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Review

Collaborations in Environmental Initiatives for an Effective "Adaptive Governance" of Social–Ecological Systems: What Existing Literature Suggests

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Abstract: Moving from the scientific literature on the evaluation of environmental projects and programs, this study identifies how and under which conditions collaborations in environmentally sustainable projects are considered effective for the adaptive governance of SES. The method adopted is a systematic literature review based on the quantitative and qualitative analysis of 56 articles selected through specific queries on the SCOPUS database and published from 2004 to 2020. Results of the quantitative analysis identify conditions able to evaluate collaborations, highlighting the need to adopt a transdisciplinary approach analysing both social and ecological challenges and assessing both social and ecological results. Moreover, they suggest preferring using primary data involving multi-sector and multi-scale actors and enlarging the geographical context to the most vulnerable countries. The results of the qualitative analysis provide specific recommendations for collaborations being effective when related to communication, equity, foresight, and respect, which need to be further strengthened by all actors. Multiplicity in visions and approaches should be seen as a resource able to stimulate creativity in social arrangements and environmental practices, making collaborations in environmental projects instrumental for the effectiveness of adaptive governance of SES.

Keywords: collaboration; adaptive governance; sustainability transformations; social–ecological systems; evaluation; systematic literature review

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1. Introduction

Human activities are exerting an increasing impact on the environment at all scales, from local to global, endangering the conditions of ecosystems [1–11]. Emergencies that global society is fighting nowadays are evidence of this close connection. Specifically, the COVID-19 pandemic has reinforced this awareness within the scientific community [12] and has probably diffused it to a broader public [13], calling for real sustainable development action [14,15]. Nevertheless, at present, sustainable development is still far from being achieved: "The world today is not sustainable, not resilient and not fair for the majority of mankind" [14] (p. 1).

Complexities and uncertainties characterizing both environmental and social challenges limit the implementation of activities able to effectively catalyze sustainable transformations [16]. In particular, the governance of the environment is challenging because many natural resources are shared among multiple competing actors, provoking conflicts. That is why collaboration is proposed as a promising approach able to address such issues [17]. However, collaboration improves the governance of natural resources if it is effective [18]. Otherwise, collaboration could be seen as a sort of panacea solution that can have no value or even make counterproductive effects [19,20]. To overcome this limitation, at present,

the existing literature reveals an urgent need to provide additional knowledge concerning the effectiveness of collaborations both in terms of evaluation approaches [18,21–23] and conditions able to foster them [24]. Hence, this study identifies how and under which conditions collaborations are considered instrumental for an effective "adaptive governance" in terms of sustainable transformations in Social–Ecological Systems (SES). The study analyses collaborative relations among different actors involved in environmental programs and projects as analyzed in the scientific literature on environmental evaluation. Specifically, this study aims to provide additional knowledge for (i) improving evaluations of collaborations in future and (ii) providing guidelines for actors to foster effective collaborations. Identifying and classifying findings emerging from evaluations of real experiences allows an understanding of why some collaborations are effective while others fail or collapse [18,25].

The analysis of project and program evaluations, which have been scrutinized through peer-review scientific articles, is at the core of this study. This is motivated by the awareness that evaluations are instrumental to increase the effectiveness of environmental actions, adjusting them to new needs emerging over time through the stimulation of the learning-by-doing process, which identifies previous failures and successes and highlights current needs [26,27]. Specifically, evaluation, and more specifically, self-evaluation, could enhance the performance of future initiatives—through an individual and collective practice of reflection on the process undertaken during the action implementation—if its results pave the way to changing community routines and individual and collective practices and behaviors [28]. Its findings, indeed, can help policymakers to reform or re-design policy instruments but also be helpful for practitioners and, generally, all stakeholders to identify the most relevant and critical aspects for promoting and making valuable and successful their entrepreneurial and social initiatives in the environmental realm [29]. In this perspective, the role of the evaluation is further strengthened if the initiatives can have a clear transformative impact and become utilized and available to the entire society by proposing evidence-based examples on transition practices for sustainable transformations [16].

Effective sustainable transformations are fostered by the capacity of all actors composing society to respond to change through adaptation [30]. This can be achieved through an ongoing individual and collective adjustment aiming at revising environmental activities [31,32]. Accordingly, adaptive governance has been defined as the set of interactions between actors, networks, organizations, and institutions that aims to facilitate transformations to achieve the desired state for SES [32,33]. The SES concept [34] highlights that nature and society coevolve through a reciprocal adaptation process based on interdependencies [8,35–37]. In particular, it clarifies that society—intended as people, communities, economies, and cultures [38]—is part of the biosphere and it is entirely dependent on nature [8]. In this paper, we focus on the societal component, and therefore on collaborations amongst humans and their organizations, while exploring in detail the ecological component and networks remains out of the scope.

We focus on collaborations among different types of social actors because sustainability transformations are usually multi-actor and multi-level processes [39] that are characterized by differences in interests, perspectives, needs, knowledge, and resources among stakeholders, leading to possible conflicts, e.g., [40–42]. The scientific literature agrees in considering collaborative relationships the most suitable means to support sustainability transformations [21,43–47]. The literature reports examples of projects which are characterized by good performances in term of effectiveness due to collaboration between different types of stakeholders, such as in biodiversity conservation projects [42], land use planning [48], and protected areas management projects [49]. Collaboration can be seen as "a set of organizational and interpersonal relationships shaped by the nature of the problems being addressed, the predispositions and capabilities of key actors, and the characteristics of the places in which the problems occur" [43] (p. 85). Collaborative relationships are characterized by strong interactions between all types of actors involved in the

process and by trust and honesty [50]. When they are characterized by accountability and transparency, they contribute to building knowledge, solving conflicts, developing trust or trustworthiness among actors, and connecting different types of actors and sectors that previously worked in isolation to identify common solutions [20,41,51,52]. Collaboration concretely happens through the creation of partnerships. Partnerships arise when different actors share their resources in order to achieve a common goal. Accordingly, creating collaborative partnerships composed of multiple actors is considered an essential tool to face uncertainties and complexities characterizing environmental challenges [53].

The needs, ideas, and actions that emerge from collaborative relationships trigger the coevolving process between society and nature by establishing new social arrangements [33], intended as new roles and interactions of actors [54]. Hence, evaluations of new collaborative interactions emerged from adaptive governance initiatives, and when scrutinized through scientific articles, could identify aspects able to improve their effectiveness and encourage sustainability transformations with a consequent improvement in the quality of SES.

The paper is organized into five sections. After this introduction, the theoretical framework is presented in Section 2, then the materials and methods are specified in Section 3. The quantitative and qualitative results are described in Section 4 and further discussed in Section 5 with concluding remarks in Section 6.

2. Theoretical Framework

2.1. On Key Basic Concepts

This article bases its foundations on the theoretical concepts of sustainable transformations and adaptive governance.

Sustainable transformations refer to changes in social and environmental interactions and feedback in all dimensions of SES by considering resilience and adaptation [30,55]. Transformations are recognized as deliberative actions activated intentionally by actors to realize a significant change (i.e., radical and non-linear social changes able to cross thresholds into new development trajectories—[55,56]) to achieve adaptation in SES [57]. Transformations can be different in focus and can be distinguished between ecological (e.g., changes of landscape, ecosystem services, and assemblages of species) and social (e.g., new values, norms, institutions, changes in governance arrangements and everyday practices), with a continuous interplay between these two sets of transformations, which depends on each other [58]. Focusing mainly on social transformations, the assumption at the basis of this study is that changes in social values, rules, and knowledge may impact decisions of individuals and organizations, fostering transformative adaptations based on shared solutions and learning by improving SES quality [31].

Adaptive governance integrates the concepts of transformations, SES, and governance [33]. The governance concept refers as the set of rules, structures, processes, and traditions that determine how people make decisions, share power, exercise responsibilities, and ensure accountability [32,59]. Adaptive governance of SES is, indeed, characterized by participation, experimentation, and collective learning of the different stakeholders involved in diverse phases of collaborative activities, such as the identification, formulation, implementation, and evaluation of environmental policies, programs, or initiatives [35]. Adaptive governance reaches its effectiveness if it is fit-for-purpose, that is, when "(i) its structure enables multiple actors to purposely guide, control, manage or steer societies through network structures that fit with their social and ecological context, (ii) its processes fit with both the network structures in which they take place and the purposes for which they are being used" [19] (p. 76). Consequently, adaptive governance should "(i) provide information (science and local knowledge); (ii) deal with conflict; (iii) induce rule compliance; (iv) provide infrastructure for capacity building; and (v) be prepared for change" [33] (p. 4).

2.2. On Collaborations

Analyzing how and in which conditions collaborations contribute to the achievement of effectiveness in adaptive governance processes requires focusing on the behaviours, decisions, and activities at the individual and collective levels which determine the effects on the biosphere [8]. Following the adaptive governance concept, the literature on sustainability transformations recognizes the critical role played by individuals and their interactions in social transformations, meaning "a set of recognizable activities and attitudes used by an actor to address the recurring situation" [60] (p. 49). The role appears because of interactions between different social groups and implies expected behaviors, rights, and duties [61]. Accordingly, actors are not passive rule-followers, but they can be active agents in systemic changes, i.e., changes in the institutional structure such as thinking, everyday habits, management practices, and resource flows [30]. Actors can exert power and influence the magnitude and effectiveness of transformations through their agency [30,60]. Specifically, [62] identifies four actor categories involved in sustainability transformations: the State, market actors, community, and the third sector (e.g., labor unions, NGOs, and science). Different features typify them in the following axes: (i) informal–formal, (ii) profit–non-profit, and (iii) public–private. The State is formal, public, and not-for-profit; the market is formal, private, and for-profit; the community is informal, private, and not-for-profit; and the Third Sector is conceptualized as an intermediary form between the three axes [37], allowing the inclusion of different organizational forms such as social entrepreneurs, social enterprises, and cooperative organizations.

Collaborative interactions between these different typologies of actors create new hybrid forms of governance and evidence the change of the conventional role attributed to a specific actor needed to compensate for limitations of other social agents [60,63], encouraging creativity and, consequently, the development of experimentations through the identification of new ideas, innovative organizational models, new social and environmental practices, novel arrangements, and agreements that potentially could contribute to the achievement of sustainability [30,64]. Moreover, interacting actors define and guide governance processes necessarily impacting (positively or negatively) on nature because they are related transversally with natural components of SES through their decisions and activities [8,22,65]. Such interactions between society and nature constitute SES [8] and are shown in Figure 1.

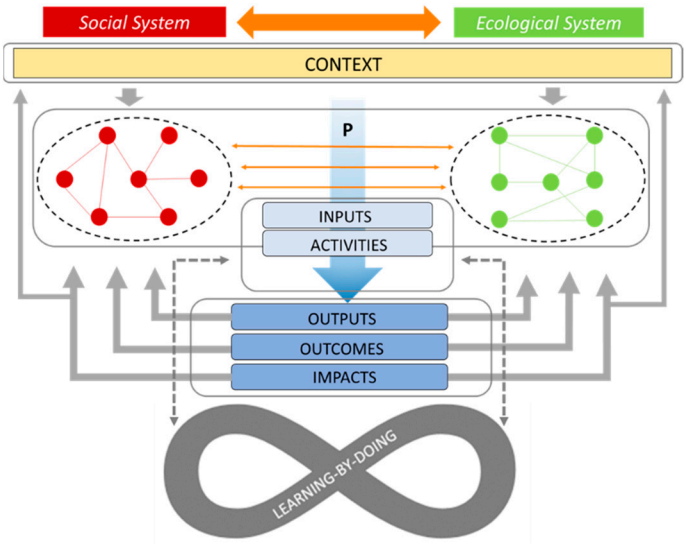

Figure 1. Result chain of adaptive governance activities in SES.

An SES is constituted by interdependent social and ecological systems whose peculiarities are due to their specific context (grey down arrows). If the ecological system can be conceptualized as an interdependent system of organisms or biological units [66] (the green

nodes connected through ties in Figure 1), the actors that constitute the social system (the red nodes connected through social relations) could be defined as individuals or organizations intended to generate changes through activities that have environmental impacts [67]. The two systems, i.e., social and ecological, are connected to each other through social and ecological interactions occurring at multiple levels of adaptive governance [68] where individuals and organizations exert a pressure on the ecological components of the SES and, vice versa, the induced changes on the environment influence actions (the orange arrows). These interactions influence both the flows among resources composing the ecological system (the green lines) and the relations within the social system (the red lines).

Effective collaborations in the adaptive governance of SES require that actors guide, control, manage, and steer environmental resources by considering both components, social and ecological. The literature recognizes that by increasing the social connectivity in SES, collaborative activities can improve effective management of the ecological component through the creation of flexible connections among stakeholders formalized in partnerships [20,69]. Connections require sharing of material and non-material resources, facilitating trust-building relations needed to resolve conflicts [17]. Connections can sustain adaptation and trigger sustainability transformations [8,30]. By identifying, formulating and implementing environmental project activities (P), actors can concretize environmental collaborations based on adaptive governance that are able to synergically consider both the social and the ecological systems (blue arrow), fostering governance activities that could be more fit-for-purpose [19] in producing outputs, outcomes, and impacts ([70] defines outputs as the tangible results made by activities that are relevant for the achievement of outcomes. Outcomes are defined as likely or achieved short-term or medium-term effects. Impacts are defined as positive or negative long-term effects produced by activities) (Figure 1) [71,72]. The results of projects could negatively or positively affect the context where they act and both the social and the ecological systems (grey arrows). Moreover, the ongoing learning-by-doing process fostered by evaluations allows identifying improvements in governance activities through an adaptive cycle as shown by dashed grey arrows (Figure 1) [30].

3. Materials and Methods

To understand how and under which conditions collaborations could contribute to effective adaptive governance of SES, we perform a systematic literature review through both a quantitative and qualitative analysis based on reliable and high-quality evaluations reported in the scientific literature [73]. The systematic review is performed to collect and synthesize pieces of evidence emerging from scientific articles focused on the results of the evaluations of environmental activities and extrapolate knowledge on collaborations in adaptive governance of SES [74]. We opted for a systematic review because it allows summarize existing and fragmented knowledge discussed in multiple scientific articles in order to handle the research questions in a sounder way [75]. Specifically, we want to reorganize the scientific knowledge that emerged from experiences already analyzed and evaluated by the scientific community, focusing on evaluating and fostering collaboration in adaptive governance. Steps constituting the literature review process are reported in Figure 2.

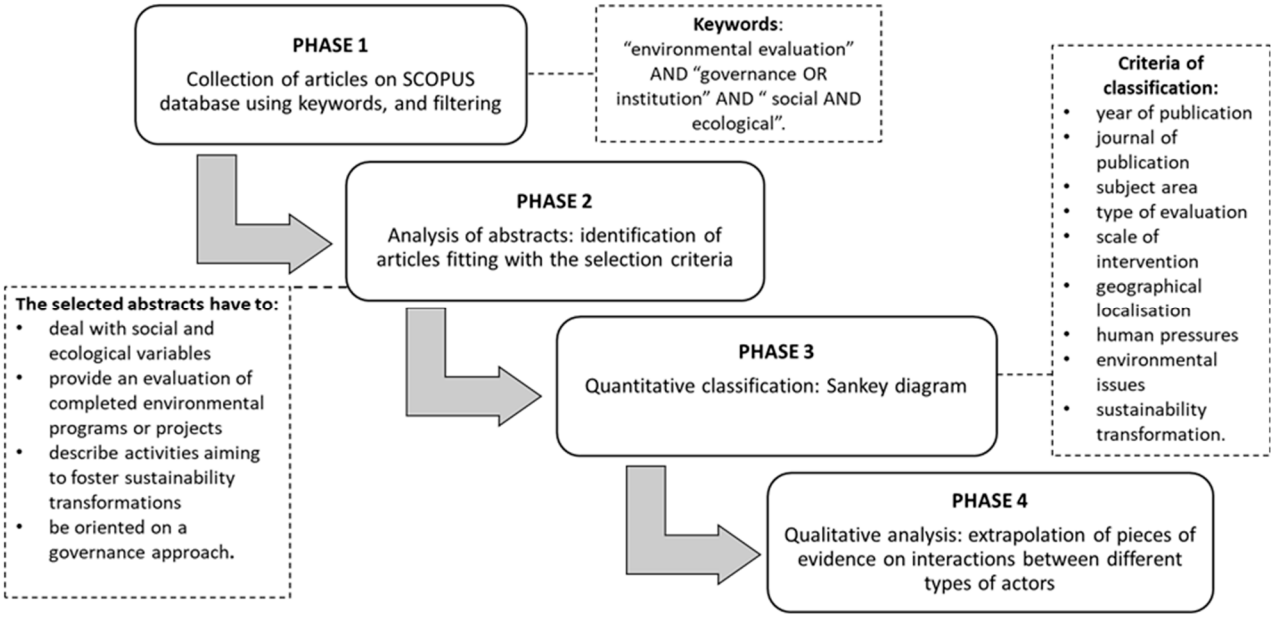

Figure 2. Schematization of the sequence of steps constituting the literature review.

3.1. Identification and Extraction of Scientific Papers

For the extraction of scientific articles, we choose the SCOPUS database, whose peculiarities guarantee high quality and reliability. SCOPUS provides the most extensive availability of high-quality journals [76] and articles from around the world, especially on environmental science, and the possibility to have easy access to abstracts for most papers compared to other academic research databases such as Web of Science [77–79]. SCOPUS assures the extraction of reliable data through the analysis of scientific articles subjected to peer review process, compared to other databases characterized by a more extensive coverage such as Google Scholar, whose citations derive from multiple sources, which also includes preprints. [80,81]. Accordingly, SCOPUS can be considered the largest curated abstract and citations database, characterized by a selection process on its contents that contribute to preserving the integrity of science. The reliability of such a database is already demonstrated by using SCOPUS for multiple evaluations, such as national assessments, government science policy evaluations, and university rankings [82]. Additionally, SCOPUS better support the implementation of systematic reviews based on key words search than other databases, especially new databases such as Dimensions or Microsoft Academic [83].

To identify articles, we used the following key words combination (string search): *"environmental evaluation" AND "governance OR institution" AND "social AND ecological"*, in order to gather a collection of scientific articles treating environmental evaluations of programs or projects aiming at fostering sustainability transformations in both the social and the ecological dimensions of SES, with a focus on governance arrangements. Then, we identified the papers that fit the purpose of the research by reading abstracts using a specific set of selection criteria of the abstracts, as proposed by [84]. The selected abstracts have to:

(i) deal with social and ecological variables
(ii) provide an evaluation of completed environmental programs or projects
(iii) describe activities aiming to foster sustainability transformations
(iv) be oriented to a governance approach.

The reduced numerosity of papers allows us to analyze them deeply by reading the whole text and valorizing every statement. By reading their texts, we classify articles and identify evidence related to collaborations through codes reported in MS Excel files and then elaborated through quantitative and qualitative analyses (e.g., [85]).

3.2. Quantitative Analysis of Relevant Data

The extraction of relevant data for the quantitative analysis, i.e., the third step of systematic literature review, was done through a Sankey diagram. The Sankey diagram is a visual tool able to define a flow from one set of values to another, highlighting their relationships. Flows and quantities are visualized from the size of lines connecting a value to another one, evidencing the magnitude of relationships. Accordingly, the wider the lines are, the larger the quantity of the flow is [86]. Here, the flow visualized by the Sankey diagram represents the coexistence in the same article of multiple attributes used for its classification, which define its peculiarities. Every article is classified through the identification of levels pertaining to six different scales. Thus, we transform qualitative information to quantitative data (i.e., number of articles in a certain level, and number of relationships between levels of two consecutive scales) in order to better identify what levels are most addressed by evaluations and what are the most recurrent relationships among levels of different scales.

We first identify the year of publication of articles, in which journals the articles are published, and in which scientific areas articles are included according to the subject areas specified by the journals. After that, we classify articles based on the following scales detailed into different levels:

(i) type of evaluations, i.e., Assessment based on indicators or indices, Pure qualitative evaluations, and Integrated evaluations [87];
(ii) scale of intervention of projects or programs evaluated, i.e., Local, Sub-national, National, International, Global [68];
(iii) geographical localization, i.e., Africa, America, Asia, Europe, Oceania (https://unstats.un.org/unsd/methodology/m49/, accessed on 1 June 2021);
(iv) human pressures on environmental resources, i.e., Agriculture, Forestry, Fishing and hunting, Tourism, Industry, Transport, Urban areas, Waste, Energy, and Climate change [88];
(v) environmental issues, i.e., Biodiversity, Freshwater, Land and soil, Ocean and coasts, and Air [88];
(vi) sustainability transformations addressed, i.e., Sustainable food, land, water and oceans, Health, well-being and demography, Sustainable cities and communities, Energy decarbonization and sustainable industry, Digital revolution for sustainable development, Education, gender, and inequality [36].

3.3. Qualitative Analysis of Relevant Data

The fourth step is the extrapolation of pieces of evidence (statements as reported in the text of the article) on interactions between different types of actors as categorized by [62], e.g., in the case of the article proposed by [41], State actors are the federal and provincial fisheries departments, market actors are local fishers and aquaculture operators, community actors are local and aboriginal communities, and third sector actors are research institutions and multiple NGOs. All statements related to pieces of evidence on interactions are collected in an Excel spreadsheet file, clarifying:

(i) what are the categories of the actors involved in the relationship (i.e., the State, market, community, and the third sector);
(ii) if and how the relationship has been effective or not in dealing with the environmental challenge in the analyzed SES (e.g., resolution of conflicts around multiple uses of marine space through the development of a new institution [41]).

Finally, a qualitative content analysis reviews and summarizes the heterogeneous knowledge by grouping the statements (narrative text) with an equal or similar meaning into homogeneous categories aggregated around broad concepts emerging from our interpretation of contents reported in articles.

4. Results

4.1. Selected Papers

The selection of articles on the SCOPUS database identifies 194 articles, which are consequently filtered, considering only articles and reviews written in the English language (147). After analysing abstracts, 56 papers (listed in Appendix A) fit with all the four criteria identified in Section 3 to address the research purposes and are used.

4.2. Quantitative Results

The analysis reveals that selected articles are relatively recent, and the oldest is published in 2004. Figure 3 shows that evaluations of environmental governance activities fitting with the research criteria are mostly published in the last decade, i.e., after 2010, with a maximum value in 2016 (nine articles published). Then, the number of articles reaches stability with five to six papers published every year.

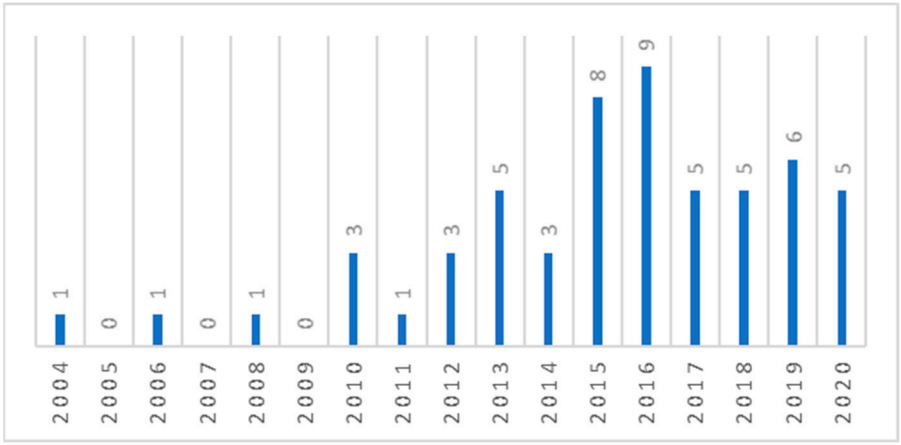

Figure 3. Numerosity of articles selected by the systematic literature review per year.

As reported in Appendix B, the selected articles are published in several journals and subject areas, which mainly belong to the Environmental Sciences (54 articles), followed by Social Sciences (22), and Agricultural and Biological Sciences (16). In addition, the classification identifies other subject areas such as Medicine (7), Economics, econometrics and finance (9), and Energy (4), evidencing the transdisciplinary nature of the topic we are exploring.

The Sankey diagram (Figure 4) shows relationships between all the scales and levels used for classification purposes. Each paper can be part of multiple classification scales and levels at the same time. Thus, the total numbers specified for each scale and for each level do not align with the total number of 56 articles.

Starting from the scale "Type of evaluations" as reported in the articles, we observe that evaluations using indices or indicators create 27 relationships, evaluations using pure qualitative methods create 19 relationships, and evaluations using a combination of participative approaches and multicriteria assessments create 15 relationships.

Moving to the "Scale of intervention", it is possible to observe that indicator assessments and pure qualitative methods are used transversally for all the levels from local to global, while integrated assessments are mostly used in evaluations at a minor scale, mostly sub-national and local. The 77% of relationships constituting the Sankey diagram focuses on program or project activities implemented at the sub-national and local levels. A minor number of relationships focuses on a national (14%) or international scale (3%), and only one article refers to a global scale (it creates five relationships because it relates with all continents).

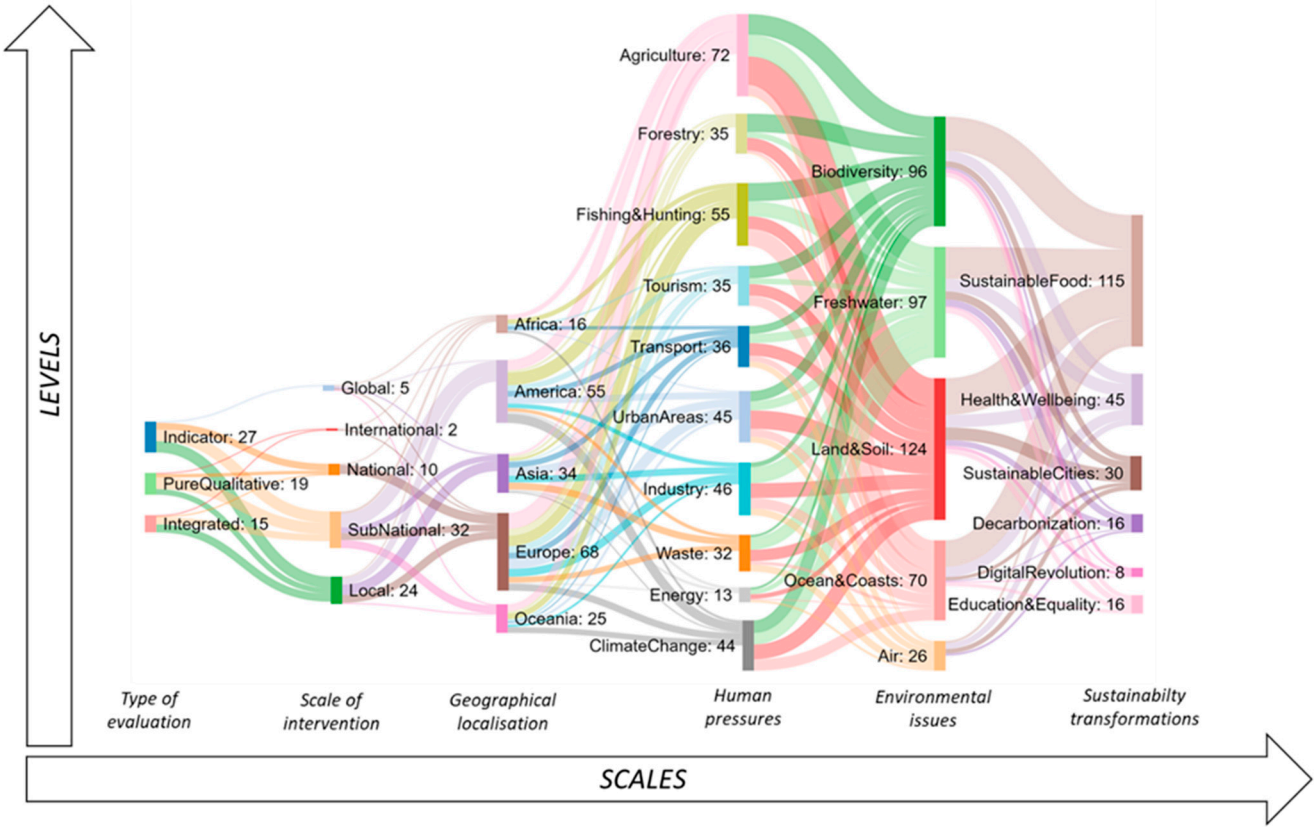

Figure 4. Classification of articles by Sankey diagram.

Focusing on the "Geographical localization", it is possible to observe that studies are mostly localized in developed countries. In fact, the geographical area with the highest number of activities analyzed is Europe with 68 relationships (34%). The review selects articles that analyze initiatives placed in all continents: Africa (8%), America (28%), Asia (17%), and Oceania (13%). However, it reveals that the poorest areas remain understudied (e.g., Sub-Saharan Africa or the Middle East).

Observing the "Human pressures" scale, it emerges that Agriculture is the most recurrent pressure in terms of relationships (17%), followed by Fishing and Hunting (13%), Industry (11%), Urban Areas (11%), and Climate Change (11%). Forestry (8%), Tourism (8%), Waste Production (8%), and Transport (9%) are less investigated, and Energy receives a little attention (3%).

Moving to "Environmental issues", the analysis reveals that Land and Soil counts 124 relationships (30%), while Freshwater and Biodiversity total 97 and 96 relationships, respectively (23% for both). Then, Ocean and Coasts attest 70 relations (17%), followed by Air with 26 relations (6%).

More specifically, if Agriculture, Climate Change, and Fishing and Hunting seem to be transversal pressures impacting all of the most addressed environmental issues, from the Sankey diagram it emerges that Forestry and Tourism mainly impact on Biodiversity and Land and Soil, while Industry and Urban Areas mainly impact on Freshwater and Land and Soil. Transport, Waste, and Energy production are mainly related to Land and Soil and Freshwater, but it is also possible to appreciate a relevant number of relationships targeting the environmental issue of Air.

Finally, focusing on the framework proposed by [36] on sustainability transformation, the classification highlights that most of the initiatives relate to the achievement of sustainability in food production, land use, water use, and oceans (115), followed by initiatives aimed to improve community health and well-being (45) and by initiatives which aim at achieving sustainability in cities and communities (30). A minor number of relationships

are related to energy decarbonization and sustainable industry and education, gender, and inequality (16 both), then followed by digital revolution for sustainable development (8).

4.3. Qualitative Results

The selected articles offer several examples of evaluations of interventions dealing with the improvement of adaptive governance of SES through the identification of novel solutions. Examples of evaluations undertaken are: (i) ex-ante evaluations of the impact caused by specific types of land use in protected areas [89]; (ii) participative evaluations aimed at creating awareness on environmental issues [90]; and (iii) the identification of best practices for resilient environmental management [24]. The following paragraphs summarize the recommendations on how and under which conditions collaborations contribute to the effective adaptive governance of SES as highlighted and suggested by evaluation results. In order to facilitate the comprehension, the qualitative results are grouped into four categories having a common conceptual significance: (i) Communication, (ii) Equity, (iii) Foresight, and (iv) Respect. These categories and their main components emerged from the analysis of the articles are summarized in Figure 5.

4.3.1. Communication

Most of the selected articles highlights the importance of clear communication among multiple stakeholders, where individuals, groups, and organizations can express their values and perceptions. Developing a **common language**, specifically if it is **informal and not technical**, helps to avoid misunderstandings among actors [41,89,91,92]. Instrumental for effective collaborations is the use of visual tools—more user-friendly and for all types of people (also for illiterate people)—in communicating environmental issues or in participative evaluation processes [24,49]. Therefore, evaluations recommend **clearness and transparency** in communicating the contents of regulations, recommendations, directives, and so on from public bodies to all the other types of stakeholders, especially on the content of policy objectives both general and specific [48,93–97]. Scientific communication is fundamental for community education. Third sector actors as proposed by [62]—especially researchers, but also NGOs and generally all public actors—to play a fundamental role in the transmission of scientific knowledge to all other actors [96,98–100]. To be effective, the content of scientific communication has to be clear and make use of tools able to be applied by non-experts [42,101,102], especially by policymakers who normally steer, guide, control, and manage natural resources. Moreover, public actors are invited to increase the number of **communicative initiatives** and tools aimed to make the community aware of environmental challenges and to propose everyday practices able to foster sustainable behaviors through the awareness that sustainable actions are more convenient for their well-being [92,103,104].

4.3.2. Equity

The integration of different typologies of actors, especially underprivileged stakeholders, and the respect of equity also within participative initiatives are essential for establishing relationships based on trust and respect [24,26,41,42,48,89,92,95,98,99,105–108]. In participative processes, there is always the risk that interests of the elites prevail or that some groups of relevant actors are excluded in the decision-making processes [24,48,91,96,109]. Therefore, moderators or facilitators have the fundamental role in assuring equity through an objective and **impartial management** of trade-offs on interests and needs among actors [26,99,106]. The need for equity explains why collective initiatives are often sustained **by external groups of experts**, mostly NGOs and universities [100,110] who **involve local stakeholders** through, e.g., citizen-science tools, trips, workshops, and practical exercises of participative multicriteria assessments [24,26,90,93,94,100,111,112]. In order to guarantee equity in participative decision-making processes, facilitators and moderators have to assure the **respect of privacy** and allocate **time allowing all actors to equally express** their opinions and values [42,89]. In addition, public and third sector actors are requested

to coordinate and stimulate people to think and act for the good of all communities and to recognize valuable allies in local stakeholders [23,92,97,99,108,109,113,114]. Additionally, public authorities are required to **devolve some power and autonomy to bottom-up initiatives** that emerge from adaptive governance processes [41,90,99,100,115]. Accordingly, all actors are invited to share material and non-material resources by considering a self-help perspective [96,98] in order to overcome limits that could preclude sustainability transformations, (e.g., the creation of ecotourism infrastructures in Amazon villages as suggested by [24]). Specifically, private actors are invited to avoid influencing scientific activities and research themes through the allocation of private funds on specific research themes that do not positively impact on the society [93].

4.3.3. Foresight

Sustainability transformations require interventions producing effects in the long term, which contrast with individual needs focused on short-term outputs. Following this view, [116] underlines that several environmental projects are funded on a short-term period. To address this weakness, public bodies are requested to maintain the attention and the support on environmental initiatives in the long term by developing **solid and coherent planning instruments**. **Institutional stability** seems able to reduce the "stakeholder apathy" [42] and **to assure continuity** in environmental adaptive governance initiatives [41,42,49,91,96,117–119]. Considering public actors, [99] highlights the need to also support collaboration between partners after the end of the project through the creation of a stable network of actors sharing common objectives and working together for a more extended period. This could be fostered by programs having a long- or medium-term vision that can promote the resilience of ecosystems [99,102,120–124]. Experiences highlight the strategic nature of proposing tools to motivate private actors to be involved in sustainability transformations. Accordingly, private actors are more likely to act when it is easy and convenient to do the right thing [26]. Sustainability transformations need to be proposed as means able to increase their well-being through, for example, the introduction of **incentives** [26,97,106,125]. The incentive has not to be only monetary (e.g., payments, subsidiaries) but also of a different nature (e.g., new job opportunities) [48,91,117]. To sustain innovations that foster sustainability transformations, donors are invited to sustain **transdisciplinary research** [94,96]. On the other side, third sector and State actors are invited to create **common spaces for boosting innovations** [42,126]. Equally, private actors, and in particular market actors, must be encouraged to sustain scientific research, especially for the development of innovative eco-friendly technologies [127]. Moreover, they are invited to trust in science and accept changes in their everyday lives, even if it is difficult to see the short-term advantages [128].

4.3.4. Respect

Relevant and suitable sustainability transformations need **dynamic and flexible regulations and policies** that take into consideration **social and ecological characteristics** and the scale where interventions take place in order to address specific emerging needs that continuously evolve among time and space [26,95,97,118,129–131]. This is why the State and third sector actors are requested to comprehend real problems dealt by local stakeholders (both community and market) [92,100,110]. In addition, public interventions need to be **culturally contextualized**, and they have to respect traditions (e.g., everyday practices and taboos) of communities where they are placed, especially in non-Western countries, in order to build trust and legitimation [24,41,91,98,99,108,111,128,132]. To do so, the literature invites the promotion of **participative evaluations processes** [108,133]. Accordingly, evaluations need to provide specific information on both the environmental and social contexts and to include indicators related to the quality of life of locals, especially of indigenous communities, which very often appear as the most marginalized groups [93,94,96,105,122,129,134–136].

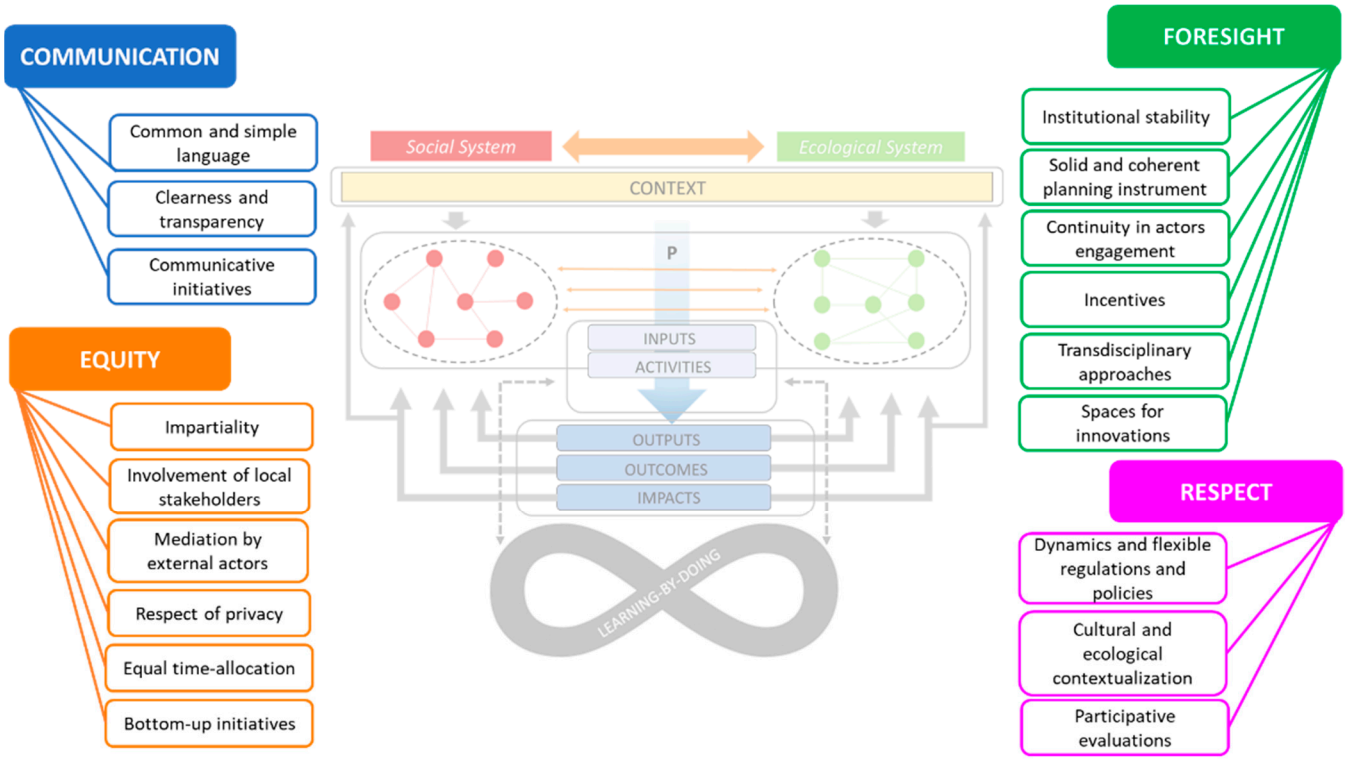

Figure 5. Categories and components fostering effective collaborations as highlighted by articles selected by the systematic review.

5. Discussion

The evaluations presented in the 56 articles highlight: (i) how effective governance of SES is difficult to achieve due to complexities and uncertainties which characterize environmental and social challenges presented in the different contexts analyzed and (ii) a specific and context-based environmental issue is typically characterized by multiple social and institutional stakeholders interconnected through different ties with a set of interrelated environmental resources, as already pointed out by e.g., [30,32].

Through the results of the quantitative and qualitative analyses, we want to provide and help to (i) improve evaluations in future and (ii) provide guidelines to actors to foster effective collaborations. The following discussion firstly presents specific indications on how to assess the effectiveness of collaborations, and secondly, examines how actors could foster them.

5.1. How to Assess the Effectiveness of Collaborations

1. ***All typologies of evaluations should adopt a transdisciplinary approach when dealing with the assessment of collaborations for the adaptive governance of SES.***

The analysis of evaluations reported in the articles demonstrate that articles use basically a transdisciplinary approach. This is corroborated by results showing that the majority of articles selected by the review (42 out 56) are published in journals belonging to multiple subject areas. In addition, the analysis identifies two main approaches used to assess adaptive governance initiatives: (i) articles dealing only with social variables (18) and (ii) transdisciplinary articles dealing with both social and ecological variables (38). The heterogeneous variables used in the 56 analyzed articles attest that transdisciplinary research is instrumental to provide a transversal knowledge fitting all dimensions of sustainability [137], as reported by, e.g., [101,111]. Nevertheless, transdisciplinary approaches involve difficulties in their operationalization, specifically related to the diversity of interests, values, and perceptions of actors involved in adaptative governance initiatives [138].

2. ***Evaluations normally centered on secondary data should also use participative techniques for primary data collection. This will allow to reach a better understanding of real situations of evaluated contexts, which is a necessary pre-condition for effective collaborations.***

The scientific literature recognizes the central importance of using participative approaches in all the phases of the project cycle, e.g., [48,49,114], in order to determine a real impact in the target context. Nevertheless, moving to the classification of evaluations reported in articles, we observe that articles using social and environmental indicators or indices limit the use of participative approaches in evaluations, e.g., [115,127]. Pure qualitative articles can be subdivided into two categories: on one side, some articles use participative approaches in projects, e.g., [90,100], and on the other side, some articles focus on analyses of policy, e.g., [93,119]. Conversely, articles based on integrated assessments reveal that the involvement of the community by using participatory approaches plays a determinant role in (i) the identification of needs or environmental challenges tacking local communities, e.g., [24,89,109]; (ii) the implementation of project activities, e.g., [49,105,108]; (iii) the evaluation of undertaken actions, the successful reaching of their objectives, and consequently, the impacts of the initiatives, e.g., [42]. Experiences demonstrate that knowledge sharing among local actors helps identify the specific needs of local communities and the interlinks among environmental and social problems, which are not immediately visible to the external managers, who typically adopt a sectorial problem-solving approach. In addition, ex-ante participative evaluations allow discussing local problems permitting people to take consciousness of the importance of the environmental challenge and identify context-based solutions that local community supports [52,89]. Results support the need to enlarge the use of participative approaches in all types of evaluations, specifically in evaluations based on indicators and indices that normally rely on secondary data to better represent real situations of evaluated contexts.

3. ***Evaluations of adaptive governance initiatives of SES should involve actors from multiple spatial scales.***

In terms of scale of intervention, our systematic literature review shows that evaluations are mainly focused on sub-national or local levels. Conversely, it evidences a low number of evaluations implemented at national, international, and global scales. Evaluations of sub-national and local interventions are characterized by a high frequency of activities based on participative approaches also implemented through multicriteria assessments, e.g., [48,99]. The local scale of intervention probably fosters the generation of effective collaborations in SES [139,140]. Consequently, evaluations based on sub-national and local scales would be more prone to assess these collaborations.

Nevertheless, the literature highlights the need to avoid inward-looking approaches because the majority of SES does not limit to the narrow boundaries of the SES analyzed but is open and susceptible to external changes [48,141]. Consequently, [142] propose to involve actors from multiple scales in participative approaches, combining together different interests to compensate for this weakness. Equally, multiple evaluations selected by the review adopt the same approach, involving stakeholders from different spatial scales, e.g., [99,107]. A quantitative analysis of relationships constituting networks through the Social Network Analysis (SNA) could be helpful in the assessment of connectivity between actors of adaptive governance initiatives, e.g., [69,107,143].

4. ***Evaluations on collaborations for adaptive governance of SES should enlarge the context of analysis to countries that, at present, are most vulnerable to climate change and natural resources depletion.***

The geographical analysis of articles reveals a high concentration of evaluations in Europe, America, and Australia. Sub-Saharan Africa and the Middle East, which are more vulnerable to climate change effects and natural resources depletion, do not attest to a scientific discussion on the research topic. Studies placed in poor areas mainly deal with activities related to Western countries activities such as wildlife tourism, e.g., [91,107,109].

Thus, the geographical analysis of articles denotes a Western-centric vision in scientific research related to the evaluation of sustainability issues and environmental challenges. This evidence is confirmed by multiple other studies related to sustainability analysis, e.g., higher education for sustainable development in [144] and resilience thinking in [145].

5. ***Evaluations of adaptive governance should focus on both environmental and social challenges to identify collaborations able to foster synergies in SES.***

The focus on human pressures evaluated by this study highlights that environmental actions reported in the articles have repercussions in addressing crucial social challenges that humanity, at present, has to deal with. Sustainability practices in food supply chain and in actions undertaken in urban areas are the most recurrent challenges in the selected articles. Agriculture and Fishing and Hunting, followed by Urban Areas and Industry, are human pressures with the highest number of relationships within the Sankey diagram. This could be explained because one of the most critical challenges that humanity must deal with in the future years will be the exponential increase of the global population and the consequent increasing demand for food to assure food security for all people [88,146] and the migration of people from rural to urban areas [147]. Accordingly, most of the adaptive activities reported in articles selected by the review focus on (i) food production in rural and urban areas, e.g., [106,112]; (ii) fishing activities, e.g., [41,105]; and (iii) the evaluation of sustainable practices in urban areas, e.g., [103,121]. Synergies between social and ecological challenges are supported in multiple international agreements and policies, e.g., Agenda 2030 and Sustainable Development Goals (SDGs) or the Farm to Fork EU Strategy [4,148]. Accordingly, it is not surprising that the number of articles selected by this study is highest in 2015 and 2016, when SDGs emerge in the international policies. Hence, evaluations need to focus on both environmental and social outputs that emerge from collaborations, as already exemplified by, e.g., [24,94].

6. ***In order to assess the effectiveness of collaborations within environmental projects and programs, evaluations should focus on synergies and trade-offs among multiple environmental challenges determined by human actions at the same time. Therefore, they should be multi-sectorial.***

Environmental issues dealt by articles are mostly related to the use of (i) Land and Soil and (ii) Freshwater, and the conservation of (i) Biodiversity and (ii) Oceans and Coasts. Little attention is devoted to the Air. Evaluations analyzed by our literature review demonstrate the necessity to consider multiple environmental issues simultaneously, such as the interdependencies between land use and biodiversity as pointed out by, e.g., [52,107]. Accordingly, the scientific literature highlights the need to consider synergies and trade-offs among multiple environmental issues generated by implementing human activities [36]. For example, in the case of agricultural activities negatively impacting on the environment, the evaluation should consider the interactions among food supply, water use, and biodiversity loss [149,150]. The generation of effective collaborations, able to cope with multiple negative effects determined by human actions, can be stimulated by the inclusion of actors of multiple sectors, as evidenced in the scientific literature, e.g., by [151,152]. Our review provides examples of various cross-sector collaborations, such as the participative evaluations that involve fishers and tourist operators, e.g., [42,99,109]. Nevertheless, despite the recognition that multi-sectoriality is fundamental for an effective environmental governance, the experiences highlight difficulties in its concretization due to different needs, visions of the world, problems to be addressed, terminology, etc., in multiple sectors [40–42]. From this background emerges the relevance and the need of trade-offs in identifying common and shared strategies to be implemented by collaborations of multiple and different actors, which, at present, are scarcely examined by the scientific literature [15].

7. ***Evaluations of the governance of SES should consider the role of effective collaborations to promote transformations towards improved community well-being.***

Articles selected by the literature review are mainly focused on transformations related to the sustainable use of natural resources such as land and oceans, followed by

transformations aimed at fostering human well-being and the sustainability of urban areas. Evaluations should focus on interventions not only in terms of assessment of the quality of ecosystems, but also as opportunities to foster community well-being through the catalyzation of multiple facts such as inclusiveness, equality, trust, education of the community, and the respect of rights and cultures, which can lead to the achievement of a thriving global society [153,154]. Accordingly, selected articles provide multiple examples of environmental evaluations which consider environmental interventions as means able to foster community well-being. For example, [24,49] demonstrate how effective management requires the involvement of indigenous communities and the respect of their cultures and lifestyles. Furthermore, [106] shows that the environmental projects placed in post-industrial cities not only impact the environmental quality, but they also accelerate environmental justice and social equity. However, at present, top-down and centralized approaches neglecting the fundamental role of local community and of peculiarities of contexts and cultures are still the most used in the governance of environmental resources [93]. Evaluations on collaborative efforts addressing specific environmental challenges through a bottom-up approach could be useful in the identification of new solutions able to improve both natural ecosystems and human well-being [17].

5.2. How to Foster Effective Collaborations

1. ***A clear communication fosters community support to environmental activities, and consequently, it increases the possibility to foster effective collaborations through community awareness on environmental challenges.***

The qualitative analysis of the final considerations reported in the analyzed articles shows that a clear communication can empower locals, help in resolving conflicts, and help communities define good practices for contributing to sustainability transformations. In addition, a transparent information on activities and outputs can favor the reliability of actions undertaken by the promoters of adaptive governance initiatives, facilitating community trust [91,136]. Clear communication fosters community awareness on environmental challenges and its support on environmental activities, e.g., [90,103], especially in contexts of poverty and marginalization, where people have little chances to be empowered through traditional channels, e.g., schooling [24,121]. For example, [106] observes that a clear communication in relation to urban community gardening has the possibility to include the most marginal groups in community activities to empower them and foster their pro-environmental behavior, and, consequently, their support of the objectives of the initiative.

2. ***Equity fosters the emergence of a conscious and shared environmental responsibility through the identification of common strategies by multiple stakeholders that support effective collaborations.***

Evaluations analyzed by the qualitative analysis highlight that equity in participative processes stimulates the emergence of a conscious and shared environmental responsibility among all stakeholders who have different rights and duties related to the environmental issue to be tackled [41]. Adaptive governance initiatives characterized by equity are more prone to generate meaningful dialogue between different actors, and, consequently, the identification of strategies in agreement with all parts involved, which considerate needs and opportunities for all actors, including the less powerful, e.g., [24,89,103,105,106,108,109,114,128].

3. ***Foresight in the governance of SES fosters a constant process of adaptation, supporting effective collaborations in the long run.***

The qualitative analysis reveals that foresight is necessary for sustaining the transformative process that essentially constitutes adaptive governance as described by the adaptive cycle [30]. Accordingly, foresight is crucial in fostering changes in natural resource management through the introduction or development of new tools or novel approaches

that could lead to the implementation of innovations [49,52,90,110,123,127,132]. Forward-looking initiatives can assure continuity in the transformative process also after the end of projects through the creation of networks of actors who continue to collaborate in order to stimulate additional improvements of the governance of SES (e.g., through the creation of new governance arrangements such as alliances and spin-offs, as reported by [90]). The continuity of collaborations in the long-term period through, e.g., regular periodical meetings [42], is, in turn, instrumental in avoiding the stakeholder apathy characterized by the declining of exchange of knowledge and the engagement of stakeholders and leadership [42,96].

4. ***Respect of social and ecological contexts leads to the design and implementation of relevant activities, building trust and legitimation, and, consequently, fostering effective collaborations.***

The initiatives described in the analyzed articles show that the respect of both ecological and social contexts is a prerequisite for implementing effective initiatives and collaborations. Context-based approaches lead to the design and implementation of relevant initiatives that consider both (i) the ecological conditions evolving in time and space and (ii) local cultures and lifestyles. From the articles selected by the literature review emerges the fundamental role of policies able to adapt to every specific area and social need, which, consequently, can support new governance arrangements generated by adaptive governance initiatives [90,93,96,100]. Relevant projects can build trust and legitimacy, helping with the generation of effective collaborations between the local community and external actors proposing initiatives, e.g., [24,49,99].

5.3. Managerial Implications

Clear communication, equity, foresight, and respect also need to be considered from a managerial point of view. In particular, if interventions concern SES, they are requested to focus on both the social and the ecological peculiarities from their starting phases. This is highlighted in multiple policy documents (e.g., Agenda 2030 [155]; Paris Agreements [156]; The European Green Deal [157]) and program regulations (e.g., LIFE Programme [158]; Interreg Europe [159]). In particular, the most general indication that emerged from this study is to valorize the fundamental role of community involvement from the very beginning of every project. Local actors, whom project managers often consider as passive beneficiaries of project results [160], need to be involved and converted into active stakeholders through the devolution of responsibilities and autonomy in actions implementation [161]. Accordingly, building a shared environmental responsibility among jurisdictional levels is functional for increasing the effectiveness of activities [162]. In the following paragraph, we provide indications on how to increase people engagement and, thus, sustain collaborations in the different phases constituting the project cycle.

(i) *Identification, formulation:* project designers are requested to clearly identify stakeholders and their potential role in the phases of identification and formulation through the stakeholder analysis (e.g., influence and matrix) and through the SWOT analysis [48,163]. In addition, to guarantee equity, the identification of possible coalitions constitutes a necessary step in order to prevent that elites prevail in decision-making processes [89]. Project designers should involve local communities from the very beginning by respecting the values and culture that could be better understood through the use of both informal conversations and well-designed questionnaires and surveys [100] or multicriteria assessments to be performed with the active participation of representatives of the local communities [48,52,89]. Instrumental, since the identification of the project, is the schedule of different meetings among stakeholders aimed to identify problems and resolve possible conflicts and identify possible trade-offs in the decision-making process [41].

(ii) *Implementation, monitoring:* effective collaborations among multiple stakeholders could be supported and stimulated through the involvement of stakeholders in regular meetings in order to avoid stakeholder apathy [42] and the promotion of the creation

of new bottom-up experiences such as spin-offs and alliances [90]. Trips, festivals, and special events are fundamental for communicating project objectives and results, stimulating a pro-environmental behavioral change of community that, consequently, is more prone to support project interventions [90]. Citizen science is instrumental for the involvement of people but also for the monitoring of activities [93].

(iii) *Evaluation:* evaluations of projects need to consider the environmental results derived by projects implementation and social outcomes derived from them. As highlighted by [94] is fundamental to assessing all dimensions of sustainability (i.e., environmental, social, and economic) through developing suitable indicators. Additionally, evaluations need to be participative and include all types of stakeholders, especially local actors, as reported by [49], using tools that better fit with people cultures and peculiarities. Conversely, evaluations and results diffusion need to be clearly communicated to everybody through, e.g., public events designed not only for technicians but also for non-experts [24]. Instrumental in communicating project results is the identification and spreading of best practices [106].

6. Conclusions

Our review of evaluations makes evident that transdisciplinary, multi-scale, and multi-sector approaches should be applied to assess the effectiveness of collaborations in adaptive governance of SES. Moreover, it shows that participative approaches are instrumental in understanding the context where initiatives are placed and demonstrate that environmental actions implemented through effective collaborations should promote social well-being. Four broad concepts can resume the conditions able to catalyze effective collaborations in the governance of SES. They include clear communication, equity, foresight, and respect. They are seen as characteristics able to incentive the inclusion of stakeholders, their trust, and consequently, their support in the definition and implementation of relevant initiatives, and to assure the continuing of the transformative process that constitutes the adaptive governance of SES.

From our analysis, it emerges that the effectiveness of adaptive governance initiatives is essentially based on processes established through the involvement of multiple actors and the consequent emergence of social networks. Future studies and evaluations of environmental projects and programs could better analyze the connectivity between actors, for example, increasing the application and use of Social Network Analysis.

Despite the abundance of recommendations that emerge from the analysis of articles related to interactions among different actors, evaluations mainly focus on the role of public actors (i.e., State and third sector), with little attention on the contribution of private actors (market and community). To address this gap, future studies could focus on the side of private actors and develop user-friendly tools to foster sustainability in everyday behaviors.

Moreover, this analysis highlights the need to highlight and valorize the most marginal voices embedded in adaptive governance. Evaluations about adaptive governance of SES located in developing countries could be opportunities for the creation of new knowledge through the sharing of both scientific and traditional/indigenous knowledge, which could propose new effective solutions and approaches useful for sustainability transformations to be also implemented in different contexts.

Even if this study is limited to the selection of articles written only in English and retrieved from the SCOPUS database, we believe it provides a useful initial overview of the current knowledge and possible improvements in evaluation of collaborations within adaptive governance of social–ecological systems and their global to local challenges.

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Appendix A

Appendix A: List of articles selected for the systematic review.

1. Ancuta, C.; Olaru, M.; Popa, N.; Isfanescu, R.; Jigoria-Oprea, L. Evaluation of the sus-tainable development of rural settlements. Case study: Rural settlementd from Romanian Banat. *Carpath. J. Earth Envrion.* **2015**, *10*, 67–80.
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Appendix B

Table A1. Journals where selected articles are published and their subject areas.

Journals	No. of Articles	Subject Areas		
Ambio	1	Environmental Science	Medicine	Social Sciences
Carpathian Journal of Earth and Environmental Sciences	1	Earth and Planetary Sciences	Environmental Science	
Ecological Economics	3	Economics, Econometrics and Finance	Environmental Science	
Ecological Indicators	2	Agricultural and Biological Sciences	Decision Sciences	Environmental Science
Ecology and Society	10	Environmental Science		
Ekoloji	1	Agricultural and Biological Sciences	Environmental Science	
Environment and Planning C: Government and Policy	1	Environmental Science	Social Sciences	

Table A1. *Cont.*

Journals	No. of Articles	Subject Areas			
Environment, Development and Sustainability	1	Economics, Econometrics and Finance	Environmental Science	Social Sciences	
Environmental Education Research	1	Social Sciences			
Environmental Management	2	Environmental Science	Medicine		
Environmental Monitoring and Assessment	1	Environmental Science	Medicine		
Environmental Policy and Governance	1	Environmental Science	Social Sciences		
Environmental Science and Policy	2	Environmental Science	Social Sciences		
Erdkunde	1	Earth and Planetary Sciences	Environmental Science	Social Sciences	
Fish and Fisheries	2	Agricultural and Biological Sciences	Earth and Planetary Sciences	Environmental Science	
Fisheries Oceanography	1	Agricultural and Biological Sciences	Earth and Planetary Sciences		
Forest Policy and Economics	1	Agricultural and Biological Sciences	Economic, Econometrics and Finance	Environmental Science	Social Sciences
Frontiers in Marine Science	1	Agricultural and Biological Sciences	Earth and Planetary Sciences	Engineering	Environmental Science
Global Environmental Change	1	Environmental Science	Social Sciences		
Integrated Environmental Assessment and Management	1	Environmental Science	Social Sciences	Medicine	
International Journal of Agricultural Sustainability	1	Agricultural and Biological Sciences	Economics, Econometrics and Finance		
International Journal of Environmental Research and Public Health	1	Environmental Science	Medicine		
Journal of Environmental Management	4	Environmental Science	Medicine		
Journal of Environmental Planning and Management	1	Chemical Engineering	Environmental Science	Social Sciences	
Journal of Environmental Studies and Sciences	1	Environmental Science	Social Sciences		
Journal of Sustainable Forestry	1	Agricultural and Biological Sciences	Energy	Environmental Science	Social Sciences
Marine Policy	2	Agricultural and Biological Sciences	Economic, Econometrics and Finance	Environmental Science	Social Sciences
Ocean and Coastal Management	1	Agricultural and Biological Sciences	Earth and Planetary Sciences	Environmental Science	
Regional Environmental Change	1	Environmental Science			

Table A1. *Cont.*

Journals	No. of Articles	Subject Areas		
Regional Studies	1	Environmental Science	Social Sciences	
Resources Policy	1	Economics, Econometrics and Finance	Environmental Science	Social Sciences
Science of the Total Environment	2	Environmental Science		
Sustainability (Switzerland)	3	Energy	Environmental Science	Social Sciences
Water Policy	1	Environmental Science	Social Sciences	

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