLIM Roadmap Step 3. Visions
The desired interdisciplinarity and the need for - shared arenas for interaction between disciplines - time and effort to reach mutual understanding	- Promotion of **transdisciplinary knowing**

Recommendations from the Webinars	ECF4CLIM Roadmap Step 4. Actions
The key role of educational institutions - training for teachers **Expanding the debate beyond the academia** and the need for/to - experiences and experiments at local level, where creating the optimal conditions for dialogue between actors and sharing meanings and goals is the easiest. - make the divergences visible and develop strategies to manage them in a fair manner. - consider the differences between what students learn and experience at school and what they do at home, i.e., between what is taught and what is done	- Structures for change - Competences (knowledge, skills and attitudes), **how to make our actions effective** and meaningful, and **how to assess the results related to our context, values and visions** of the more sustainable futures

The expert recommendations will certainly allow us to refine and operationalise the above-mentioned elements of the Roadmap, and can also help to elaborate the evaluation criteria.

Secondly, **the focus of the interventions that we are codesigning and co-implementing** at our Demonstration sites in WP4 and WP5 is **very similar to the approaches suggested by our experts** to nurture multi-, inter- and transdisciplinarity. More concretely, the interventions designed through our participatory and deliberative processes (through the SCTs and SCCs) are indeed designed to foster "experiences and experiments at local level, where creating the optimal conditions for dialogue between actors and sharing meanings and goals is the easiest".

Summing up, the findings from our Webinars suggest that both our conceptual approach to the ECF, that is, the Roadmap, and its operationalisation through concrete interventions at the various demonstration sites exhibit significant potential to foster multi-, inter- and transdisciplinarity dialogue.

In the light of these considerations, **we suggest two parallel strategies for monitoring and evaluating multi-, inter- and transdisciplinarity dialogue in ECF4CLIM**:

a) **Incorporating in WP6 (evaluation) indicators designed to measure progress towards multi-, inter- and transdisciplinarity dialogue** through the diverse interventions implemented at the demonstration sites.

The indicators could relate, for example, to aspects such as:

- Time and resources dedicated to multi-, inter- and transdisciplinarity dialogue
- Articles that adopt a multi-, inter-, or transdisciplinary approach
- Collaboration between disciplines
- Efforts and measures designed to render visible the differences and diverging views between disciplines
- Knowledge and understanding of the perspectives of the other actors implicated in the process

The project team has started elaborating, as part of WP6, indicators for evaluating the efficacity of the interventions that will be implemented during the project. The moment is therefore ideal for including within the set of indicators those that allow us to gather empirical evidence on the presence (or absence) and quality of these multi-, inter- and transdisciplinarity dialogues.

b) Generate **shared arenas for interaction between disciplines and devote time and effort to reach mutual understanding within** the multiple activities of **the project consortium**.

The next General Assembly of the project will be held in Lisbon, 11-12 May 2023. To seize the opportunity offered by the presence of scholars and experts from a wide range of disciplines (engineering, environmental sciences, social sciences, education, etc.), from the demonstration sites (school and university teachers, professors, and headmasters), as well as from the broader educational community (NGOs, local authorities, etc.), the meeting schedule will include a participatory and deliberative activity designed to foster to multi-, inter- and transdisciplinary dialogue. The General Assembly participants will interact in different settings throughout the two meeting days. At the end of the second day, the participants will jointly reflect upon their experiences of interacting with people from different disciplinary backgrounds (that is, on the benefits, difficulties, and opportunities of multi-, inter- and transdisciplinary dialogue). This exercise will also allow us to critically analyse the basic assumptions underpinning the measures suggested (by experts and our Roadmap) for advancing transdisciplinarity.

In this way, these forums and arenas of joint reflection will allow us to progressively review, and adjust if needed, the evaluation criteria, as well as to explore the adequacy of our initial assumptions concerning the measures designed to foster transdisciplinarity and, ultimately, our understanding of the very notions of sustainability, sustainable development, and multi, inter-, and transdisciplinarity.

Applying these strategies, we seek to generate empirical evidence that can result in actionable knowledge and recommendations on how to foster multi-, inter- and transdisciplinarity dialogue in EU-financed projects more generally.

7. REFERENCES

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