water

Article

Community-University Partnership in Water Education and Linkage Process. Study Case: Manglaralto, Santa Elena, Ecuador

Paúl Carrión-Mero [1,2,*], Fernando Morante-Carballo [1,3,4], Gricelda Herrera-Franco [5], María Jaya-Montalvo [6,*], Denise Rodríguez [7], Carolina Loor-Flores de Valgas [6] and Edgar Berrezueta [8]

[1] Centro de Investigación y Proyectos Aplicados a las Ciencias de la Tierra (CIPAT), ESPOL Polytechnic University, Guayaquil 09-01-5863, Ecuador; fmorante@espol.edu.ec
[2] Facultad de Ingeniería en Ciencias de la Tierra (FICT), ESPOL Polytechnic University, Guayaquil 09-01-5863, Ecuador
[3] Facultad de Ciencias Naturales y Matemáticas (FCNM), ESPOL Polytechnic University, Guayaquil 09-01-5863, Ecuador
[4] Geo-Recursos y Aplicaciones GIGA, ESPOL Polytechnic University, Guayaquil 09-01-5863, Ecuador
[5] Facultad de Ciencias de la Ingeniería, Universidad Estatal Península de Santa Elena (UPSE), La Libertad 240204, Ecuador; grisherrera@upse.edu.ec
[6] Junta Administradora de Agua Potable Regional de Manglaralto (JAAPMAN), Manglaralto 241754, Ecuador; mcloor@espol.edu.ec
[7] Escuela Superior Politécnica del Litoral, Facultad de Ingeniería en Mecánica y Ciencias de la Producción (FIMCP), ESPOL, Guayaquil 090112, Ecuador; mrodri@espol.edu.ec
[8] Departamento de Infraestructura Geocientífica y Servicios, Instituto Geológico y Minero de España (IGME, CSIC), 33005 Oviedo, Spain; e.berrezueta@igme.es
* Correspondence: pcarrion@espol.edu.ec (P.C.-M.); mjaya@espol.edu.ec (M.J.-M.); Tel.: +593-99-826-5290 (P.C.-M.); +593-98-250-9363 (M.J.-M.)

Abstract: Universities have the mission to serve society by being pragmatic, diverse, and multidisciplinary. Similar to society in general, these centers have a common challenge: finding a way to articulate projects that favor the demands and needs of vulnerable rural sectors. In this case, the community-university partnership is based on the interaction of the Manglaralto population, represented by the Junta Administradora del Agua Potable Regional de Manglaralto and the Escuela Superior Politécnica del Litoral (ESPOL), both from Ecuador. Specifically, it is based on a collaborative relationship since 2005, through the Centro de Investigación y Proyectos Aplicados a Ciencias de la Tierra (CIPAT) of the ESPOL. This work aims to evaluate the community-university partnership through the results obtained in community work projects. In addition, it describes the resolution of problems reached on the sustainability of water resources in the parish of Manglaralto (Ecuador). The methodology was based on (i) the description of the existing community-university interaction framework, (ii) the analysis of the community projects that CIPAT developed in the period 2017–2020, and finally, (iii) the evaluation of the impact of the actions carried out on the sustainability of the coastal aquifer. The community-university partnership has generated relevant information (e.g., water reserves, extraction processes, aquifer recharge, and care of the resource) for the community and has allowed for the strengthening and transmitting of knowledge in different specialties (education, culture, and environment). In the 2017–2020 period, four community projects were carried out with students, researchers, and the inhabitants of the rural area of Manglaralto. These projects allowed wells for water extraction and engineering structures such as dikes and green filters that help the use and recharge the aquifer. In addition, the initiatives carried out made it possible to inform the population of the importance of the sustainable exploitation of water resources. In general, this work made it possible to identify a natural laboratory of human interaction in which the results obtained are based on the collaboration and contribution of all the participating actors.

Keywords: education for sustainable development; research projects; community; water resources; Sustainable Development Goal

check for updates

Citation: Carrión-Mero, P.; Morante-Carballo, F.; Herrera-Franco, G.; Jaya-Montalvo, M.; Rodríguez, D.; Loor-Flores de Valgas, C.; Berrezueta, E. Community-University Partnership in Water Education and Linkage Process. Study Case: Manglaralto, Santa Elena, Ecuador. *Water* **2021**, *13*, 1998. https://doi.org/10.3390/w13151998

Academic Editor: Guadalupe Martínez-Borreguero

Received: 22 May 2021
Accepted: 16 July 2021
Published: 21 July 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

1.1. Overview and Objective

Universities are vital institutions for education, research, and community service through their social action proposals [1,2]. Community involvement is generally considered part of universities' Third Mission (community service) [3]. This link with society is the primary role that universities can and should play in addressing pressing social problems and, at the same time, in fostering the creation of prosperous regions [4], framing their actions as "Magnets for Economic Growth" [5].

With the advances of science, it has become possible for Higher-Education Institutions (HEI) to cross borders and reach the most remote communities in the world [6]. Nowadays, the relationship between schools, colleges and universities, and the community is essential for developing a more balanced and scientifically prepared society. According [7], the university–community relationship is the collaboration between institutions of higher education and their larger communities (local, regional/state, national, and global) for the beneficial exchange of knowledge and resources in a context of partnership and reciprocity.

In general, the participation of universities in the communities offers remarkably favorable results. The research conducted by the University of Seville (Spain) mentions the term "Service-Learning" and relates it to the interaction of students helping society as a methodological strategy for student learning. In addition, it raises students' awareness of their civic commitment and their role in the community [8]. The first signs of "Service-Learning" were in the 1990s. In that decade, Dewey [9] investigated the role of academic institutions in community development and introduced the concept of "learning-by-doing". In addition to Service-Learning (SL), finding other models for studying community-university partnerships in the scientific literature is possible. Among these models, the following stand out Community-Engaged Research (CEnR) [10], Community-based Participatory Research (CBPR) [11,12], Participatory Action Research (PAR) [13] and Participatory Action Learning and Action Research (PALAR) [14]. According to Reference [15], the models that stand out most are CBPR and PAR. These two models are based on research methods involving the researchers and the community affected by a problem: (i) the exchange and co-construction of knowledge and (ii) applying participatory practices, which provide benefits to the community [16,17]. A description of the two models used in this study is presented in Section 1.2.

The university system, or HEI, included the terminology sustainability [18–20], whose application has a complex and long-term objective [21]. According to Wiek et al. [22], there are five key competencies in developing sustainability in higher education (interpersonal, systems-thinking, anticipatory, normative, and strategic competencies), and they should be interrelated. Sustainability in education was first introduced in 1975 at the international level within the United Nations Educational, Scientific and Cultural Organization–United Nations Environmental Programme (UNESCO–UNEP) [23]. Since then, HEIs have developed initiatives that seek to put sustainability as a primary focus in education (e.g., [24–30]). The most remarkable HEIs initiatives are energy use and energy efficiency, greenhouse gas reduction, waste management, water management, food procurement, transportation, and accessibility for people with disabilities [31].

"Quality of Education" is one of the proven drivers to ensure sustainable development [32]. The "Quality of Education" is included in the Sustainable Development Goals (SDG) indicators promoted by UNESCO [33]. One of these indicators is SDG 4 of the 2030 Agenda, which seeks to "Ensure inclusive and quality education for all and promote lifelong learning". With "Quality Education", many other SDGs can be achieved [34], such as reducing inequalities (SDG 10), reducing poverty (SDG 1), or favoring good health and well-being (SDG 3) [32]. Hence the importance of universities in the obligation and need to train students with social commitment, innovative capacity, and drivers of the economic development of society [35–37].

Within the water framework, certain universities such as Portland State University (United States of America) have community-initiated water quality improvement projects.

These projects promote understanding of watershed concepts and, primarily, community participation, education, and partnership through the Community Watershed Stewardship Program (CWSP) [38]. An example in urban areas applied to water management is the "community-based environmental project" of the New Jersey City University (United States of America). This program monitors both surface and groundwater quality in New York and New Jersey, exposed to intense industrialization and urbanization [39].

In Ecuador, the Escuela Superior Politécnica del Litoral (ESPOL) through the Centro de Investigación y Proyectos Aplicados a Ciencias de la Tierra (CIPAT) carries out cooperation initiatives with the Junta Administradora del Agua Potable Regional de Manglaralto (JAAPMAN), characterized by the water-resource problems in the rural parish of Manglaralto (Ecuador). This study serves as the basis for the research question on which to address the initiative. The research question is as follows: How can community-university partnerships provide water use and management solutions in rural areas, considering sustainability criteria? The objective of this work was to evaluate the community-university partnership between ESPOL and the population (community) represented by the JAAPMAN through the results obtained in community projects developed during the 2017–2020 period. In addition, we aimed to determine the degree of resolution of the problem of water-resource sustainability in Manglaralto.

1.2. Models of Applied Analysis

HEIs have adopted "Service-Learning" as a standard teaching tool and learning strategy [40]. According to Tapia [41], Service-Learning (SL) is considered an activity or program of solidarity service led by students, aimed at effectively meeting the needs of a community. According to [41], this learning should be planned in an integrated manner with the curricular contents of different disciplines to optimize learning. It is essential to highlight that SL has been applied in several disciplines, such as business and economics [42], physical education [43], computer and information sciences [44], health sciences [45,46], education on urban water quality [47], and natural hazards education [48]; it is even is integrated with modern online Service-Learning system approaches (e.g., service e-learning, e-service learning, and extreme service learning [49–51]).

The definitions of Service-Learning are varied in the scientific literature [52]. However, the concept of Service-Learning is based mainly on the theory and philosophy of learning-by-doing of John Dewey, who promoted the idea that the community is an essential element of the educational experience [53,54]. When students apply the SL simultaneously, they contribute to relational living, citizenship, and democracy [53,55]. According to Mtawav [56], SL is defined as a pedagogical approach and a subset of the public mission of universities through which their members (staff, students, and communities) establish sustainable partnerships and engage in activities that empower them, develop their capabilities and enhance their well-being.

The SL aims to improve students' learning and practical experience, strengthening reflection and reciprocal relationships between students and community members [57]. Specifically, it has two main elements: (i) engagement within the community (service) and (ii) reflection on that engagement (learning) [58,59]. The creation of community partnerships is essential for SL because it allows universities and communities to collaborate and develop new ideas to meet the needs of communities [60]. Therefore, the first step for successful SL experiences is establishing community-university partnerships [61], becoming an essential part of this partnership [62,63].

Community-university partnerships have been plagued with challenges and difficulties, mainly because "reciprocity" is not always established as a central principle of interaction. In particular, it often becomes a challenge to maintain a continuous and sustained commitment from university partners [64]. In addition, the possibility arises for communities to become simple teaching tools [65–67] since the main objective of service programs is the educational well-being and professional development of students [68]. The

SL is limited in certain cases by predetermined and inflexible university schedules that do not always conform to the schedules of community partners [69].

The Participatory Action Research (PAR) model also has wide application in HEIs. This model is defined as a research approach committed to the democratic principles of justice and equality [70]. PAR is characterized by "research with" and not "research on" people [71]. The five values of PAR are (i) empowerment, (ii) social justice and equity, (iii) supportive relationships and inclusion, (iv) mutual learning and reciprocal education, and (v) respect for diversity and power-sharing [68]. The PAR method is a cyclical process that allows researchers and community members to work together to define a problem, take action on the problem, and evaluate the effectiveness of the action [72,73].

One way to integrate research and education into a mutual learning process is PAR [74]. PAR provides the opportunity for universities to generate important research for communities while students reap the benefits of SL [75]. The interest of HEIs is to develop sustainable initiatives [24–30]. Applying democratic and deliberative approaches such as PAR can facilitate sustainable planning and development, especially in rural areas [75].

In general, active learning approaches (SL and PAR) share something in common: collaboration and experimental knowledge production. However, it is emphasized that there is a challenge in incorporating PAR in university education [76].

1.3. Study Zone

The parish of Manglaralto is a rural area in the north of the province of Santa Elena on the coast of Ecuador. According to the Population and Housing Census projection (2020), the parish would have for that year about 38670 inhabitants, distributed in an area of 426.0 km^2 [77]. In national terms, in Ecuador, more than 3.5 million people have access to water and sanitation through water boards [78]. Data on water service provision for consumption in 2017 show that, in rural areas, 69.2% of the service was managed by the Autonomous Decentralized Governments (GADs), while 30.8% is provided exclusively by water boards [79].

JAAPMAN is in the parish of Manglaralto and is responsible for exploiting and supplying the scarce groundwater resources available. The supply service covers the communities of Montañita, Río Chico, Cadeate, San Antonio and Libertador Bolívar, in addition to Manglaralto itself. This board is a community organization created in 1979 by Archbishop Othmar Stahelli. According to the Inter-American Development Bank (IDB), the organization provides water and sanitation services to 3500 members, 20000 inhabitants (local population), and a floating population (tourism) of 20,000 in high season [78].

The climate in Manglaralto and its surroundings has a climatological sequence in which from January to May, there is a rainy season, while from June to December, there are no or low precipitation levels. This cycle is affected by two principal agents: (a) the Humboldt Current, a predominant factor that, due to the displacement of humid air to the east, the province reaches temperatures of 20 °C and even lower; and (b) the El Niño phenomenon, which allows for the average temperature to reach 36 °C during the dry season [80]. In general terms, Manglaralto and its surroundings are located in the semi-arid zone of the Santa Elena Peninsula, where the level of evapotranspiration is higher than the current precipitation [81]. Numerous riverbeds are primarily dry most of the year and only contain appreciable freshwater during periods of high rainfall and climatic phenomena such as "El Niño" [80].

Manglaralto has an important aquifer. Specifically, southwest of the foothills of the Chongón Colonche Coastal Range (CCC) (Figure 1a), within the Manglaralto hydrological basin and geological units corresponding to the Late Cretaceous and recent alluvial deposits (Figure 1b). The impermeable layer that favors water entrapment corresponds to the lithological units of the Ancon group, and the permeable layer with good porosity and permeability conditions are the Quaternary alluvial deposits [81–83]. In this last geologic unit, there have been promising results in collecting water resources through wells, whose estimation of water volume is 13.6 Hm^3 [84]. Intensive pumping and climatic conditions have lowered the phreatic level and resulted in seawater intrusion into the basin [82].

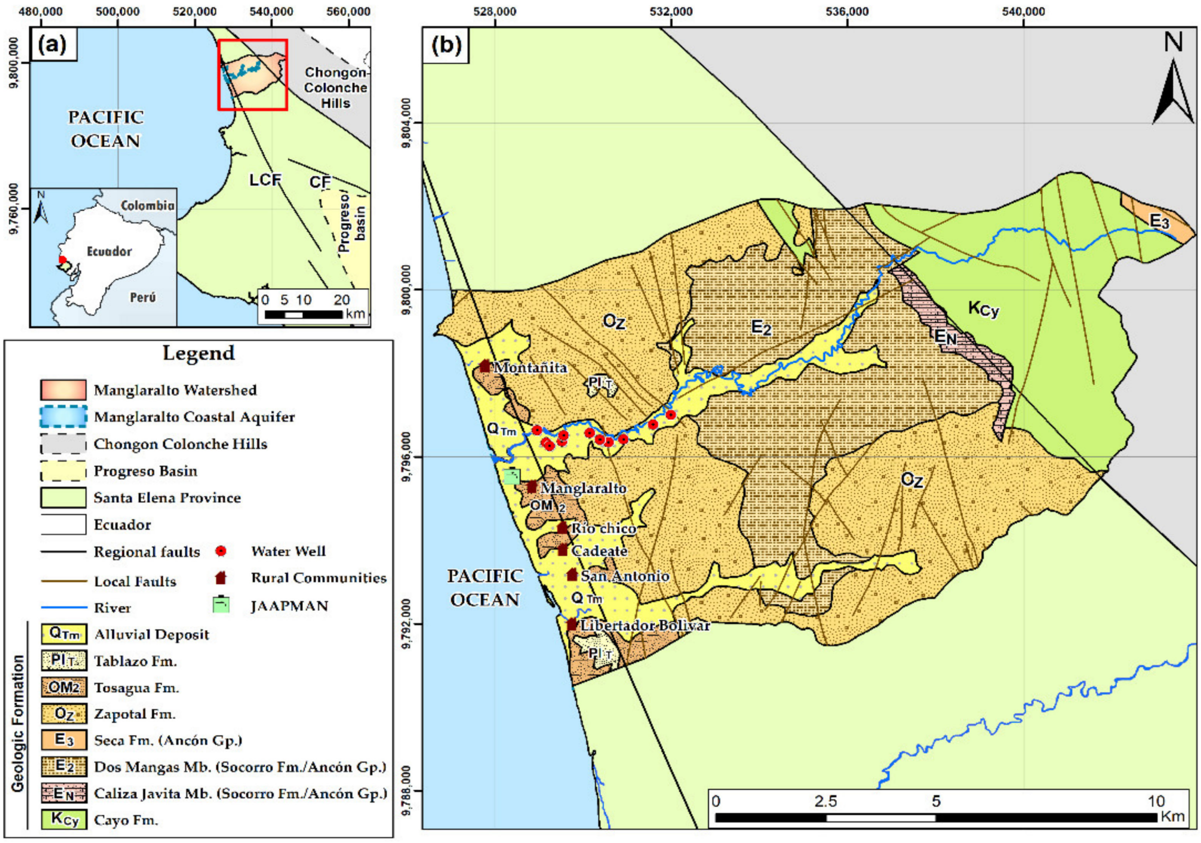

Figure 1. Manglaralto watershed: (**a**) location of the basin, main regional geological structures (regional faults: LCF, La Cruz fault; CF, Carrizal fault) and geomorphological elements (Chongon Colonche Hills and Progreso basin); (**b**) geological units, and regional and local faults in the study area.

It is essential to point out that, in addition to the hydrogeological conditions of the aquifer (limited reserves), factors such as population growth (fixed and seasonal inhabitants), increased per capita consumption, and global climate change (decrease in precipitation in the area) must be considered when correctly characterizing the scarcity of fresh water in this region.

2. Materials and Methods

The methodology proposed to understand the community-university interaction was developed in three phases (Figure 2): (i) description of the framework of community-university interaction between the Manglaralto community and ESPOL; (ii) analysis of the community projects that CIPAT has developed in the period 2017–2020; and, finally, (iii) evaluation of the impact of actions on the sustainability of the coastal aquifer studied.

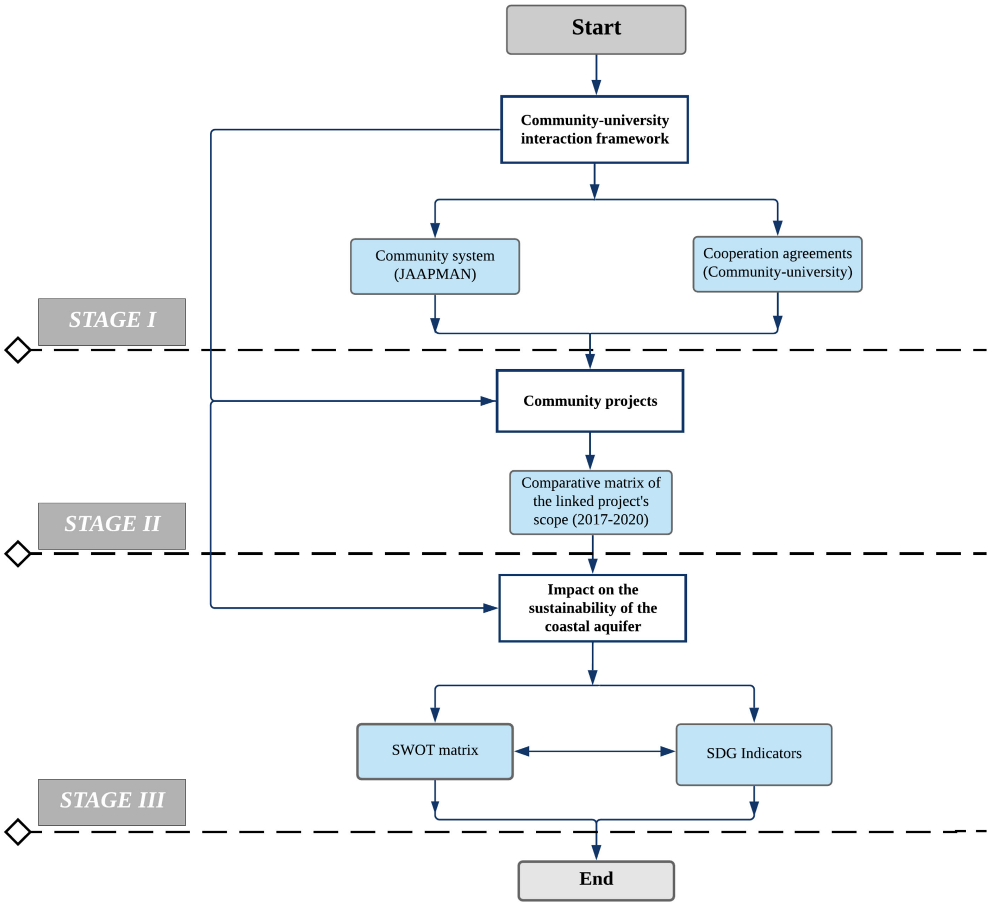

Figure 2. Scheme of the methodology followed in this study.

2.1. Stage I: Community-University Interaction Framework

In phase I, first, the detailed description of JAAPMAN's water-management system was addressed. Secondly, the procedure was oriented to describe the link and the community-university dynamics by collecting data: (a) technical data (scientific articles, graduate, undergraduate, and post-graduate theses) and (b) social data (surveys, community meetings/workshops, and field visits) of the cooperation projects carried out since 2007, focusing on the linkage (community) projects the 2017–2020 period related to Manglaralto. Information is available in the CIPAT repositories (final and partial project reports).

2.2. Stage II: Community Projects

Phase II detailed the activities and goals achieved by the community projects. Although it is indeed managed as an academic project with its methodologies and processes, in practice, it adapts to the needs community, working in the field and sharing efforts. This information was presented in a comparative matrix between the linkage projects implemented, their scope of the study, and the evolution over time during the development of practices for integrated water management in the Manglaralto coastal aquifer.

2.3. Stage III: Impact on the Sustainability of the Coastal Aquifer

In this phase, a diagnosis was made of the information obtained in Phase II. Specifically, water-resource management was described based on the practices and technical studies carried out. In addition, its impact on the sustainable use of the aquifer in the Manglaralto communities was analyzed. Finally, in this phase, a SWOT analysis [85] was applied based on surveys and questionnaires to 30 researchers/interns of Geological, Civil and Chemical Engineering careers of the four community projects carried out by ESPOL's Unidad de Vinculación con la Sociedad (UVS) in the study area. Specifically, the information collected addressed five aspects: (i) degree of satisfaction with the experience of the interns, (ii) interaction between research assistant-practitioners, (iii) skills and strengths acquired, (iv) materials and fieldwork resources available, and (v) weaknesses of the activities developed.

Based on the results obtained previously, an analysis of CIPAT's performance was undertaken to identify whether the projects carried out in the 2017–2020 period promoted and contributed to community development. Specifically, comparing these results with the 2030 Agenda for Sustainable Development indicators in the literature [33].

3. Results

3.1. Description of the Link and Dynamics between the University and the Community

3.1.1. JAAPMAN's Community System

The inventory results conducted at JAAPMAN indicate 3766 users of the provided service (water supply), dispensing water to approximately 38,830 inhabitants of the six communities of the rural parish of Manglaralto. The estimate corresponds to an average of five people per household. The board's management system consists of the delegates of the six affiliated communities. These delegates appoint a board of directors (president, treasurer, secretary, and members), managing the board's operation. Figure 3 presents the organization chart of the water board. This chart represents the socio-hydrological system [86] that serves as a reference for the practical operation of the board. Although the board president is the legal representative and oversees the economic and attendance reports to the control body (Ministerio del Ambiente y Agua (MAAE)), the figure of the operators plays a vital role in the community system. The four operators, described in the organization chart, are the ones who carry out the fieldwork (meter reading and monthly monitoring of the static/dynamic levels of the aquifer together with university interns), which is fundamental for the efficient use of the resource.

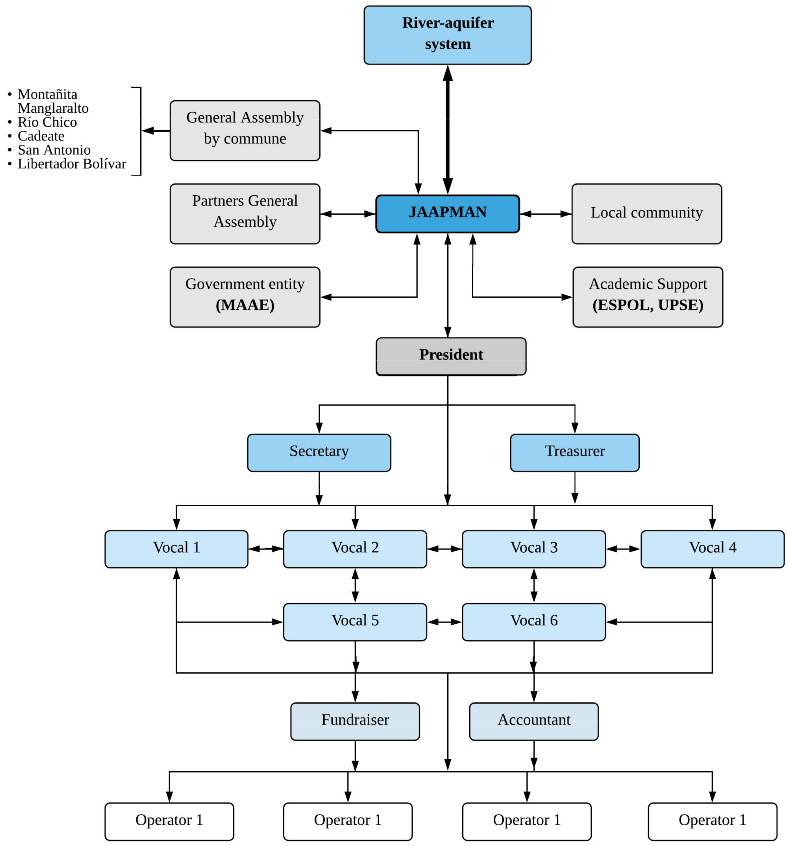

Figure 3. JAAPMAN's community system organization chart.

3.1.2. Cooperation Agreements (Community-University)

The relation between the academy and the community began in 2007. From that year to date, CIPAT–ESPOL and the International Atomic Energy Agency (IAEA) of the United Nations have developed six technical cooperation projects:

1. ECU/8/041: Characterization of coastal aquifers in the Santa Elena Peninsula;
2. RLA/8/026: Application of Isotopic Tools for Integrated Management of Coastal Aquifers;
3. RLA 7/018: Improving knowledge of groundwater resources to contribute to their protection, integrates management and governance (CXXVII);
4. RLA 7/024: Integrating Isotope Hydrology in National Comprehensive Water Resources Assessments;
5. ECU/7/005: Improvement of the management of coastal aquifers by studying the recharge rate of the alluvial aquifer of the Manglaralto river basin;
6. RLA/7/016: Use of isotopes for the hydrogeological evaluation of excessively exploited aquifers in Latin America (CXXVII).

These projects resulted from ESPOL's official request to the IAEA to carry out groundwater-resource characterization and evaluation studies on the coast of Ecuador. In these initiatives, the community was involved in different tasks, such as training workshops (given by international experts) on the chemical and isotopic characterization of groundwater, and, additionally, on its application in the study of aquifers. In addition, the community was offered several fields and monitoring activities focused on water-resource-management planning in the area [87].

Since IAEA participated in Ecuador, ESPOL through CIPAT has maintained a positive and interactive cooperation relationship with the community. Specifically, since 2017, several studies have been carried out in the area through community service projects (Linkage), such as the following:

1. PG03-PY18-13: Hydrology and hydrogeology applied to the coastal aquifer of Manglaralto (Phase I);
2. PG03-PY18-13: Hydrology and hydrogeology applied to the Manglaralto coastal aquifer (Phase II);
3. PG03-PY19-09: Integrated water management in Manglaralto Parish watersheds;
4. PG03-PY20-03: Resilience in water management, before COVID-19, Manglaralto.

The linkage projects covered hydrogeological and environmental studies of the Manglaralto coastal aquifer, optimization of the stabilization lagoon system of Libertador Bolivar, and the development of an experimental green filter system in the Manglaralto parish [88]. In addition, all the projects developed included an evaluation of the environmental impact of the extraction and use of water resources. Examples include (a) the estimation of the ecological footprint of the water extraction and use process [89], (b) the presentation of a plan to reduce the use of aquifer material in construction, and (c) the proposal of civil works to minimize the saline intrusion process in the aquifer ([82,83,90]).

3.1.3. The Relation between Linkage and Research in University–Community Cooperation

Figure 4 shows the CIPAT–ESPOL cooperation system within its general and activities (e.g., coastal aquifer) for the community. This scheme shows the relationship between external and internal academic researchers, undergraduate students, professors, directors of the Unidad de Vinculación con la Sociedad (UVS), and community members. All existing relationships promoted the creation, development, and transmission of mutual learning. In this case, it regards the Manglaralto coastal aquifer.

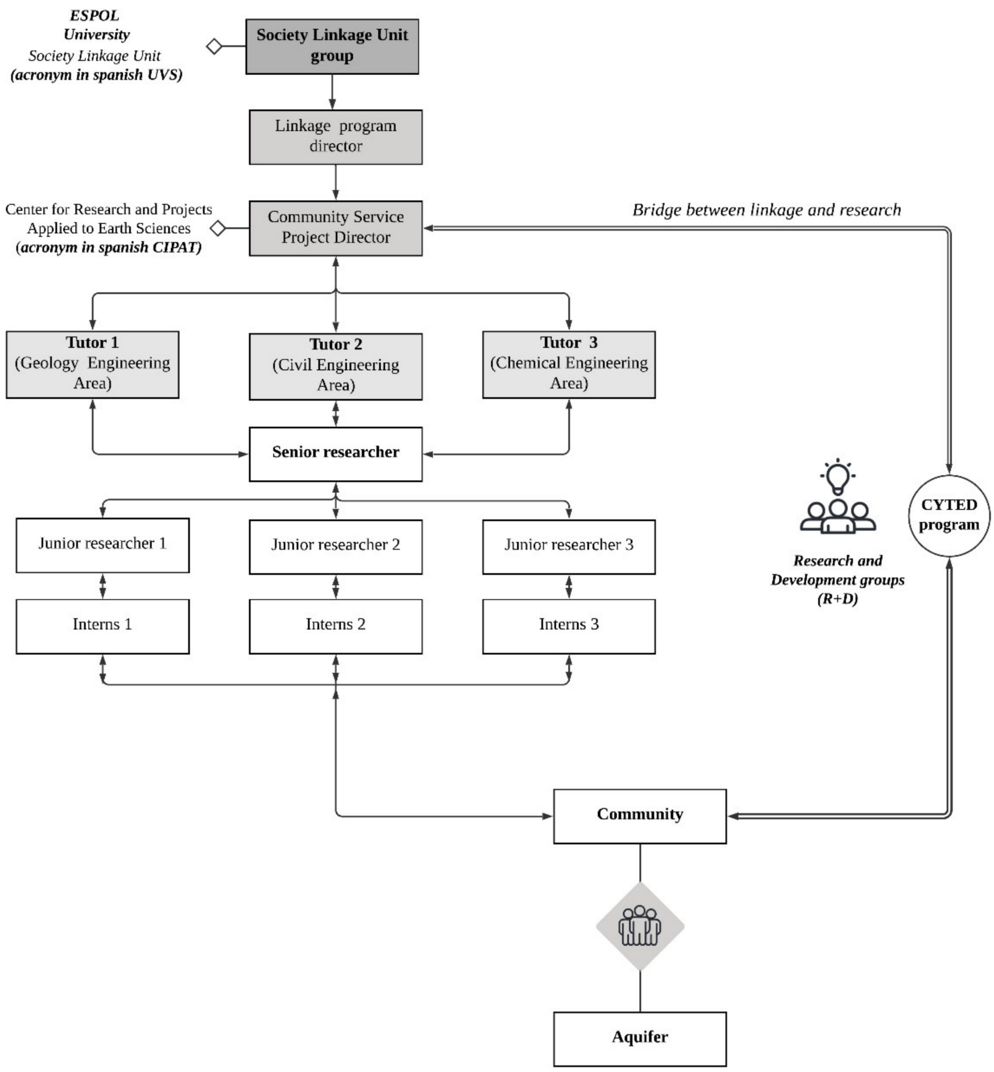

Figure 4. The relation between linkage and research in the context of sustainable water-resource management.

The UVS mission is to regulate, plan and coordinate the community service projects carried out by ESPOL. For example, in the multidisciplinary program entitled "Strengthening community capacities for the Sustainable Development of Canton Santa Elena", the UVS designates a teacher expert in the institutional program domain who will be the "Linkage program director". The main task of the Linkage program director is to ensure permanent communication with the team of teachers, students, and the community; among his team is the "Community Service Project Director".

In the "Community Service Project Director", the link between linkage and research arises because the director and part of his team (tutors) are members of the Research and Development (R&D) group of the Ibero–American Program of Science and Technology for Development (CYTED) [91]. One of the 11 networks of CYTED's "Sustainable Development" R&D line is the "Sowing and Harvesting Water in Natural Protected Areas-SYCA Network", made up of 68 researchers and technicians from Argentina, Bolivia, Chile, Colombia, Ecuador, Spain, Mexico, and Peru. These countries have ancestral practices or methods where man collects and infiltrates (sows) rainwater and runoff in the subsoil in order to capture (harvest) it to provide water for human, animal, or agricultural use [92]. In the JAAPMAN–ESPOL community-university partnership, this relation becomes a means of gathering and exchanging scientific knowledge, case studies, and obtaining funding sources.

The "Community Service Project Director" oversees the direction, formulation, development, and evaluation of the actions involved in the community intervention process. The director has a team made up of tutors who can be external and internal researchers from the three academic domains related to the project (geological, civil, and chemical engineering), students/interns, and co-researchers who facilitate the research process by actively and collaboratively involving themselves through the "Service-Learning" educational strategy, where the student assumes the role of protagonist [93]. Tutors guide students, facilitate, coordinate, review the trainee's profile, and resolve any conflicts.

3.1.4. Community Project Activities and Goals Achieved

Since 2017, the CIPAT center developed four community service projects (listed in Section 3.1.2) as part of the ESPOL Unidad de Vinculos con la Sociedad (UVS). These four projects aimed to understand the geometry of the aquifer, analyze water quality, and finally propose sustainable water-resource management. Table 1 presents the activities developed and the scope of the community projects.

Table 1. Scope of community service projects and communes Manglaralto (MG), Libertador Bolivar (LB), Olon (OL), Montañita (MT), and Cadeate (CT) during the period 2017–2020. The vertical axis represents the main activities developed in the projects. The horizontal axis represents the year and the commune of the study.

Activities	**Year**									
	2017	**2018**	**2019**			**2020**				
	MG	**MG**	**MG**	**LB**	**OL**	**MG**	**LB**	**OL**	**MT**	**CT**
Well levels	■	■	■		■	■		■		
Physical–chemical parameters	■	■	■		■	■		■		
Workshops and socioeconomic surveys	■	■	■	■	■	■	■			
Geological mapping	■	■								■
Geographic landmark	■									
Topography	■	■	■	■						
Aquifer conceptual model		■			■					
Aquifer geometric model [84]			■							
SEV [1] y ERT [2]	■	■	■	■	■	■	■	■		
Hydrological study of the watershed	■	■	■							
Design or proposal of dikes (tapes)	■	■	■		■					■
Environmental management in the sector			■	■						
Water hydrochemical and isotopic characterization [82]		■								
Wastewater treatment tests and characterization				■					■	
Articles and graduation projects	■	■	■	■	■	■	■	■	■	■
Well construction technical report			■			■				
IKIAM [3] University student internships			■	■	■					
Informative videos and poster production			■	■	■					
Delivery of 2 signage and a geosite sign			■	■						
Design of green filter system				■					■	
Production of a lysimeter				■			■		■	
Soil sampling and characterization			■	■						
Preliminary design of containment dike for temporary ponds				■						
Flow and transport numerical model [83].						■				
Energy calculation of solar panels for pumping water from wells						■				
Video [94], Green Filter 3D modeling [95], and website as educational tools						■	■	■		

[1] Vertical Electrical Soundings, [2] Electrical Resistivity Tomography, and [3] Amazon Regional University.

Table 1 highlighted the following aspects:

- Commune: There has been a growth in the scope of the study sectors during the community projects development. In 2017 and 2018, the focus was on the Manglaralto area, while, in 2019, it was located on the communes of Libertador Bolívar and Olón (where another community organization called Junta Administradora del Sistema Regional de Agua Potable de Olón (JASRAPO) managed the water resource). Finally, in 2020, studies focused on the communities of Cadeate and Montañita;
- Dikes: Manglaralto has five dikes, namely one technical–artisanal dike (concrete dike) and four artisanal dikes (earthen dike). In addition, there are artisanal infrastructures (tapes) aimed at artificially recharging the aquifer. The town of Olón has three artisanal type dikes. Finally, in the town of Cadeate, only proposals for the strategic location of tapes have been defined [96].
- Aquifer system: The information obtained previously and the geological studies carried out in Manglaralto have made it possible to generate a conceptual, geometric, and numerical model of the aquifer's flow and transport [83,84]. In the case of Olon and other communes, there is only one study with primary conceptual models [97];
- Wastewater treatment: In the municipalities of Libertador Bolívar and Montañita, studies and pilot tests have been carried out for wastewater management, using a green filter [88]. In addition, CIPAT carried out diagnoses, evaluations, and optimization of the purification systems (oxidation ponds) in Libertador Bolívar;
- Integrated water management: Reforestation plans have been developed in Manglaralto and Libertador Bolívar as a solution to the problem of land degradation and to halt the loss of biodiversity;
- Solar or alternative energy: A feasibility study for sizing a photovoltaic system for the water pumping has been developed exclusively in Manglaralto.

During the period analyzed (2017–2020), there was an increase in the number of students in internships and the participation of different careers (e.g., geological engineering, civil engineering, and chemistry engineering) interested in community service projects (Figure 5). In contrast to 2017 and 2018, where there was only student collaboration from the field of engineering geology, other majors were present in 2019. In this last period, students shared field knowledge and practices jointly. In addition to the ESPOL students, students from IKIAM University also shared their experiences with the community. In 2020, despite the health crisis of the COVID-19 pandemic and the presence of the "La Niña" phenomenon [98], there was only a slight decrease in the total number of students in cooperation projects compared to 2019 (Figure 5).

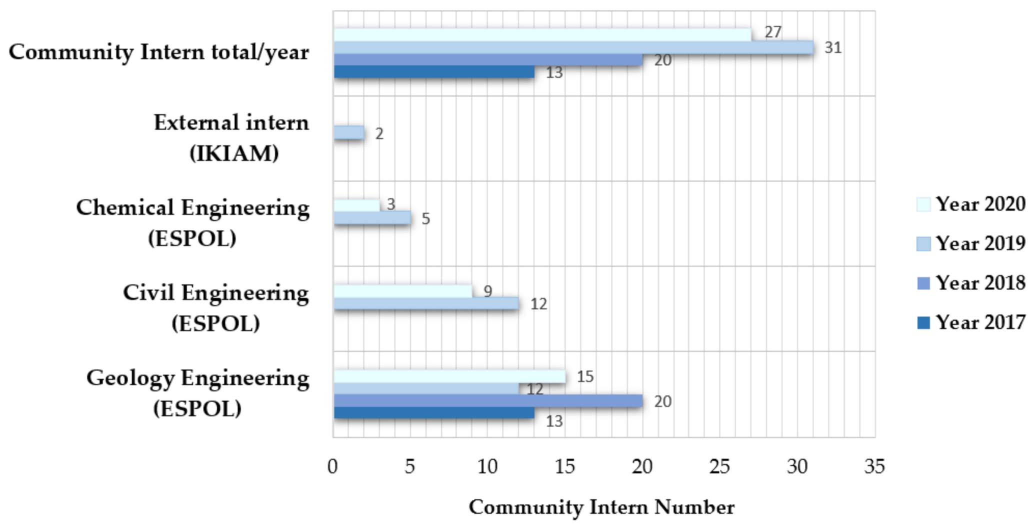

Figure 5. Evolution of the number of interns in community service projects during the period 2017–2020.

As a result of the linkage projects, a significant scientific production has been generated in the four years of activity analyzed. The works generated include undergraduate theses (14), master's theses (2), and scientific articles (16). The latter was published in national journals and, for the most part, in international indexed journals. It is important to note that 90% of the theses produced under the direction of CIPAT–ESPOL have been published in indexed scientific journals.

Another relevant aspect is the academic consultancy developed for the communes within the service projects' framework. Specifically, a habit has been created to monitor the aquifer's water levels (e.g., twelve times in 2019 and six times in 2020). In addition, engineering and technological knowledge have been provided to the inhabitants in managing the resource. Finally, the university has generated technical reports that have been used as a basis for decision-making by the water board (e.g., three technical reports in 2019 and six technical reports in 2020).

Figure 6 shows the goals achieved in the community service projects developed during the period 2017–2020. The results presented in Figure 6 indicate the achievement, in the first instance (years 2017–2018), of general and basic information (e.g., general thematic cartography). In later stages (years 2019–2020), the results have a more specific and applied profile (e.g., tourism promotion and inventory of geosites). In general terms, it highlighted that, in 2020, the work carried out in the project won first place in the Social Entrepreneurship category and second place of all the ventures in the Eureka CICE 2020 Fair, organized by the Bolivian Catholic University San Pablo.

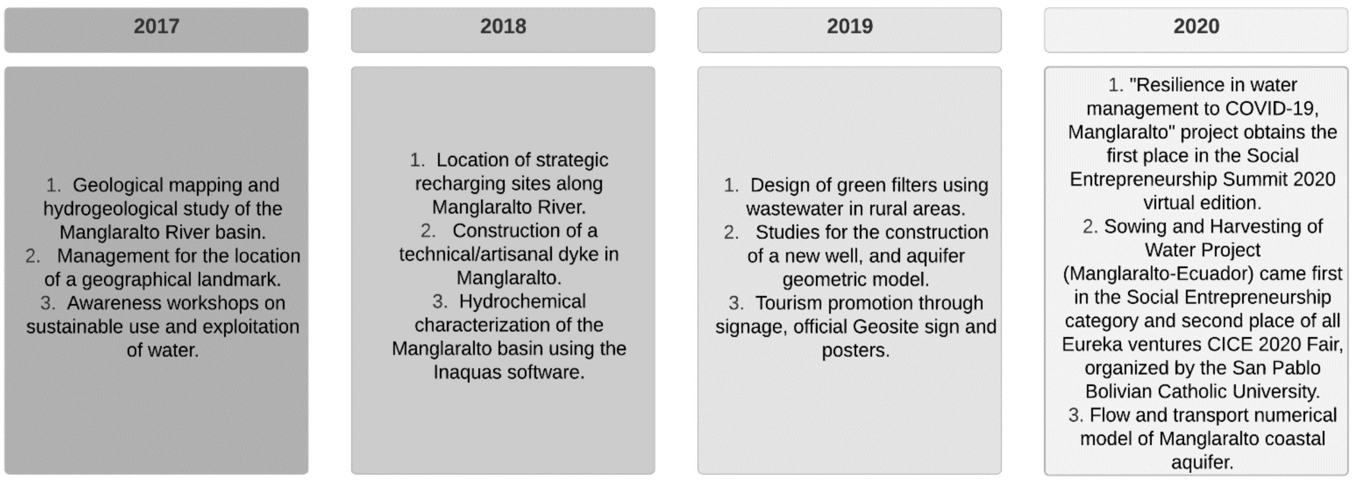

Figure 6. Goals achieved in community service projects during the 2017–2020 period.

3.2. Contribution of Community Activities to the Sustainable Use of the Aquifer

This section presents the primary practices and activities developed in the period 2017–2020 (Table 2 and Figure 7) and their effect generated in the communes of Manglaralto. The most noteworthy aspects in terms of the contribution provided to the community are technical studies and monitoring (e.g., taking measurements of static/dynamic levels, and physical–chemical parameters), the approach of sustainable solutions to water scarcity and treatment (e.g., green filters, dikes, and well construction), and awareness campaigns on the use and cycle of water that achieved community participation and knowledge transfer.

Table 2. Effects of the activities carried out by the academy in the communities of Manglaralto.

Main Practices	Impact on the Community
Technical studies and aquifer monitoring	Control of overexploitation and contamination of the aquifer.
Research and graduation projects	They provide scientific support in the reports submitted by the water board to the control body.
Application of water management techniques	Solutions to water scarcity: artificial recharge of the aquifer through retention dikes that feed the aquifer by infiltration in rainy seasons. Water-quality treatment and control: natural filter to eliminate urban wastewater contamination and evaluate the condition of stabilization ponds.
Workshops and socioeconomic surveys	Raise awareness and sensitize the community on water use and transfer technical knowledge on integrated water-resource management.

Figure 7. Practices carried out in the process of community-university partnership: (**a**) 3D modeling of the green filter system as one of the educational tools; (**b**) concrete dike; (**c**) monitoring of water levels and physical–chemical water parameters; (**d**) installation of timber tree cultivation lines; (**e**) soil sampling and characterization; and (**f**) SEV campaigns.

The SWOT matrix resulted from a survey of 30 students/researchers who carried out community internships at the research center during the four linkage projects. Table 3 shows the summary of the SWOT analysis.

Table 3. Strengths, weaknesses, opportunities, and threats (SWOT) matrix.

Internal Environment / **External Environment**	**Strengths (S)**	**Weaknesses (W)**
	S_1. Technical skills and scientific research. **S_2.** Software and equipment management. **S_3.** Communication and teamwork. **S_4.** Strengthening of concepts and field practices.	**W_1.** The interns do not have the necessary experience to carry out technical studies. **W_2.** Little predisposition to resolve conflicts/problems. **W_3.** Academic workload difficulty unemployment in community internships. **W_4.** Failure to adequately apply safety standards in the field. **W_5.** More equipment needed for isotopic and electromagnetic TDEM analysis studies.
Opportunities (O)	**Strategies: S + O**	**Strategies: W + O**
O_1. To become familiar with different areas related to the participating careers. **O_2.** Scientific articles and presentations at international conferences. **O_3.** Certificates of training and courses for equipment handling. **O_4.** Work experience, internships, and trainings.	**$S_1.O_2$.** Create a research club that encourages scientific writing and brainstorming solutions. **$S_2.S_3.O_3$.** Establish a training program in geophysics applied to water. **$S_4.O_4$.** Formulation of projects that help the community in its priority needs.	**$W_1.W_4.O_3$.** Plan complementary courses on Occupational Health and Safety Management. **$W_2.O_4.O_3$.** Establish a Complex Problem-Solving course as a preparation process. **$W_1.O_1$.** Strengthen cultural exchange and leadership skills.
Threats (T)	**Strategies: S + T**	**Strategies: W + T**
T_1. Lack of interest on the part of the inhabitants of the commune. **T_2.** Scarce economic funds would limit community work. **T_3.** Climate change could affect the successes achieved. **T_4.** Closure of the Manglaralto linkage project by ESPOL **T_5.** Other communities request academic advising.	**$S_2.S_3.T_5$.** Establish a collaboration network with other universities neighboring the sector, to share experiences and methodologies to be followed in other communities. **$S_4.T_3.T_4$.** Applied R&D&I projects with academic participation in research and linkage.	**$W_5.T_2.T_3$.** Preparation of research project proposals for international funding. **$W_5.T_3.T_5$.** Technical and budgetary strengthening for new equipment and greater outreach and research.

The SWOT analysis carried out allowed us to propose four main strategies focused on strengthening the community-university partnership of the study:

- Raising international funds to carry out actions that favor the implementation of pilot projects on a larger scale and to obtain a seawater desalination plant to combat water shortages in the communities: $S_4.O_4$. Formulation of projects that help the community in its priority needs from Table 3;
- Develop complementary courses in Occupational Health and Safety Management and Complex Problem Solving that strengthen students' cultural exchange and leadership skills: $W_1.W_4.O_3$. Plan complementary courses on Occupational Health and Safety Management and $W_2.O_4.O_3$. Establish a Complex Problem-Solving course as a preparation process from Table 3;
- Establish a collaborative network of students from primary and secondary schools and universities at the local level to share experiences and methodologies to follow

in the management of water resources in the other rural communities of Santa Elena: $S_2.S_3.T_5$. Establish a collaboration network with other universities neighboring the sector, to share experiences and methodologies to be followed in other communities from Table 3;

- Promote scientific research on sustainable water use and climate change through R&D&I projects (e.g., Concurso Ecuatoriano de Proyectos I+D+i."CEPRA"): $S_4.T_3.T_4$. Applied R&D&I projects with academic participation in research and linkage from Table 3.

Table 4 presents the results of the qualitative assessment of the framework status of those Sustainable Development Goal (SDG) indicators and Agenda 2030 targets that are directly related to community-based project activities.

Table 4. Relationship of SDG indicators to community-related project activities (2017–2020).

No.	SDG Description	Target	Indicators	Relationship with Community Project Activities
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.	4.7.	4.7.1. Extent to which (i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in: (a) national education policies, (b) curricula, (c) teacher education, and (d) student assessment	The participation of women interns has been growing from 23.1% in 2017 to 48.15% in 2020. The community-university partnership is bidirectional. Each party has a mutual benefit. It is based on the following: 1. Students/researchers engage with the environment, work in a multidisciplinary team, and develop and apply to learn and evaluate engineering solutions; 2. Community acquires all the technical knowledge and obtains solutions to their problems. Important spaces are created to exchange knowledge, not only academic but also cultural; the community shares its experiences in managing the scarce resource with ancestral techniques such as "Water Sowing and Harvesting".
6	Ensure availability and sustainable management of water and sanitation for all.	6.3.	6.3.1. Proportion of wastewater safely treated	The removal efficiency of the Libertador Bolívar stabilization lagoon system is 61% for BOD [1] and 73.5% for COD [2]. Urgent sludge removal, permanent removal of creams on the water's surface to allow sunlight to pass through and blocking the passage of illegal connections were recommended. The non-conventional green filter method in the Montañita commune reduces BOD [1] and total coliforms in the oxidation lagoons by up to 80% at depths of 90 cm, complying with Ecuadorian environmental quality standards [88].
			6.3.2. Proportion of bodies of water with good ambient water quality	Physical–chemical parameters and well water levels are taken monthly to ensure that the water is fit for consumption by the community. Numerical simulation [83] shows that marine intrusion has reached wells W2, W3, and W4 (located near the coastline). Implementing dikes in the sector forms a "barrier" to advancing this phenomenon, reducing the TDS[3] concentration of the groundwater and improving its quality.
		6.4.	6.4.1. Change in water-use efficiency over time	A process of protection and construction of water resilience has been carried out in Manglaralto based on three actions carried out with the support of the academy: 1. Protect water sources: reforestation campaigns, prohibition of exploitation of construction material from the banks, declaration of its territory as a natural reserve; 2. Recharge and efficient use of water: implementation of artisanal and technical–artisanal dikes to take advantage of seasonal rains, avoid rapid discharge into the sea, and recharge the aquifer; 3. Plan for sustainable water management: A habit of monthly participatory water monitoring and development of local capacities for its maintenance was created through the interaction system that involves all interested parties in water management decisions from the community with advice from academia and national control agencies.
			6.4.2. Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	With the help of the geophysical data collected, an aquifer geometric model has been made, where an in-flow volume of 13.6 Hm^3 was estimated, alerting of a recharge deficit [84]. The 2020 "La Niña" phenomenon aggravated the situation, raising the stress level to 20%.
		6.6	6.6.1. Change in the extent of water-related ecosystems over time	The Manglaralto parish has an estimated total area of 426.0 km^2 [77], 51.92% of its territory is made up of two types of protected areas: Forest and Protective Vegetation, and Community Conservation Areas [99]: 1. Forests and Protective Vegetation 1987–2002 (198.64 km^2): Loma Alta Communal Ecological Reserve (1.97 km^2;1987), Chongón Colonche Protective Forest (196.58 km^2; 1995), Esterillo Oloncito (0.02 km^2; 2001) and Cangrejal de Olón (0.07 km^2; 2002); 2. Community Conservation Areas 2011-2014 (22.56 km^2): Dos Mangas (7.12 km^2; 2011), Comuna Sinchal (3.93 km^2; 2012), San Francisco de las Nunez (2.46 km^2; 2013), Comuna Loma Alta (3.37 km^2; 2014), Comuna Barcelona (6.17 km^2; 2014), and Comuna Olón (1.20 km^2; 2014); 3. Community Conservation Areas in the process of registration 2019: Manglaralto (0.003461 km^2). These areas harbor vegetation that is important for water supply, as it filters and retains water in the drizzle clouds (garua) [100].

Table 4. *Cont.*

No.	SDG Description	Target	Indicators	Relationship with Community Project Activities
15	Protect, restore, and promote sustainable use of terrestrial ecosystems; sustainably manage forests; combat desertification; and halt and reverse land degradation and halt biodiversity loss.	15.2.	15.2.1. Progress towards sustainable forest management	Field of cultivation with timber trees and reforestation with guadua cane (area: 0.00075 km^2)
		15.4.	15.4.1. Coverage by protected areas of important sites for mountain biodiversity	Bordering the parish lies part of the Chongón Colonche Protected Forest (196.58 km^2—official registries 1995) forest named after the Chongón Colonche coastal mountain range that crosses NW-SE in the sector. In addition, a small percentage of the Loma Alta Communal Ecological Reserve crosses next to the protective forest (1.97 km^2—official registry 1987), both are located within the Tumbes Choco-Magdalena biodiversity hotspot [101] and the biological corridor Chongón Colonche-Machalilla, being one of the last vestiges of native flora and vegetation of the coast [102]. There are cloud forests, secondary forests, different species of avifauna mainly [103], and regenerating areas in these protected areas (e.g., Manglaralto).

[1] Biochemical Oxygen Demand, [2] Chemical Oxygen Demand, and [3] Total Dissolved Solids.

4. Interpretation of Results and Discussion

Educational innovation is based on a transformation of the role of the student and the teacher through active methodologies. The community-university partnership (JAAPMAN–ESPOL) described in this study shows how Manglaralto (study area analyzed) becomes a scenario of educational experiences or natural laboratory (Figure 7). Students/researchers are the protagonists in this environment, as they apply the knowledge acquired in classes to solve real community problems [93]. The different projects described in the paper (Table 1 and Figure 7) combine groundwater utilization practices [83,84,90,96,104–107], wastewater management through the diagnosis of the condition of oxidation ponds, and development of green filters [88], highlighting the university's collaboration with the community. In addition, these projects recommended the possibility of using alternative energy for water pumps as a sustainable practice. They also address the awareness of water use, its cycle, and taking measures against the COVID-19 pandemic. The different activities addressed have generated a positive impact on habitat conservation and have mainly contributed to SDG 4 ("Quality education"), SDG 6 ("Clean water and sanitation"), and SDG 15 ("Life on land") (Table 4).

The community-university partnership between JAAPMAN–ESPOL described in the study is based on Service-Learning, coinciding with what is proposed in the scientific literature [45]. Specifically, it is a system where students actively participate by applying their knowledge (Figure 4) to solve problems such as water scarcity in the semi-arid zone of Manglaralto [108]. In addition, because of this partnership, three water-resilience actions in the communes of Manglaralto are verified: (i) protection of water sources, (ii) recharge and efficient use of water, and (iii) plan for sustainable management of water in search of sustainability (Table 4). The studies and activities carried out by the academy have generated (i) a remarkable scientific production in the four active years and impact on the community (Table 2) and (ii) spaces that promote cultural exchange through the different ancestral practices of Water Sowing and Harvesting [92,109]. These ancestral practices date back more than 1500 years and continue to be applied by the communities (e.g., "Albarrada" or "jagüey" y "Tape" [109–111]). These resilience actions have made it possible to overcome the problems and try to assemble a sustainable system.

According to Wiek et al. [22], there are five key competencies in developing sustainability in higher education. This author highlights that there must be an interaction between interpersonal, systems-thinking, anticipatory, normative, and strategic competencies when exploring a complex sustainability problem. The work carried out indicates that in the community-university partnership (JAAPMAN–ESPOL), interpersonal competency skills are developed in the pre-field, field, and post-field processes. It also evidenced that this partnership practiced effective communication, multidisciplinary teamwork, leadership, empathy, negotiation and deliberation skills, pluralistic and cross-cultural critical thinking [112–115]. In addition, it is essential to highlight that competencies related to systems-thinking, also described in similar works, are applied [116,117]. Specifically, the following are analyzed and defined: stakeholders, technical aspects, contextual aspects, and, finally, their relationships in a complex system, such as the one studied.

As for the strategic and normative competencies defined by Wiek et al. [22]. The first consists of strategies or actions to intervene and positively influence this desirable future [118]. Normative competence is the ability to collectively evaluate and choose visions of project sustainability or standard or ideal model [119]. Both competencies have been developed somehow in the JAAPMAN–ESPOL relation in building the green filter or proposals for the design and strategic placement of dikes ("tapes"). Competencies that students develop when they participate in Service-Learning [93]. However, it is a future challenge in the community-university partnership (JAAPMAN–ESPOL) to apply anticipatory competence, including the capacity to analyze, evaluate, and generate possible alternative scenarios [22].

The analysis shows that the cultural exchange and awareness workshops addressed in the cooperation projects (Table 2) provide experiences to the community, the JAAPMAN representatives, and the ESPOL students/researchers. On the one hand, they transform the role of the student through Service-Learning [45], as well as empower the beneficiary community by considering their ancestral knowledge in engineering solutions [105,111] and contribute to social learning [106,120]. That is, the community-university partnership (JAAPMAN–ESPOL) combines Service-Learning [45] with Participatory Action Research (PAR) [24]. Combined qualitative methodologies are carried out in other universities such as Prince of Songkla University in Thailand [121] or Szent István Universit in Hungary [75], searching for sustainability, community capacity building, encouraging participatory methodologies focusing on educational innovation.

When evaluating the results obtained (SL and PAR) with other studies such as the Master's Program in Environmental Education at Songkla University [121], the influence of community capital (human capital and wisdom) is revealed. The strong social relations of the community, reinforced by religious and traditional practices, are considered. In addition, local wisdom on conservation, management, and ecological systems of the forests, while the university contributes methodological knowledge for sustainable development. Similar to the Manglaralto case study, where the community still conserves ancestral practices of Water Sowing and Harvesting [92,109], which are considered by ESPOL's program of linkage with society to provide solutions to the different problems of resource scarcity, naming the new project of Sowing and Harvesting Water in the face of COVID-19, Manglaralto 2021.

One means of creating educational initiatives focused on sustainable development is incorporating the PAR methodology in Service-Learning programs. When joining PAR, teachers must act as tutors for their students and carry out research. As the case study presents (Figure 4), the tutors and teachers of the different disciplines of the project are researchers and members of the research network (CYTED). The need for all participants, but especially instructors, to be flexible, prioritize process over results, and willing to share control over the direction of classroom and community activities is emphasized [76].

Given the limitations of the PAR and SL methodologies, namely inflexible academic schedules, lack of student training, the workload for students and teachers, logistics work, and research in the community requires more time to publish scientific articles, among others [64–67,69,122], a key point is the sustainability [75,76]. The experiences of SL and PAR in the community-university partnership (JAAPMAN–ESPOL) have a particularity: (i) in the interaction, the community partners acquire skills that are transmitted to the community and to the students who enter each academic semester, (ii) the heritage generated in 40 years of active community organization, and (iii) the alliance with a university research centre are factors that contribute to the sustainable development of the community, achievements in research and professional training, minimizing the weaknesses of the cited models.

A major challenge in community-university partnerships is to generate long-term benefits for the community [64]. For example, a specific threat in the initiatives addressed is the short duration (Table 3) of community service projects (1 year). In this study, the relationship addressed has provided a better use and knowledge of the water resource in the community studied. Without a doubt, the results obtained in this initiative (Tables 2–4 and Figure 6) are an example to follow in other locations with similar potentialities. Some of the processes addressed have been collected in international outreach forums (e.g., see References [81,87]) sing university–community projects as an example of feasibility. Finally, highlighting the success of the measures involves the cooperation and collaboration of society in the proposed initiatives. Another important factor is the institutional support to sustain community-university partnerships [64]. Additionally, incorporating interdisciplinarity allows students to collaborate with other disciplines to solve community problems not only in social work [123], but in areas such as earth sciences.

In general, it is essential to emphasize that the study has made it possible to identify a fundamental factor for the correct functioning of the community-university partnerships—specifically, the existence of community coordinators. In addition to their knowledge of the community's problems, they are aware of the university's potential contributions. These coordinators are those who would guarantee the continuity of the collaboration based on an adequate transmission of information about the subject matter addressed.

5. Conclusions

The evaluation of the community-university partnership between JAAPMAN and ESPOL indicates that, in the period evaluated, practical application projects have been generated with the participation of multidisciplinary teams. These projects have provided solutions to community problems related to water resources. In these cooperative projects, students, in their fieldwork, have maintained a direct relationship with JAAPMAN members and community members, thus acquiring communication skills, leadership, and decision-making experience. This remarkable exchange of knowledge and concerns between both parties has provided positive results both in the projects undertaken and future actions. Among the specific results of the collaboration are the 16 graduation projects, the participation of 91 interns in the initiatives, the publication of 16 scientific articles, and 10 training courses' delivery to the community. In the context of resource sustainability, the community-university partnership has led the community to declare a small natural reserve area to preserve the territory and its water characteristics and reforestation and water-use awareness campaigns.

Among the practical results of community-university partnerships is implementing solutions in water-use management with sustainable criteria: (a) support and training for the recipient population to make the investments, thus compensating for the inability of the authorities to provide the service; (b) a detailed inventory and economic valuation of the assets that the community has (wells and water reserves), so that, through this, they can opt for improvements to credits and improve maintenance of their infrastructures; and (c) knowledge and awareness of the importance of proper management of the water resource that they supervise.

In general terms, the work carried out shows that ESPOL, although having a traditional education system, has adapted to the needs required by society, especially in water and climate change. Encouraging university students from all disciplines to create solutions within an economic, environmental, social, and cultural context. However, it is also important to highlight the need to address research involving other branches of science to optimize responses to the community.

The partnership between the community and academia shows scientific knowledge application for the attention and solution of problems related to water (well construction, dike, geometric model, water hydrochemical and isotopic characterization, flow and numerical transport model, and green filters). However, on the other hand, the experience and practice of the community provide a unique scenario for the transfer of experiences, pragmatism, and field lessons that allow the student to practice and learn sustainable techniques, some of which come from ancestral knowledge, which constitutes an imprint in the culture of human beings.

Author Contributions: Conceptualization, P.C.-M., F.M.-C., G.H.-F., M.J.-M., D.R., C.L.-F.d.V. and E.B.; methodology, P.C.-M., F.M.-C., G.H.-F., M.J.-M., D.R., C.L.-F.d.V. and E.B.; validation, P.C.-M., F.M.-C., G.H.-F., M.J.-M., D.R., C.L.-F.d.V. and E.B.; formal analysis, P.C.-M., F.M.-C., G.H.-F., M.J.-M., D.R., C.L.-F.d.V. and E.B.; investigation, P.C.-M., F.M.-C., G.H.-F., M.J.-M., D.R., C.L.-F.d.V. and E.B.; resources, P.C.-M. and D.R.; writing—original draft preparation, P.C.-M., F.M.-C., G.H.-F., M.J.-M., D.R., C.L.-F.d.V. and E.B.; writing—review and editing, P.C.-M., F.M.-C., G.H.-F., M.J.-M. and E.B.; supervision, P.C.-M.; project administration, P.C.-M. and D.R.; funding acquisition, P.C.-M. and D.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: We thank the community organization JAAPMAN, especially its president, Rocio Muñoz, as well as the Santa Elena program coordinator, Gina Andrade and all the technical staff of ESPOL's Unit of Links with Society (UVS), for all the technical and human support to the project. This research was support by the "Registry of geological and mining heritage and its impact on the defense and preservation of geodiversity in Ecuador" project by ESPOL University with code: CIPAT-01-2018. This work is based on previous initiatives sponsored by the Red Minería XXI (CYTED: 407310RT0402, IGME). Furthermore, we thank the reviewers and editorial committee for their observations and suggestions for improving the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. De la Fuente, J. The Higher Education Sector Must Create Innovative Partnerships for Social Construction, Interview, GUNI Newsl. Issue 56, May 2010. Available online: http://www.guninetwork.org/guni-talks/juan-ramon-de-la-fuente (accessed on 27 April 2021).
2. Pavel, C.; Ţicău, A. Role of University in Relationship Building between Individual and Community. *Procedia Soc. Behav. Sci.* **2014**, *142*, 118–122. [CrossRef]
3. Kagan, C.; Diamond, J. *University–Community Relations in the UK: Engaging Universities*; Macmillan, P., Ed.; Springer International Publishing: Cham, Switzerland, 2019; ISBN 978-3-030-12983-5.
4. Hooper, D. *Supporting Thriving Communities: The Role of Universities in Reducing Inequality*; University Alliance: London, UK, 2016.
5. Birch, E. Special report: Anchor institutions. *Next Am. City Summer* **2007**, *15*, 1–28.
6. Jongbloed, B.; Enders, J.; Salerno, C. Higher education and its communities: Interconnections, interdependencies and a research agenda. *High. Educ.* **2008**, *56*, 303–324. [CrossRef]
7. Weerts, D.J.; Sandmann, L.R. Community Engagement and Boundary-Spanning Roles at Research Universities. *J. High. Educ.* **2010**, *81*, 632–657. [CrossRef]
8. Rodríguez Gallego, M.R. El Aprendizaje-Servicio como estrategia metodológica en la Universidad. *Rev. Complut. Educ.* **2014**, *25*, 95–113. [CrossRef]
9. Dewey, J. Experience and Education. *Educ. Forum* **1986**, *50*, 241–252. [CrossRef]
10. Barkin, S.; Schlundt, D.; Smith, P. Community-Engaged Research Perspectives: Then and Now. *Acad. Pediatr.* **2013**, *13*, 93–97. [CrossRef] [PubMed]
11. Lucero, J.; Wallerstein, N.; Duran, B.; Alegria, M.; Greene-Moton, E.; Israel, B.; Kastelic, S.; Magarati, M.; Oetzel, J.; Pearson, C.; et al. Development of a Mixed Methods Investigation of Process and Outcomes of Community-Based Participatory Research. *J. Mix. Methods Res.* **2018**, *12*, 55–74. [CrossRef]
12. Israel, B.A.; Eng, E.; Schulz, A.J.; Parker, E.A.; Satcher, D. *Methods in Community-Based Participatory Research for Health*; Jossey-Bass: San Francisco, CA, USA, 2005; ISBN 978-0-787-98006-1.
13. McDonald, C. Understanding Participatory Action Research: A Qualitative Research Methodology Option. *Can. J. Action Res.* **2012**, *13*, 34–50. [CrossRef]
14. Kearney, J.; Wood, L.; Zuber-Skerritt, O. Community-University Partnerships: Using Participatory Action Learning and Action Research (PALAR). *Gateways Int. J. Community Res. Engagem.* **2013**, *6*, 113–130. [CrossRef]
15. Drahota, A.M.Y.; Meza, R.D.; Brikho, B.; Naaf, M.; Estabillo, J.A.; Gomez, E.D.; Aarons, G.A. Community-Academic Partnerships: A Systematic Review of the State of the Literature and Recommendations for Future Research. *Milbank Q.* **2016**, *94*, 163–214. [CrossRef]
16. Vaughn, L.M.; Whetstone, C.; Boards, A.; Busch, M.D.; Magnusson, M.; Määttä, S. Partnering with insiders: A review of peer models across community-engaged research, education and social care. *Health Soc. Care Community* **2018**, *26*, 769–786. [CrossRef]
17. Baum, F. Participatory action research. *J. Epidemiol. Community Health* **2006**, *60*, 854–857. [CrossRef] [PubMed]
18. Boks, C.; Diehl, J.C. Integration of sustainability in regular courses: Experiences in industrial design engineering. *J. Clean. Prod.* **2006**, *14*, 932–939. [CrossRef]
19. Todd, M. Local Wealth Building: Harnessing the Potential of Anchor Institutions in Preston. Available online: https://cles.org.uk/blog/local-wealth-building-harnessing-the-potential-of-anchor-institutions-in-preston/ (accessed on 26 April 2021).
20. Wemmenhove, R.; de Groot, W.T. Principles for university curriculum greening. An empirical case study from Tanzania. *Int. J. Sustain. High. Educ.* **2001**, *2*, 267–283. [CrossRef]
21. Marinho, M.; do Socorro Gonçalves, M.; Kiperstok, A. Water conservation as a tool to support sustainable practices in a Brazilian public university. *J. Clean. Prod.* **2014**, *62*, 98–106. [CrossRef]
22. Wiek, A.; Withycombe, L.; Redman, C.L. Key competencies in sustainability: A reference framework for academic program development. *Sustain. Sci.* **2011**, *6*, 203–218. [CrossRef]
23. UNESCO. *Activities of the UNESCO-UNEP International Environmental Education Programm (1975–1983)*; United Nations Educational, Scientific, and Cultural Organization: Paris, France, 1984.

24. Disterheft, A.; Ferreira da Silva Caeiro, S.S.; Ramos, M.R.; de Miranda Azeiteiro, U.M. Environmental Management Systems (EMS) implementation processes and practices in European higher education institutions—Top-down versus participatory approaches. *J. Clean. Prod.* **2012**, *31*, 80–90. [CrossRef]
25. Klein-Banai, C.; Theis, T.L. Quantitative analysis of factors affecting greenhouse gas emissions at institutions of higher education. *J. Clean. Prod.* **2013**, *48*, 29–38. [CrossRef]
26. Davidson, C.I.; Hendrickson, C.T.; Matthews, H.S.; Bridges, M.W.; Allen, D.T.; Murphy, C.F.; Allenby, B.R.; Crittenden, J.C.; Austin, S. Preparing future engineers for challenges of the 21st century: Sustainable engineering. *J. Clean. Prod.* **2010**, *18*, 698–701. [CrossRef]
27. Ryan, A.; Tilbury, D.; Blaze Corcoran, P.; Abe, O.; Nomura, K. Sustainability in higher education in the Asia-Pacific: Developments, challenges, and prospects. *Int. J. Sustain. High. Educ.* **2010**, *11*, 106–119. [CrossRef]
28. Stephens, J.C.; Graham, A.C. Toward an empirical research agenda for sustainability in higher education: Exploring the transition management framework. *J. Clean. Prod.* **2010**, *18*, 611–618. [CrossRef]
29. Nomura, K.; Abe, O. Higher education for sustainable development in Japan: Policy and progress. *Int. J. Sustain. High. Educ.* **2010**, *11*, 120–129. [CrossRef]
30. Blaze Corcoran, P.; Chacko Koshy, K. The Pacific way: Sustainability in higher education in the South Pacific Island nations. *Int. J. Sustain. High. Educ.* **2010**, *11*, 130–140. [CrossRef]
31. Lozano, R.; Ceulemans, K.; Alonso-Almeida, M.; Huisingh, D.; Lozano, F.J.; Waas, T.; Lambrechts, W.; Lukman, R.; Hugé, J. A review of commitment and implementation of sustainable development in higher education: Results from a worldwide survey. *J. Clean. Prod.* **2015**, *108*, 1–18. [CrossRef]
32. González García, E.; Colomo Magaña, E.; Cívico Ariza, A. Quality Education as a Sustainable Development Goal in the Context of 2030 Agenda: Bibliometric Approach. *Sustainability* **2020**, *12*, 5884. [CrossRef]
33. United Nations Sustainable Development Goals. Take Action for the Sustainable Development Goals. Available online: https://www.un.org/sustainabledevelopment/sustainable-development-goals/ (accessed on 20 October 2020).
34. Osei Kwadwo, V.; Konadu, O.A. Can Ghana Afford the Sustainable Development Goal on Education? *Afr. Educ. Rev.* **2020**, *17*, 177–197. [CrossRef]
35. UNESCO. *Engineering: Issues Challenges and Opportunities for Development*; United Nations Educational, Scientific and Cultural Organization: Paris, France, 2010; pp. 1–394. ISBN 978-92-3-104156-3.
36. Conlon, E. The new engineer: Between employability and social responsibility. *Eur. J. Eng. Educ.* **2008**, *33*, 151–159. [CrossRef]
37. Terrón-López, M.-J.; Velasco-Quintana, P.J.; Lavado-Anguera, S.; del Espinosa-Elvira, M.C. Preparing Sustainable Engineers: A Project-Based Learning Experience in Logistics with Refugee Camps. *Sustainability* **2020**, *12*, 4817. [CrossRef]
38. Miller, T.; Goodling, E.; Herrington, C.; Devlin, J. The Community Watershed Stewardship Program: Experiments in engagement and equity in Portland, OR. *Curr. Opin. Environ. Sustain.* **2015**, *17*, 30–35. [CrossRef]
39. Jung, H.B.; Zamora, F.; Duzgoren-Aydin, N.S. Water Quality Monitoring of an Urban Estuary and a Coastal Aquifer Using Field Kits and Meters: A Community-Based Environmental Research Project. *J. Chem. Educ.* **2017**, *94*, 1512–1516. [CrossRef]
40. Salam, M.; Awang Iskandar, D.N.; Ibrahim, D.H.A.; Farooq, M.S. Service learning in higher education: A systematic literature review. *Asia Pacific Educ. Rev.* **2019**, *20*, 573–593. [CrossRef]
41. Tapia, M.N. Calidad académica y responsabilidad social: El aprendizaje servicio como puente entre dos culturas universitaria. In *Aprendizaje Servicio y Responsabilidad Social de las Universidades*; Martínez, M., Ed.; Recursos: Barcelona, Spain, 2008; pp. 27–56. ISBN 9788480639699.
42. Petkus, E. A Theoretical and Practical Framework for Service-Learning in Marketing: Kolb's Experiential Learning Cycle. *J. Mark. Educ.* **2000**, *22*, 64–70. [CrossRef]
43. Whitley, M.A.; Walsh, D.S. A Framework for the Design and Implementation of Service-learning Courses. *J. Phys. Educ. Recreat. Danc.* **2014**, *85*, 34–39. [CrossRef]
44. Nejmeh, B.A. (Ed.) *Service-Learning in the Computer and Information Sciences*; John Wiley & Sons, Inc.: Hoboken, NJ, USA, 2012; ISBN 9781118319130.
45. Voss, H.C.; Mathews, L.R.; Fossen, T.; Scott, G.; Schaefer, M. Community–Academic Partnerships: Developing a Service–Learning Framework. *J. Prof. Nurs.* **2015**, *31*, 395–401. [CrossRef] [PubMed]
46. Hart, S. Engaging the learner: The ABC's of service–learning. *Teach. Learn. Nurs.* **2015**, *10*, 76–79. [CrossRef]
47. Tedesco, L.P.; Salazar, K.A. Using Environmental Service Learning in an Urban Environment to Address Water Quality Issues. *J. Geosci. Educ.* **2006**, *54*, 123–132. [CrossRef]
48. Brand, B.; Sass, M.; Brascia, K. Active learning through community outreach: A case study of service-learning in a natural hazard, vulnerability and risk class. *High. Learn. Res. Commun.* **2019**, *9*. [CrossRef]
49. Uppal, M.A.; Ali, S.; Gulliver, S.R. Factors determining e-learning service quality. *Br. J. Educ. Technol.* **2018**, *49*, 412–426. [CrossRef]
50. Pham, L.; Limbu, Y.B.; Bui, T.K.; Nguyen, H.T.; Pham, H.T. Does e-learning service quality influence e-learning student satisfaction and loyalty? Evidence from Vietnam. *Int. J. Educ. Technol. High. Educ.* **2019**, *16*, 7. [CrossRef]
51. Bourelle, T. Adapting Service-Learning into the Online Technical Communication Classroom: A Framework and Model. *Tech. Commun. Q.* **2014**, *23*, 247–264. [CrossRef]
52. Jacoby, B. Taking campus-community partnerships to the next level through border-crossing and democratic engagement. Michigan Journal of Community Service Learning, 22(1), 140+. *Mich. J. Community Serv. Learn.* **2015**, *22*, 140–147.

53. Dewey, J. *Democracy and Education: An Introduction to the Philosophy of Education*; Macmillan Company: New York, NY, USA, 1916.
54. John, E.C. Is Back, or is He? the Dewey Revival and Community Service-Learning in Higher Education. In *Critical Issues in Higher Education. Critical Issues in The Future of Learning and Teaching*; Kompf, M., Denicolo, P.M., Eds.; SensePublishers: Rotterdam, The Netherlands, 2013; ISBN 978-94-6209-046-0.
55. Kezar, A.; Rhoads, R.A. The Dynamic Tensions of Service Learning in Higher Education. *J. High. Educ.* **2001**, *72*, 148–171. [CrossRef]
56. Mtawa, N.N. Exploring the Role of Service-Learning in Human Development: Perspectives of Staff, Students and Community Members. Ph.D. Thesis, University of the Free State, Bloemfontein, South Africa, 2017.
57. Harkavy, I.; Hartley, M. Pursuing Franklin's Dream: Philosophical and Historical Roots of Service-Learning. *Am. J. Community Psychol.* **2010**, *46*, 418–427. [CrossRef] [PubMed]
58. Mikelić Preradović, N. Service-Learning. In *Encyclopedia of Educational Philosophy and Theory*; Peters, M.A., Ed.; Springer Singapore: Singapore, 2015; pp. 1–6. ISBN 978-981-287-532-7.
59. Bringle, R.; Hatcher, J. A service learning curriculum for faculty. *Mich. J. Community Serv.* **1995**, *2*, 112–122.
60. Campbell, E.M. Implementing Service Learning into a Graduate Social Work Course: A Step-by-Step Guide. *J. Teach. Soc. Work* **2012**, *32*, 300–313. [CrossRef]
61. Cashman, S.B.; Seifer, S.D. Service-Learning: An Integral Part of Undergraduate Public Health. *Am. J. Prev. Med.* **2008**, *35*, 273–278. [CrossRef]
62. Rosing, H.; Hofman, N.G. Notes From the Field: Service Learning and the Development of Multidisciplinary Community-Based Research Initiatives. *J. Community Pract.* **2010**, *18*, 213–232. [CrossRef]
63. Oberg De La Garza, T.; Moreno Kuri, L. Building Strong Community Partnerships: Equal Voice and Mutual Benefits. *J. Latinos Educ.* **2014**, *13*, 120–133. [CrossRef]
64. Allahwala, A.; Bunce, S.; Beagrie, L.; Brail, S.; Hawthorne, T.; Levesque, S.; von Mahs, J.; Visano, B.S. Building and Sustaining Community-University Partnerships in Marginalized Urban Areas. *J. Geogr.* **2013**, *112*, 43–57. [CrossRef]
65. Bringle, R.G.; Hatcher, J.A. Campus-Community Partnerships: The Terms of Engagement. *J. Soc. Issues* **2002**, *58*, 503–516. [CrossRef]
66. Kegler, M.C.; Twiss, J.M.; Look, V. Assessing Community Change at Multiple Levels: The Genesis of an Evaluation Framework for the California Healthy Cities Project. *Health Educ. Behav.* **2000**, *27*, 760–779. [CrossRef] [PubMed]
67. Lasker, R.D.; Weiss, E.S.; Miller, R. Partnership Synergy: A Practical Framework for Studying and Strengthening the Collaborative Advantage. *Milbank Q.* **2001**, *79*, 179–205. [CrossRef] [PubMed]
68. Winkler, T. At the Coalface: Community-University Engagements and Planning Education. *J. Plan. Educ. Res.* **2013**, *33*, 215–227. [CrossRef]
69. Nyden, P.; Wiewel, W. Collaborative research: Harnessing the tensions between researcher and practitioner. *Am. Sociol.* **1992**, *23*, 43–55. [CrossRef]
70. Ali, H.O.; Rahman, A.A.; Abidin, W.Z. Service Learning: An Investigation into its Viability as a Strategy to Achieve Institutional Goals. *Procedia Soc. Behav. Sci.* **2012**, *56*, 388–395. [CrossRef]
71. Ochocka, J.; Janzen, R. *Blending Commitment, Passion and Structure: Engaging Cultural Linguistic Communities in Collaborative Research*; Williamson, A., DeSouza, R., Eds.; Muddycreek Press: Auckland, New Zealand, 2007.
72. Minkler, M. Assessment/evaluation. Using participatory action research to build healthy communities. *Public Health Rep.* **2000**, *115*, 191–198. [CrossRef] [PubMed]
73. Kelly, P.J. Practical Suggestions for Community Interventions Using Participatory Action Research. *Public Health Nurs.* **2005**, *22*, 65–73. [CrossRef]
74. Steiner, G.; Posch, A. Higher education for sustainability by means of transdisciplinary case studies: An innovative approach for solving complex, real-world problems. *J. Clean. Prod.* **2006**, *14*, 877–890. [CrossRef]
75. Bodorkós, B.; Pataki, G. Linking academic and local knowledge: Community-based research and service learning for sustainable rural development in Hungary. *J. Clean. Prod.* **2009**, *17*, 1123–1131. [CrossRef]
76. Kindon, S.; Elwood, S. Introduction: More than Methods—Reflections on Participatory Action Research in Geographic Teaching, Learning and Research. *J. Geogr. High. Educ.* **2009**, *33*, 19–32. [CrossRef]
77. INEC Población y Demografía. Available online: https://www.ecuadorencifras.gob.ec/censo-de-poblacion-y-vivienda/ (accessed on 23 October 2020).
78. Acosta, M.; Basani, M.; Solís, H. *Prácticas y Saberes en la Gestón Comunitaria del Agua Para Consumo Humano y Saneamiento en las Zonas Rurales de Ecuador*; Banco Interamericano de Desarrollo: Quito, Ecuador, 2019.
79. INEC Gestión de Agua Potable y Alcantarillado. Available online: https://www.ecuadorencifras.gob.ec/documentos/web-inec/Encuestas_Ambientales/Municipios_2017/Agua_potable_alcantarillado-2017/BoletintecnicoAPA2017.pdf (accessed on 23 October 2020).
80. García-Garizábal, I. Rainfall variability and trend analysis in coastal arid Ecuador. *Int. J. Climatol.* **2017**, *37*, 4620–4630. [CrossRef]
81. Oyola, S.J.; Mero, P.C.; Crespo, P.R. *Ecuadorian Aquifer Studied for Marine Intrusion*; IAEA: International Atomic Energy Agency: Vienna, Austria, 2010; Volume Isotope Hy.

82. Carrión-Mero, P.; Montalván, F.J.; Morante-Carballo, F.; Heredia, J.; Elorza, F.J.; Solórzano, J.; Aguilera, H. Hydrochemical and Isotopic Characterization of the Waters of the Manglaralto River Basin (Ecuador) to Contribute to the Management of the Coastal Aquifer. *Water* **2021**, *13*, 537. [CrossRef]
83. Carrión-Mero, P.; Montalván, F.J.; Morante-Carballo, F.; Loor-Flores de Valgas, C.; Apolo-Masache, B.; Heredia, J. Flow and Transport Numerical Model of a Coastal Aquifer Based on the Hydraulic Importance of a Dyke and Its Impact on Water Quality. Manglaralto—Ecuador. *Water* **2021**, *13*, 443. [CrossRef]
84. Carrión-Mero, P.; Quiñonez-Barzola, X.; Morante-Carballo, F.; Montalván, F.J.; Herrera-Franco, G.; Plaza-Úbeda, J. Geometric Model of a Coastal Aquifer to Promote the Sustainable Use of Water. Manglaralto, Ecuador. *Water* **2021**, *13*, 923. [CrossRef]
85. Dyson, R.G. Strategic development and SWOT analysis at the University of Warwick. *Eur. J. Oper. Res.* **2004**, *152*, 631–640. [CrossRef]
86. Herrera-Franco, G.; Montalván-Burbano, N.; Carrión-Mero, P. Bravo-Montero, L. Worldwide Research on Socio-Hydrology: A Bibliometric Analysis. *Water* **2021**, *13*, 1283. [CrossRef]
87. Macneill, M. IAEA Helps Parched Santa Elena Find Water. *IAEA Bull.* **2011**, *1*, 12–13.
88. Carballo, F.M.; Brito, L.M.; Mero, P.C.; Aguilar, M.A.; Ramírez, J. Urban Wastewater Treatment through a system of Green Filters in the Montañita Commune, Santa Elena, Ecuador. In *Proceedings of the WIT Transactions on Ecology and the Environment*; WIT Press: Southampton, UK, 2019; pp. 233–249.
89. Berrezueta, E.; Arenas-Montes, L.; Herrera, G.; Saeteros, M.; Olaya, P. Valoración de la gestión de recursos naturales mediante la medida de la Huella Ecológica (HE). Cuenca de Manglaralto, Ecuador. In *Técnicas aplicadas a la Caracterización y Aprovechamiento de Recursos Geológico-Mineros*; Berrezueta, E., Dominguez-Cuesta, M.J., Eds.; Red Minería XXI, CYTED e Instituto Geológico y Minero de España: Madrid, Spain, 2013; p. 13. ISBN 978-84-15413-23-3.
90. Briones, J.; Carrión, P.; Herrera, G. Prácticas de gestión para una comunidad sostenible y su incidencia en el desarrollo, Manglaralto-Santa Elena, Ecuador. In *Proceedings of the 17th LACCEI International Multi-Conference for Engineering, Education, and Technology: "Industry, Innovation, and Infrastructure for Sustainable Cities and Communities", Montego Bay, Jamaica, 24 July 2019*; Latin American and Caribbean Consortium of Engineering Institutions: Montego Bay, Jamaica, 2019; pp. 1–9.
91. CYTED. Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo. Available online: http://www.cyted.org/?q=es/detalle_proyecto&un=975 (accessed on 27 April 2021).
92. Martos-Rosillo, S.; Durán, A.; Castro, M.; Vélez, J.J.; Herrera, G.; Martín-Civantos, J.M.; Mateos, L.; Durán, J.J.; Jódar, J.; Gutiérrez, C.; et al. Ancestral Techniques of Water Sowing and Harvesting in Ibero-America: Examples of Hydrogeoethical Systems. In *Advances in Geoethics and Groundwater Management: Theory and Practice for a Sustainable Development*; Abrunhosa, M., Chambel, A., Peppolini, S., Chaminé, H.I., Eds.; Springer International Publishing: Porto, Portugal, 2021; pp. 489–492.
93. Clevenger, C.M.; Ozbek, M.E. Service-Learning Assessment: Sustainability Competencies in Construction Education. *J. Constr. Eng. Manag.* **2013**, *139*, A4013010. [CrossRef]
94. PPC FILTROS VERDES VIDEO FINAL. Available online: https://www.youtube.com/watch?v=bPSv6NskoF0 (accessed on 26 April 2021).
95. Filtros Verdes. Available online: https://sketchfab.com/3d-models/filtros-verdes-db8569c0ba1344b9a67004ae000cf0ac (accessed on 26 October 2020).
96. Briones, J.; Carrión, P.; Mora, D.; Morante, F.; Toalombo, M.; Berrezueta, E. Exploración de Aguas Subterráneas para un Plan de Abastecimiento Sostenible en una Comunidad Rural: Caso Cadeate, Santa Elena, Ecuador. In *Proceedings of the 18th LACCEI International Multi-Conference for Engineering, Education, and Technology: "Engineering, Integration, and Alliances for a Sustainable Development" "Hemispheric Cooperation for Competitiveness and Prosperity on a Knowledge-Based Economy", 27–31 July 2020, Virtual Edition*; Latin American and Caribbean Consortium of Engineering Institutions: Buenos Aires, Argentina, 2020; pp. 1–10.
97. Herrera-Franco, G.; Bravo-Montero, L.; Carrión-Mero, P.; Morante-Carballo, F.; Apolo-Masache, B. Community management of the Olón coastal aquifer, Ecuador, and its impact on the supply of water suitable for human consumption. In *Proceedings of the WIT Transactions on Ecology and the Environment, 9–11 November 2020, Virtual Edition*; WIT Press: Southampton, UK, 2020; pp. 169–181.
98. El Fenómeno de La Niña Estó en su Fase Final. Available online: http://www.espol.edu.ec/es/noticias/el-fenómeno-de-la-niña-estó-en-su-fase-final (accessed on 2 May 2021).
99. Ministerio del Ambiente y Agua. Available online: http://ide.ambiente.gob.ec/mapainteractivo/ (accessed on 26 January 2021).
100. Freile, J.F.; Santander, T. Áreas Importantes para la Conservación de las Aves en Ecuador. In *Áreas Importantes para la Conservación de las Aves en los Andes Tropicales: Sitios Prioritarios Para la Conservación de la Biodiversidad*; BirdLife International: Quito, Ecuador, 2005; pp. 283–470. ISBN 9978-44-196-4.
101. Myers, N.; Mittermeier, R.A.; Mittermeier, C.G.; da Fonseca, G.A.B.; Kent, J. Biodiversity hotspots for conservation priorities. *Nature* **2000**, *403*, 853–858. [CrossRef]
102. Mendoza, M.S.; Cun, P.; Horstman, E.; Carabajo, S.; Alava, J.J. The Last Coastal Jaguars of Ecuador: Ecology, Conservation and Management Implications. In *Big Cats*; Shrivastav, A.B., Singh, K.P., Eds.; IntechOpen: Rijeka, Croatia, 2017; pp. 111–131.
103. BirdLife International Important Bird Areas Factsheet: Reserva Ecológica Comunal Loma Alta. Available online: http://datazone.birdlife.org/site/factsheet/reserva-ecológica-comunal-loma-alta-iba-ecuador (accessed on 26 January 2021).

104. Gricelda, H.F.; Paúl, C.M.; Niurka, A.M. Participatory Process for Local Development: Sustainability of Water Resources in Rural Communities: Case Manglaralto-Santa Elena, Ecuador. In *Handbook of Sustainability Science and Research*; Leal Filho, W., Ed.; Springer: Cham, Switzerland, 2018; pp. 663–676.
105. Carrión, P.; Herrera, G.; Briones, J.; Sánchez, C.; Limón, J. Practical adaptations of ancestral knowledge for groundwater artificial recharge management of Manglaralto coastal aquifer, Ecuador. In *Proceedings of the WIT Transactions on Ecology and the Environment*; WIT Press: Southampton, UK, 2018; pp. 375–386.
106. Herrera Franco, G.; Yambay de Armijos, K.; Carrión Mero, P. Participatory action research as an integrating factor in research projects-the educational process of the inhabitants of Manglaralto coastal aquifer in Ecuador. In *Proceedings of the 1th annual International Conference of Education, Research and Innovation, Seville, Spain, 12–14 November 2018*; IATED: Seville, Spain, 2018; pp. 5349–5358.
107. Herrera, G.; Carrión, P.; Yambay, K.; Briones, J. Educational considerations for conservation management and sustainable development of a watershed. Manglaralto, Santa Elena-Ecuador. In *Proceedings of the 13th International Technology, Education and Development Conference, Valencia, Spain, 11–13 March 2019*; IATED: Valencia, Spain, 2019; pp. 9243–9250.
108. Herrera-Franco, G.; Carrión-Mero, P.; Aguilar-Aguilar, M.; Morante-Carballo, F.; Jaya-Montalvo, M.; Morillo-Balsera, M.C. Groundwater Resilience Assessment in a Communal Coastal Aquifer System. The Case of Manglaralto in Santa Elena, Ecuador. *Sustainability* **2020**, *12*, 8290. [CrossRef]
109. Durán, A.; Castro, M.; Vélez, J.; Briones, J.; Carrión, P.; Herrera, G.; Morante, F.; Guttiérrez, C.; Bardales, J.; Peña, F.; et al. Siembra y Cosecha de Agua (SyCA), técnicas ancestrales que solucionan problemas del siglo XXI. In *Proceedings of the 18th LACCEI International Multi-Conference for Engineering, Education, and Technology: "Engineering, Integration, and Alliances for a Sustainable Development" "Hemispheric Cooperation for Competitiveness and Prosperity on a Knowledge-Based Economy", 27–31 July 2020, Virtual Edition*; Latin American and Caribbean Consortium of Engineering Institutions: Buenos Aires, Argentina, 2020; pp. 1–9.
110. Yapa, K. *Prácticas Ancestrales de Crianza de Agua: Una Guía de Campo: Estrategias Para Adaptarnos a la Escasez de Agua*; Mantra, Ed.; United Nations Development Program—Ecuador (Undp Ecuador): Riobamba, Ecuador, 2013; ISBN 9789942988782.
111. Herrera, G.; Carrión, P.; Briones, J. Aplicación del conocimiento ancestral mediante albarradas y tapes en la gestión del agua en la provincia de Santa Elena, Ecuador. *Boletín Geol. Min.* **2020**, *131*, 77–90. [CrossRef]
112. Crofton, F.S. Educating for sustainability: Opportunities in undergraduate engineering. *J. Clean. Prod.* **2000**, *8*, 397–405. [CrossRef]
113. De Haan, G. The BLK '21' programme in Germany: A 'Gestaltungskompetenz'-based model for Education for Sustainable Development. *Environ. Educ. Res.* **2006**, *12*, 19–32. [CrossRef]
114. Kearins, K.; Springett, D. Educating For Sustainability: Developing Critical Skills. *J. Manag. Educ.* **2003**, *27*, 188–204. [CrossRef]
115. Kelly, P. Letter from the oasis: Helping engineering students to become sustainability professionals. *Futures* **2006**, *38*, 696–707. [CrossRef]
116. Grohs, J.R.; Kirk, G.R.; Soledad, M.M.; Knight, D.B. Assessing systems thinking: A tool to measure complex reasoning through ill-structured problems. *Think. Ski. Creat.* **2018**, *28*, 110–130. [CrossRef]
117. Sterling, S.; Thomas, I. Education for sustainability: The role of capabilities in guiding university curricula. *Int. J. Innov. Sustain. Dev.* **2006**, *1*, 349. [CrossRef]
118. Loorbach, D.; Frantzeskaki, N.; Huffenreuter, R. Transition Management: Taking Stock from Governance Experimentation. *J. Corp. Citizsh.* **2015**, *58*, 48–66.
119. Baron, J. *Thinking and Deciding*; Cambridge University Press: New York, NY, USA, 2000.
120. Herrera-Franco, G.; Alvarado-Macancela, N.; Gavín-Quinchuela, T.; Carrión-Mero, P. Participatory socio-ecological system: Manglaralto-Santa Elena, Ecuador. *Geol. Ecol. Landsc.* **2018**, *2*, 303–310. [CrossRef]
121. Kittitornkool, J.; Burt, P. Promoting learning processes for public participation in sustainable development: Lessons and experiences from action research in Southern Thailand. *Int. J. Environ. Sustain. Dev.* **2006**, *5*, 199. [CrossRef]
122. Bennett, M. A Review of the Literature on the Benefits and Drawbacks of Participatory Action Research. *First Peoples Child Fam. Rev.* **2020**, *1*, 19–32. [CrossRef]
123. Gerstenblatt, P.; Gilbert, D.J. Framing Service Learning in Social Work: An Interdisciplinary Elective Course Embedded within a University–Community Partnership. *Soc. Work Educ.* **2014**, *33*, 1037–1053. [CrossRef]