



TransformAr

Accelerating and upscaling transformational adaptation in
Europe: demonstration of water-related innovation
packages

Final Exploitation Plan

Deliverable 6.7



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ABBREVIATIONS

Abbreviations	Description
GA	Grant Agreement
CA	Consortium Agreements
KER	Key Exploitable Result
IPR	Intellectual Property Rights
TA	Transformational Adaptation
CCA	Climate Change Adaptation
IP	Intellectual Property
IP	Intellectual Property Rights
IEM	Innovation and Exploitation Manager
IMB	Innovation Management Board
SoA	State of the Art

EXECUTIVE SUMMARY

The following deliverable corresponds to the Final Exploitation Plan (D6.7) for TransformAr's project results. This deliverable can be considered as a planning document useful for project partners regarding their possibilities, rights, and obligations to protect all created results in the framework of the project by Intellectual Property Rights. Similarly, this document can be considered as a consulting document to obtain additional information about how the exchange of information and results analysis executed in order to execute exploitation of them in a consistent manner.

Based on the planned activities of the project's results, this final version of the Exploitation Plan (D6.7) describes the exploitation activities that were developed during the project's lifetime, also points out result protection possibilities and summarises provisions and terms of the grant and consortium agreements (GA & CA) regarding TransformAr results protection. This document allowed the establishment, from the beginning of the project, the goals, guidelines, strategies, and workflows for partners to follow when developing the activities related to the transfer of knowledge and exploitation towards end-users, being updated regularly, aligned with new results coming out during project implementation.

This final version of the Exploitation Plan includes the evaluation of related patents to Key Exploitable Results (KER) as well a description of actions leading to exploitation including the specific model and strategy for each exploitable result, summarising the possible exploitation strategies for the obtained TransformAr outcomes, that will serve as a basis for the creation of the business model including most suitable channels for commercialization (to be included as part of D6.7 Business report).

The design of actions leading to exploitation are described, executed in order to set strategic guidelines for obtaining a specific model and strategy for the exploitation of each significant exploitable result. With this objective in mind, we must initially highlight two fundamental pillars on which the proper execution of a Results Exploitation Plan is based:

- **Project results collection:** different types of results were expected within the project, from services or tools to new methodologies or strategies. All these results were analysed to define which of them are more likeable to be susceptible to market upscale.
- **Intellectual Property Rights (IPR) management:** To define a tailor-made and effective exploitation strategy for TransformAr results it will be necessary to ensure that the dissemination measures proposed during and after the end of the project are aligned with exploitation requirements and IPR (Intellectual Property Rights) management procedures, particularly the disclosure of new ideas with commercial potential.

1.0 INTRODUCTION

Climate change impacts are here and now. The impacts on people, prosperity and planet are already pervasive but unevenly distributed, as stated in the new EU Blueprint strategy (European Commission-EC, 2019). To reduce climate-related risks, the EC and the IPCC agree that transformational adaptation (TA) is essential. In TransformAr, TA refers to the upscaling and acceleration of systemic climate change adaptation (CCA). TransformAr will break down to major barriers for TA, reflected also in the EU Blueprint on adaptation: the need for more and better data, deeper knowledge and faster deployment of solutions, limited awareness on the need for adaptation and limited resources (financial and human) to make the transition from adaptation planning to actual implementation. TransformAr aims to develop and demonstrate solutions and pathways, deemed essential for climate and social resilience, to achieve rapid and far-reaching transformational adaptation across the EU. Transformational adaptation will be triggered by a co-innovation process that will co-create transformational adaptation pathways for six demonstrator regions and communities in Europe.

During the project, several significant results were achieved. The primary purpose of the Exploitation Plan is to outline, from the outset of the project, the objectives, strategies, and workflows that partners should adhere to when conducting activities related to knowledge transfer and result exploitation aimed at end-users. This Exploitation Plan serves as a guiding document, detailing the actions and steps involved in this task to support partners in effectively utilizing project outcomes for maximum impact. It includes:

- **RESULTS COLLECTION (Section 5):** This section outlines the actions carried out during the project implementation to achieve the identified Key Exploitable Results (KERs) of the project, which are also included as part of this section. Throughout the project development, this list was continuously updated to reflect the main outputs obtained from the contributions of the partners
- **LIST OF EXPLOITABLE RESULTS (Section 6), EXPLOITATION ANALYSIS (Section 7) AND MARKET ANALYSIS (SECTION 8):** The key results that were compiled (section 5) were analysed to identify and classify them in those that are considered innovative to be transferred to the market. Gathering their target market and applicability as well value proposition, innovation and development degree, for the proposal of exploitation potential and a potential impact for each result.
- **IPR AND EXPLOITATION STRATEGY (SECTION 9):** This section describes partners-specific exploitation plans, including the most adequate path for protecting the results through IPR, the proposed exploitation route and the proposed action plan. For each of the exploitable results identified, the most appropriate exploitation strategy will be drawn up, considering the interests of the partners as well as taking into account the state of the art and market information obtained in the previous section.

2.0 GRANT AGREEMENT AND CONSORTIUM AGREEMENT ARTICLES RELATED WITH EXPLOITATION

The Grant Agreement “101036683 — TransformAr — H2020-LC-GD-2020 / H2020-LC-GD-2020-2” stipulates several articles related to exploitation and protection of results. Articles covering the management of IP, agreement on background and the access rights to background:

- ARTICLE 23a — MANAGEMENT OF INTELLECTUAL PROPERTY
- ARTICLE 24 — AGREEMENT ON BACKGROUND
- ARTICLE 25 — ACCESS RIGHTS TO BACKGROUND

These articles, detailed below, provide a foundation for this deliverable:

- **ARTICLE 26 — OWNERSHIP OF RESULTS**

26.1 Ownership by the beneficiary that generates the results

Results are owned by the beneficiary that generates them. ‘Results’ means any (tangible or intangible) output of the action such as data, knowledge, or information — whatever its form or nature, whether it can be protected or not — that is generated in the action, as well as any rights attached to it, including intellectual property rights.

26.2 Joint ownership by several beneficiaries

Two or more beneficiaries own results jointly if:

- (a) they have jointly generated them and
- (b) it is not possible to:
 - (i) establish the respective contribution of each beneficiary, or
 - (ii) separate them for the purpose of applying for, obtaining or maintaining their protection (see Article 27).

The joint owners must agree (in writing) on the allocation and terms of exercise of their joint ownership (‘joint ownership agreement’), to ensure compliance with their obligations under this Agreement. Unless otherwise agreed in the joint ownership agreement, each joint owner may grant non-exclusive licences to third parties to exploit jointly owned results (without any right to sub-license), if the other joint owners are given:

- (a) at least 45 days advance notice and
- (b) fair and reasonable compensation.

Once the results have been generated, joint owners may agree (in writing) to apply another regime than joint ownership (such as, for instance, transfer to a single owner (see Article 30) with access rights for the others).

- **ARTICLE 27 – PROTECTION OF RESULTS – VISIBILITY OF EU FUNDING**

27.1 Obligation to protect the results

Each beneficiary must examine the possibility of protecting its results and must adequately protect them - for an appropriate period and with appropriate territorial coverage – if:

- (a) The results can reasonably be expected to be commercially or industrially exploited and
- (b) Protecting them is possible, reasonable, and justified

- **ARTICLE 28 – EXPLOITATION OF RESULTS**

28.1 Obligation to exploit the results

Each beneficiary must – up to four years after the period set out in Article 3 – take measures aiming to ensure ‘exploitation’ of its results (either directly or indirectly, in particular through transfer or licensing; see Article 30) by:

- (a) Using them in further research activities (outside of the action).
- (b) Developing, creating or marketing a product or process.
- (c) Creating and providing a service, or
- (d) Using them in standardization activities

3.0 OBJECTIVES OF THE EXPLOITATION PLAN

This deliverable 6.7, includes the Exploitation Plan containing the routes for the project results, including the joint exploitation objectives as well as the partner-specific exploitation plans for each significant result. It includes also a description of actions leading to exploitation as well as the specific model and strategy for each exploitable result.

This Exploitation Plan will set a strategic plan to exploit the results generated throughout the project, allowing for the implementation of the strategic plan beyond TransformAr's lifetime.

Partners developed a new scientific knowledge that was disseminated when relevant during the project and further actions will be executed until project finalization and beyond. The process for knowledge protection will be defined in the Exploitation Plan to define the rights to each partner and the possibilities incurred by the solutions development, both for the patenting and exploitation plan.

To maximise the impact of the exploitation activities, the involvement of all partners in the exploitation plan activities and in the achievement of the described objectives is highly recommended.

Also, as part of the innovation strategy within TransformAr project:

- Innovation and Exploitation Manager (IEM) was the responsible for guaranteeing the full exploitation of the innovation potential as well as the implication of all project partners exploring individual and common exploitation interests (T6.4). The IEM was also ensuring the alignment of the IPR strategy drafted in the Consortium Agreement with the communication and dissemination strategy of the project.
- Innovation Management Board (IMB) advised on the management of knowledge and of intellectual property and of other innovation related activities arising in the project. This advice was aligned with the terms of the CA signed at the start of the project. IMB collaborated closely with technology transfer specialists and legal advisors from the partner organisations concerned by results exploitation. It was chaired by FEUGA (IEM) and included EQY (Ms. Charlotte Francois). The IMB advised the Steering Committee (SC) on how to present the project results and tangible outcomes to the industrial stakeholders. Upon request of the SC the IMB:
 - Assisted in identifying results that could be the matter of protection, use or dissemination, based on publications, deliverables, and activity reports.
 - Assisted the partners in identifying the most appropriate measures for protecting and disseminating results.
 - Made a proposal to the Steering Committee and to the concerned partners on the allocation of co-ownership shares over results obtained by several partners. The IMB proposed solutions to the concerned partners in case of co-ownership issues between different partners having different policies and endeavouring to resolve possible conflicts related to intellectual property rights.
 - Assisted in case of possible conflict: i) handle and moderate discussions related to accessing the background and results to be granted according to the needed information to carry out the R&D tasks and ii) more generally, moderate and propose fair solutions to any potential conflict related to IPRs.

4.0 EXPLOITATION STRATEGY DEFINITION AND RELATED EXPLOITATION ACTIVITIES

The overall objective of this task deal with the identification, management and IP (Intellectual Property) protection evaluation of the innovations generated during the project together with the definition of the most suitable exploitation measures and channels in order to ease the post-project use, up-scaling and/or commercialization of results. In order to achieve this goal, the exploitation strategy has been designed around four main pillar activities as illustrated in Figure 4.1.



Figure 4.1 Exploitation methodology flow-chart design.

The four pillars of the TransformAr exploitation methodology

1. Information and results obtained within the development of WP1 to WP6 feed the first stage to **obtain a preliminary description of the expected results and the interests of each partner regarding the exploitation corresponding to each Work Package** followed by the identification of the key exploitable results (KERs).
2. Analysis of project potential outcomes by carrying out the **evaluation of the protection possibilities after an in-depth benchmarking analysis including 'State of the Art'** in patent databases, projects, news and initiatives in related topics each potential outcome.



3. Exploitation plan definition for each KER. Information regarding the **IP rights** (Ownership, participating members; associated company), **exploitation rights, role of each participant** in protection and **geographical scope** of protection, together with the analysis of the potential **geographical coverage** and target markets where project results will be exploited, including potential users, main competitors and competitive advantages will be used for the exploitation strategy development of each outcome.
4. Explore potential Business Models. All the obtained information will be synthesised in order to describe the best exploitation roadmap and commercialization paths for the TransformAr outcomes, that will be included part of D6.8 Business report.

From the beginning of the project until month 40, different exploitation activities were conducted related with the pillar 1 "Identification of the key exploitable results (KER)" (more detailed explanation can be observed in Section 5):

- Periodical **IP and exploitation Workshops** for the consortium moderated by FEUGA took place during project Meetings, aiming to raise **awareness on IP protection**, to identify threats and to collect the interests and **clarify doubts** regarding exploitation to all partners. These sessions were executed following specific methodologies depending on the project stage:
 - **Kick of Meeting**: the methodology plan to be applied was share as well IP basic concepts to be applied to project results
 - **First Executive Meeting**: explanation of how to fill Outcomes Form (a toll shared during the first workshop) to father key data from partners.
 - **Consortium Meeting 2**: IP and Exploitation workshop sharing first Key Exploitable Results identified for partners validation.
 - **Consortium Meeting 3**: Intellectual Property Management Workshop sharing the method to Prior Notice of Planed Publications and asking for updates on Key Exploitable Results Identified.
 - **Consortium Meeting 5**: Exploitation Workshop to work on new list of Key Exploitable Results defined, working with partners to define key characteristics and related words defining each result and main updates on its potential application to society and value proposition. A proposal of a preliminary exploitation plan for the project results was shared with partners as well a follow up on relevant related actions to be continuously carried out within the task,
 - **Consortium meeting 6**: An Innovation and Exploitation workshop including an update of findings from the results analysis and proposing tool to maximize project outputs exploitation: one pager and project slide deck, to be applied for project results.
 - **Consortium meeting 7**: Innovation and Exploitation workshop focused on a cocreation session for exploitation of demonstrator's results, proposing an activity for partners to update latest technical characteristics of the results, unique selling proposition, and SWOT analysis (strengths, weaknesses opportunities and threats) as well target groups.
- A **dedicated section to the Exploitation of TransformAr results was implemented in the collaborative platforms** of the project in order to **facilitate and automate the collection of results** generated on the project.
- An **Outcomes Form** (included on the specific Exploitation section on the collaborative platform) has been designed to **easily collect the whole range of information necessary for the evaluation of possible exploitation of results at different levels of project development**: technical



description, application, value proposition, partners involved, among others, with the objective that the Work Package Leaders (WPLs) (or other members they consider relevant) can complete it individually at the time they consider appropriate. This action was carried out in order to facilitate bilateral communication between the WPLs and the Innovations and Exploitation Manager (IEM).

- **1:1 meetings were held between FEUGA and WPLs during May and June 2022 to discuss how to fill Outcomes form and clarify doubts about the KERs identification.**

With the aim of guarantee the market introduction and the correct exploitation of TransformAr outcomes, exploitation activities were executed being adapted to project needs and evolution.

5.0 RESULTS COLLECTION

This section includes a list of the project results identified during the activities executed with partners (meetings, workshops and consultations) as well as the technical description of them and the partner(s) contribution to the generation of each result during the project’s lifetime

This section and table were updated periodically during the project duration to make sure that all generated project results are considered.

In table 5.1, it is included the preliminary list of exploitable assets¹ identified at project month 6, after analysing Grant Agreement and Outcomes Form, by this, specific results were identified and considered for project results evaluation as part of value proposition.

Table 5.1 TransformAr preliminary exploitable assets²

	KEY EXPLOITABLE RESULTS (KERs)	INVOLVED PARTNERS
KNOWLEDGE	Data projections of climate hazard and biophysical impacts.	CMCC, PIK
	Assessment of the full-scale socio-economic, industrial, and distributional implications of climate change.	E3M, CMCC, PIK
	Systemic risk assessment.	CMCC, E3M, ACTERRA, PIK
	Solution Catalogue and best governance practices.	ACTERRA, UA
	Pathways co-construction.	ACTERRA, WRT, CMCC, E3M, VERHAERT
	Tools on avoided damages and benefits of implementation of adaptation (Decision support system).	UA, E3M, PIK
	Transformation action plan and combination of solutions.	ACTERRA
	Learning stories concept methodology.	ADEME
	Results on public acceptance and the capitalisation, consolidation, and integration of the knowledge resources on Transformational Adaptation (TA) in the 7 project Innovation Packages (IPs) of TransformAr.	CMCC, UA
	Policy recommendations and gap analysis	ACTERRA, CETMAR, UA, UVIGO, EPSILON, WRT, CMCC
	Replication Guide	MOG, NTNU, LUT, ACTERRA
Website Community Hub	WE, FEUGA	
PROCESS TECHNOLOGY/	Nature based solutions for phosphate mitigation & phosphate credits scheme.	WRT
	Mobile application for crowd sensing	NTNU, LUT, NCSR
	Smart sea-opening systems	MEDSEA
	Sensor-based monitoring systems	
	Forecasting system for inbound flow	MOE, NCSR, CETMAR, UVIGO
	Climatic and environmental monitor systems based on IOT low-cost sensors	

¹ "Assets" are resources, property, or items of value owned by a person, company, or organization that have economic or productive worth, it is used in this report to refer to the lists of "results", outcomes or outputs of the project that can be financial, operational, experimental, etc.

² Data obtained from Grant Agreement NUMBER 101036683 – TransformAr and Outcomes Forms filled by partners.



	Stormwater Modular system	LAPP, LUT, VERHAERT
	Climate models	PIK, CMCC

In order to collect the project results, a specific exploitation methodology was followed. The TransformAr partners were requested to identify their corresponding Key Exploitable Results (KERs) that they intend to exploit and their strategy. A dedicated space for exploitation task on the TransformAr project was set in the TransformAr collaborative online platform in order to easily collect and monitor them during the project. The use of this tool aimed to simplify the information flow from the WP partners and WP leaders to the Innovation Management Board (IMB). A specific exploitation “Outcomes form” was elaborated and uploaded to the TransformAr collaborative platform. Definitions and guidelines about the terms included in the “Outcomes Form” were also provided to guide users through all this result collection procedure.

WPLs were requested to download the “Outcomes Form” template (Table 5.2) and to fill it with the required information, including, among others: a technical description, potential applicability, problem it solves, current Technology Readiness Level (TRL), background IP. First outcomes compilation table (Table 5.1) has been fed by the outcomes forms filled by WPLs.

Table 5.2 TransformAr Outcomes Form Template

TABLE FOR KEY EXPLOITABLE RESULTS (KERs)	
KER NAME	
TECHNICAL DESCRIPTION	
APPLICABILITY	
PROBLEMS SOLVED/ VALUE PROPOSITION	
MATURITY/DEVELOPMENT STATE (Current TRL)	
EXPECTED TRL	
POTENTIAL EXPLOITATION ROUTE	
BACKGROUND IPR	
INVOLVED PARTNERS	
MARKET IMPLEMENTATION/FEASIBILITY QUANTIFICATION	
MAIN TECH CONTACT	

The results presented in Table 5.1 were initially reviewed through one-on-one meetings with work package leaders to validate the accuracy of the preliminarily identified assets. These discussions aimed to assess each asset's potential for further development, feasibility, and overall impact. However, after extensive deliberation, it was agreed with the partners that the identified assets did not fully align with the expected project outputs. As a result, a revised approach was proposed, adopting a broader perspective for exploitation. This approach builds upon the list of actionable adaptive solutions, developed as part of the demonstrators, as the definitive project exploitable assets (Key Exploitable Results). The preliminary assets are now considered integral to the value proposition rather than standalone results.

This approach facilitated the public dissemination of the Preliminary Exploitation Plan analysis, which was updated at M26 to reflect the set of actionable adaptive solutions publicly shared by the TransformAr project. From that point onward, the actionable adaptive solutions listed in Table 5.3 served as the foundation for the exploitation analysis. The Final Exploitation Plan was subsequently developed based on this list, incorporating insights and knowledge previously gathered from project partners.

Table 5.3 TransformAr preliminary exploitable assets³

	GROUP ⁴	SOLUTION	INVOLVED PARTNERS
TECHNOLOGY	Behavioural change and awareness-raising solutions	<p>Citizen App (CA):</p> <p>CAF - Mobile application for crowd sensing and real time monitoring of extreme flooding events due to CC events by citizens.</p> <p>CAE - Augmentation of existing Municipal app for citizen to conduct a vulnerability and resilience assessment to climate change in terms of social services demand and the supported infrastructure.</p>	LAPP MOG Verhaert MOE NCSR
	Nature-based solutions	Integrated constructed wetlands (ICW) - Nutrient and soil management measures to demonstrably control farmyard run-off by catching nutrients, sequestering carbon and creating additional water for farmers	CZU WRT CMCC
		Smart Grid for coastal management (SG) - Smart sea-opening system using rapid unhooking grid and gates for emergency opening in case of extreme events	CMCC MEDSEA
		Urban run-off system (URB) – a biofiltration area, that captures and treats runoff and storm water from the surroundings street and sidewalk in the city centre of Lappeenranta.	LAPP
	Technological and digital solutions	Digital monitoring (SWMM) - Monitoring system with simple probes to monitor flow rates and water quality through individual modules. The monitoring user interface will be made visual and browser-based, enabling access from any smartphone or laptop. Publicly displayed information will be accessible to all	LUT LAPP
		Smart climate solutions (SCS) - To acquire a detailed view of the micro-climatic conditions, with focus on better understating of the fine scale flows and heat exchanges leading to urban heat island, its diurnal variation and supporting studies apportioning its origins and determination factors. Data will be used in addition to existing environmental, transport, energy data from the city forming a city-wide IoT to be used in other relevant action.	MOE NCSR
		Mussel raft monitoring (MRM) - Environmental and hydrodynamic sensors based on the implementation of IoT solutions powered by solar and wind energy. Digitalization will allow knowing in real-time the state of the platform, alarms in case of risky water conditions and the construction of a comprehensive database.	CETMAR
		Intertidal monitoring (INTERM) - To improve the knowledge of environment behaviour and numerical modelling to predict banks response under changing environmental conditions.	CZU WRT UVIGO
		Nudging (NUDG) - Nudge design and understanding the factor of personalisation (based on the Lytics programme)	ADEME ACTERRA
	KNOWLEDGE	Behavioural change and awareness-raising solutions	Awareness-raising and behavioural change modules (AWAR) - Monitor the impact of the project activities on the local population - educational material to be developed for the young and school pupils to promote climate neutrality and awareness, perception of CC and potential impacts

³ Data obtained from Grant Agreement NUMBER 101036683 – TransformAr and from 1:1 discussion with partners.

⁴ Actionable Adaptive Solutions Groups established in Grant Agreement NUMBER 101036683 – TransformAr section 1.4.3.

Governance schemes	Resilience index (RI) - Stimulate behavioural change through the creation of a resilience index for the mussel aquaculture sector	UVIGO
	Coastal contracts (COAST) - Instrument for ensuring greater coordination between different levels of spatial planning and authorities in charge of coastal wetlands management, while limiting conflicts between preservation issues and economic activities. Promotes voluntary agreements between public institutions and private individuals, new forms of institutional cooperation, new ways of integrating the different practices of spatial and sectoral planning	CMCC MEDSEA
	Demand analysis for social services/infrastructures (DSI) - Continuous assessment of climate “deep resilience” of SI, following H2020-EU-CIRCLE project methodology, creating stronger social networks and reducing inequality	MOE
	Climate Innovation Hub (CIH) - Within the existing Municipal Innovation Hub, promoting green, resilient and climate friendly entrepreneurship towards the creation of a Climate Innovation Hub.	MOE
Insurance, financial and economic schemes	Green bonds (GB) - The identification and use of change-agents as a broker between private buyers and private sellers that allow for complex and layered environmental goods and services to be transacted. The role of the change-agent is to pull together all stakeholders and seek agreement on the protocols needed to assess the costs and the benefits either to secure future public funding or the measurement, accounting and verification needed to make goods and services bankable	WRT
	Adaptation fund (AF) - Various financial flows exist, from the French public agencies at local and national level, but also EU-wide. For investments at local level, in this case the overseas region of Guadeloupe, there is no harmonised vision on financing in climate change adaptation. A need exists for better cohesion to direct existing flows into specific types of adaptation’s actions. Mechanisms will be setup, resulting in a fund, on how to bundle and catalyse financial flows in Guadeloupe with the specific aim of climate adaptation	ADEME
	Choice experiment for investors (CEI) - Choice experiments for stormwater management system upscaling	UA LUT NTNU LAPPERANTA
	Insurance mechanism (INSUR) - Development and validation of damage functions, as part of climate proofing	MOE LAPPERANTA CETMAR ADEME WRT CMCC MEDSEA

The most recent update to the list of Key Exploitable Results, including their development stage, involved partners, and potential, was carried out on Month 39. Partners were requested to deliver the most updated data available about each of the solutions part of the list of actionable adaptive solutions (decided to be addressed in the final exploitation plan as final list of Key Exploitable Results). This update ensured the delivery of the most current and comprehensive Exploitation Plan, these partners contributions are detailed in Table 5.4, and were the base to update and deliver the Final Exploitation Plan.

Table 5.4 TransformAr list of exploitable assets final update⁵

SOLUTION	DESCRIPTION REDEFINITION	DEMOSTRATOR	UNIQUE SELLING PROPOSITION / VALUE PROPOSITION	IDENTIFIED TARGET GROUPS
Citizen App (CAF) - Mobile application for crowd sensing and real time monitoring of extreme flooding events due to CC events by citizens.	<p>MOG: The Citizen app is a web app (mobile adaptive web page) where citizens are able to report flooding events to the municipality. The citizens can report location, description and upload photos. All observations from the app are visible to all users, including their status (Received, Investigating, Solved, etc.). The reporting citizen can choose how they want to be notified about the handling of the situation.</p> <p>LAPP: CitySen.App is a progressive web application which operates directly in the browser without downloading from app stores. The target audience of the application are the citizens, who can report anomalies e.g. flooding and upload photos of them or give feedback to the city. Citizens can also view the situation in storm water system: quantity and quality of storm water. Also, street works, air quality and weather information are distributed. Via CitySen.App citizens and especially schools can participate in citizen science. There is a observation form, where users can upload their own water sample data. Observations are visible to other users in the map.</p>	Municipality of Gjøvik (MOG) City of Lappeenranta (LAPP)	The municipality cannot have sensors and cameras to cover the entire city. Allowing the citizens to report floodings, we have a better overview, and we are better able to prioritize measures and handle flooding events. Raising awareness through reporting and observation.	Citizens, schools
Integrated constructed wetlands (ICW) - Nutrient and soil management measures to demonstrably control farmyard run-off by catching nutrients, sequestering carbon and creating additional water for farmers.	Restoration and creation of wetlands and creation of riparian buffers	Westcountry Rivers Trust	A multi-benefit solution that provides a range of benefits including, slowing the flow, reducing N and P inputs, improving summer base flow	
Smart Grid for coastal management (SG) - Smart sea-opening system using rapid unhooking grid and gates for emergency opening in case of extreme events.	The SG and the monitoring solution are part of NBS, focused on restoring the Marceddi and San Giovanni wetland system (Sardinia). The solution aims to collect key water quality parameters, support long-term assessments and improve water circulation management by testing a prototype of SMART GATE controlled by a multi-parameter algorithm.	MEDSEA Foundation	Testing an automatic system to control and regulate the water circulation between freshwater input from the river mouth and the brackish water of the San Giovanni Pond.	
Urban run-off system (URB) – a biofiltration area, that captures	Biofiltration area is filtering the stormwater and reducing pollutants. The aim is to reduce the amount of water led to storm water sewer system, to filter harmful	City of Lappeenranta (LAPP)	Decentralised nature-based stormwater management in the city centre.	

⁵ This list was building on contributions from involved partners gathered during project month 36

and treats runoff and storm water from the surroundings street and sidewalk in the city centre of Lappeenranta.	substances, such as heavy metals and nutrients, and to ensure the formation of groundwater.			Fishing and agriculture sectors and public authorities.
Digital monitoring (SWMM) - Monitoring system with simple probes to monitor flow rates and water quality through individual modules. The monitoring user interface will be made visual and browser-based, enabling access from any smartphone or laptop. Publicly displayed information will be accessible to all.	Information is not publicly available. Selected information (e.g. quantity and quality of storm water in the system) is accessible via CitySen.App. (LAPP)	Municipality of Gjøvik (MOG) City of Lappeenranta (LAPP)	Decentralised nature-based stormwater management in the city centre.	Inhabitants, industry and research community's resident.
Smart climate solutions (SCS) - To acquire a detailed view of the micro-climatic conditions, with focus on better understating of the fine scale flows and heat exchanges leading to urban heat island, its diurnal variation and supporting studies apportioning its origins and determination factors. Data will be used in addition to existing environmental, transport, energy data from the city forming a city-wide IoT to be used in other relevant action.	Smart climate solutions (SCS) - To acquire a detailed view of the microclimatic conditions, with focus on better understating of the fine scale flows and heat exchanges leading to urban heat island, its diurnal variation and supporting studies apportioning its origins and determination factors. The data are publicly available via the citizen app. Data will be used in addition to existing environmental, transport, energy data from the city forming a city-wide IoT to be used for the development of the MOE Digital twin. Beyond the TransformAr initiative, the data collected through the Smart Climate Solutions (SCS) will be used to monitor the effectiveness of various actions and measures implemented in MOE. By comparing measurements and relevant indicators before and after implementation, this data will facilitate the quantification and formulation of evidence-based policy recommendations.	Municipality of Egaleo (MOE), Greece	Realtime weather information and air quality.	Citizen app users (data accessible) Local authorities Research institutes
Mussel raft monitoring (MRM) - Environmental and hydrodynamic sensors based on the implementation of IoT low-cost monitoring solutions powered by solar energy. Digitalization will allow knowing in real-time the state of the platform, alarms in case of risky water conditions, production monitoring and the construction of a comprehensive database	Mussel Raft Monitoring (MRM): CETMAR has pioneered the digitalization of mussel rafts to enable real-time production monitoring. This tool's design and implementation has been carried out in close collaboration with mussel production stakeholders, adapting to their needs. It focuses on the collection of extensive real-time data from mussel rafts to optimise the management of mussel production, particularly in response to climate-related challenges.	GALICIA - CETMAR	IoT solution viable for the marine environment and adapted to mussel farmers needs	Mussel Farmers Industry Associations Local Authorities and Policymakers Research Institutions Social-Environmental Organizations

<p>Intertidal monitoring (INTERM) - To improve the knowledge of environment behaviour and numerical modelling to predict banks response under changing environmental conditions.</p>	<p>Intertidal Monitoring (INTERM): The sedimentological knowledge increase and the application of an up-to-date morpho-dynamic model by UVIGO-GEOMA, enhances our understanding of the intertidal sandbank response to climate change. It provides valuable insight for adapting production in the face of changing environmental conditions.</p>	<p>GALICIA – UVIGO</p>	<p>A sedimentological monitoring solution based on shellfishes needs to improve scientific knowledge to support managements decisions</p>	<p>Shell-fishing sector Research institutions</p>
<p>Nudging (NUDG) - Nudge design and understanding the factor of personalization (based on the Lytics program). Cognitive design artefacts and behavioural economics artefacts released to end-users at specific moments in time, often correlated to a trigger and state of mind, to develop a new sustainable behaviour focusing mainly on tourism in the project implementation</p>	<p>Nudging is a behavioural strategy that subtly influences individuals to make choices that benefit themselves or society without restricting their freedom. As part of the TransformAr project, ADEME and Verhaert piloted a nudging experiment in Guadeloupe to reduce water usage in hotel showers. Flyers, stickers, and sensors were used in 17 establishments, with data from the initiative contributing to climate adaptation strategies in Guadeloupe.</p>	<p>Guadeloupe, France</p>	<p>A scalable, cost-effective behavioural solution for reducing water consumption in the hospitality sector, promoting climate adaptation while empowering stakeholders with actionable insights to drive sustainability. This emphasizes the experiment's uniqueness:</p> <p>Behavioural focus: Subtle, non-coercive interventions (nudges) encourage eco-friendly behaviour without imposing restrictions.</p> <p>Low-cost and scalable: Relies on simple tools like flyers and sensors, making it replicable across regions and sectors.</p> <p>Environmental impact: Directly addresses water conservation, contributing to climate resilience. Stakeholder engagement: Actively involves hotels and tourists in sustainability efforts, fostering awareness and participation.</p>	<p>Tourists, Hotels and Accommodations providers, Local communities, Local authorities</p>
<p>Awareness-raising and behavioural change modules (AWAR) - Monitor the impact of the project activities on the local population - educational material to be developed for the young and school pupils to promote climate neutrality and awareness, perception of CC and potential impacts.</p>	<p>MOE develops and tests a curriculum of 45 min for pupils between 13-15 years old related to climate change understanding and climate awareness. Beyond this, a living lab is being created with the participation of the community, within the framework of which stakeholders design actions to address the impacts of climate change.</p>	<p>Municipality of Egaleo (MOE), Greece</p>	<p>AWAR is expected to enhance young people's understanding of climate change and address common misconceptions about its nature, impacts, and potential solutions. By doing so, it aims to foster a more climate-aware generation that actively pursues mitigation and adaptation efforts at both the municipal level and through broader social transformation. Additionally, through the community's involvement in decision-making processes for addressing the phenomenon of climate change, citizens will become more aware of actions to combat the issue, collaborate with and trust municipal services, and take a more active role in the municipality's initiatives.</p>	<p>Local students Teachers Schools Parents</p>
<p>Resilience index (RI) - Stimulate behavioural change through the creation of a resilience index for the mussel aquaculture sector.</p>	<p>The Resilience Index (RI) is a comprehensive assessment tool designed by UVIGO-REDE to evaluate adaptative capacity of the galician mussel aquaculture sector in response to climate change. It provides insights into risks scenarios caused by the effects of climate change and identifies the key resilience factors available for adaptation. This index is built through the gathering of scientific data, consultation with experts and stakeholders on the one hand, and modelling of data on the other hand. This knowledge support practitioners and</p>	<p>GALICIA – UVIGO</p>	<p>The RI excels in providing a tailored framework that combines quantitative data with qualitative insights, enabling stakeholders to make informed decisions. It guides the design of actionable risk mitigation strategies, helping to optimise resource allocation and improve the overall resilience of the mussel aquaculture sector. By addressing both current and emerging climate challenges, IR serves as a crucial tool for sustainable development.</p>	<p>Mussel Farmers Industry Associations Local Authorities and Policymakers Research Institutions</p>

	<p>policymakers to carry out informed decision-making processes and define efficient strategies for enhancing the sustainability and resilience of the production processes of the Galician mussel aquaculture.</p>			
<p>Coastal contracts (COAST) - Instrument for ensuring greater coordination between different levels of spatial planning and authorities in charge of coastal wetlands management, while limiting conflicts between preservation issues and economic activities. Promotes voluntary agreements between public institutions and private individuals, new forms of institutional cooperation, new ways of integrating the different practices of spatial and sectoral planning.</p>		<p>MEDSEA Foundation</p>	<p>COAST facilitates a cross-sectoral cooperation overcoming the fragmentation of local governance to:</p> <ul style="list-style-type: none"> -mitigate negative impacts of human activities. -enhance water quality and circulation. -increase resilience to climate change. 	<p>Public authorities Economic sectors (fishing, agriculture, tourism) Trade associations Citizens</p>
<p>Demand analysis for social services/infrastructures (DSI) - Continuous assessment of climate "deep resilience" of SI, following H2020-EU-CIRCLE project methodology, creating stronger social networks and reducing inequality.</p>	<p>MOE offers a range of social and health services to its citizens. Due to the impacts of climate change, the demand for these services is expected to shift. In preparation for maintaining uninterrupted service provision and addressing future demand, a comprehensive demand analysis of social services and infrastructure will be conducted.</p>	<p>Municipality of Egaleo (MOE), Greece</p>	<p>This analysis will generate data to inform the development of an adaptation strategy, considering the future supply and demand of social services.</p>	<p>Vulnerable citizens of Egaleo</p>
<p>Climate Innovation Hub (CIH) - Within the existing Municipal Innovation Hub, promoting green, resilient and climate friendly entrepreneurship towards the creation of a Climate Innovation Hub</p>	<p>MOE transforms a multi-purpose facility into a Climate Innovation Hub by: (a) establishing a permanent exhibition on climate change and the TransformAr solutions implemented by MOE, (b) showcasing real-time data streaming from Smart City Systems (SCS) along with the post-processed indicators, and (c) organizing a series of events aimed at promoting climate innovation (e.g., datathons).</p>	<p>Municipality of Egaleo (MOE), Greece</p>	<p>These initiatives will provide public access to MOE's data and encourage the development of innovative solutions to address the municipality's climate-related challenges.</p>	
<p>Green bonds (GB) - The identification and use of change-agents as a broker between private buyers and private sellers that allow for complex and layered environmental goods and services to be transacted. The role of the change-agent is to pull together all stakeholders and seek agreement on the protocols needed to assess the costs and the benefits either to secure future public funding or</p>	<p>The concept 'Green Bonds' doesn't fit to the solution described, but the description is accurate to what WRT have been implementing. I would better be renamed as 'delivery partnerships'.</p>	<p>Westcountry River Union</p>	<p>The unique value proposition of delivery partnerships is that they simplify, and therefore accelerate, investment in climate change adaptation. By removing the need for sellers and buyers to interact on a case-by-case basis, it becomes much simpler to aggregate credits/ natural capital products for sale, and buyers find it easier to interact with one marketplace to meet targets/achieve necessary offsets. Delivery partnerships with a third-sector organisation capable of delivering conservation works, as well as arranging market opportunities, also helps to establish and maintain high-quality interventions. Ensuring high-quality outcomes for nature.</p>	<p>Corporations</p>

the measurement, accounting and verification needed to make goods and services bankable.				
Adaptation fund (AF) - Various financial flows exist, from the French public agencies at local and national level, but also EU-wide. For investments at local level, in this case the overseas region of Guadeloupe, there is no harmonised vision on financing in climate change adaptation. A need exists for better cohesion to direct existing flows into specific types of adaptation's actions. Mechanisms will be setup, resulting in a fund, on how to bundle and catalyse financial flows in Guadeloupe with the specific aim of climate adaptation.	The Adaptation Fund is a financial mechanism designed to support the development and implementation of projects that help vulnerable communities adapt to the impacts of climate change. Unlike traditional funds focused on mitigation, the Adaptation Fund specifically targets efforts to build resilience against climate risks such as floods, droughts, and extreme weather events. In Guadeloupe, the Local Adaptation Fund (FLAG) was established as part of the TransformAr project to fill the gap where most funding was previously directed toward mitigation efforts. FLAG is France's most advanced adaptation fund, aiming to reallocate resources for local climate solutions, foster partnerships, and bridge public-private gaps. FLAG has already supported six adaptation projects totaling €1.24 million, with contributions from both public and private investors.	Guadeloupe, France	Localized focus: Designed to meet Guadeloupe's specific adaptation needs, such as managing hurricanes, droughts, and coastal erosion, which are not adequately addressed by generic funding mechanisms. Adaptation-first: Fills a critical gap by focusing exclusively on climate adaptation, whereas previous funds in the region primarily targeted mitigation Public-Private synergy: Bridges the gap between public needs and private sector interests, fostering diverse partnerships and co-financing opportunities Inclusive financial accessibility: Supports smaller-scale, locally relevant projects that might not meet thresholds for larger national or international funding schemes Innovation in adaptation: Promotes governance, nature-based solutions, technology, and behavioral change projects tailored to local risks Flexible funding model: Employs financial engineering to manage multiple funding sources, ensuring adaptability to local needs Replicability: Serves as a pioneering model that can inspire similar funds in other regions facing climate adaptation challenges	
Choice experiment for investors (CEI) - Choice experiments for stormwater management system upscaling.	Survey for citizens (homeowners etc.), to find out their willingness to pay for storm water solutions on their own property.	Municipality of Gjøvik, City of Lappeenranta	Input to local and regional authorities	Population, municipality, regional authorities
Insurance mechanism (INSUR) - Development and validation of damage functions, as part of climate proofing		City of Lappeenranta Municipality of Gjøvik (MOG) Guadeloupe, France Westcountry River Union Municipality of Egaleo (MOE), Greece MEDSEA Foundation GALICIA – UVIGO GALICIA - CETMAR		

6.0 LIST OF EXPLOITABLE RESULT(S)

From the different actions of project results identification, a selection of outcomes deemed exploitable was made to analyze their exploitation potential. The chosen results include the actionable adaptive solutions, categorized in Table 6.1 by type. Solutions classified as knowledge are organized into three groups, each encompassing related solutions following GA originally defined distribution. This grouping approach was adopted after analysis revealed that considering the solutions as part of a group enhances their overall exploitation potential.

From the final result collection data executed during month 36, the mayor modifications were referred to the solution Integrated constructed wetlands (ICW), will now on be referred to as Restoration and creation of wetlands and creation of riparian buffers (RCWRB), as gathered in table 5.4 as a description redefinition supplied by involved partners. Other specific descriptions of results were updated as well based on the last result collection; this updated data was used in the result definition included as part of results exploitation analysis (section 7).

As part of the list of exploitable results 6.1, those considered under dissemination efforts are included as well. However, **this report focuses on stating a final exploitation plan for technological and knowledge solutions, since specific efforts for results that are being disseminated are already being executed as part of work package 7.**

Since the project implementation period is still ongoing, potential new results will continue to be monitored. Additionally, the defined exploitation potential will be adjusted if its necessary based on current findings.

Table 6.1 TransformAr exploitable assets⁶ classification for exploitation analysis

TYPE OF RESULT	RESULTS
TECHNOLOGY	<ul style="list-style-type: none"> • Citizen App (CA) • Restoration and creation of wetlands and creation of riparian buffers - Integrated constructed wetlands (RCWRB) • Smart Grid for coastal management (SG) • Urban run-off system (URB) • Digital monitoring (SWMM) • Smart climate solutions (SCS) • Mussel raft monitoring (MRM) • Intertidal monitoring (INTERM)
KNOWLEDGE	<ul style="list-style-type: none"> • Behavioural change and awareness-raising solutions • Governance schemes • Insurance, financial and economic schemes
DISSEMINATION	<ul style="list-style-type: none"> • D3.2.1. Adaptive Transformation Playbook⁷

⁶ Data obtained from Grant Agreement NUMBER 101036683 – TransformAr and from the activities detailed in result collection section.

⁷ [Playbook Version 5 \(TransformAr\)](#)

	<ul style="list-style-type: none"> • Data visualisation platform⁸ • Mission and Green Deal Success Stories • Policy Brief on Transformational Adaptation • Replication guide • Replication potential of individual solutions • Other outputs from various WPs
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7.0 EXPLOITATION ANALYSIS

The exploitation analysis was conducted applying Strategic Intelligence methodology, aiming to indemnify other initiatives working on related topics.

For this, the starting point is a State-of-the-Art Analysis, for Technical Solutions, the data bases consulted were patents, meanwhile, for Knowledge Base Solutions, the data bases consulted were projects, news and initiatives.

For all the solutions, the same procedure was followed.

1. The Innovation and Exploitation Manager **reviewed the result data available** to define the result characteristics and **execute a first version of the State of the Art (SoA) analysis**.
2. The **results** analysed with its **characteristics definition** and first **SoA results** were **shared with partners** to allow those involve validating definitions and commenting on their specific interests on the results.
3. During the 5th consortium meeting the results were **in person share with partners** taking the opportunity of **creating a slot for discussion and feedback collection**. **In person meetings** took place during the meeting and **key information about results was collected** to improve the first analysis version.
4. **The analysis of the results was updated completing the data with the feedback obtained from the partners**
5. The **data form the final consultation**, executed at month 39 (see table 5.4), with partners was **applied to finally updated the database consultations and conduct visual analysis of obtained outputs** to complete the exploitation analysis

This section includes a final exploitation analysis of project results included in Table 6.1, following the same structure, that will be the base to propose the exploitation plan of project results.

7.1 Citizen App (CA) - Mobile application for crowd sensing and real time monitoring of extreme flooding events due to CC events by citizens.

Two partners are working on specific implementations of the solution Citizen App (CAE and CAF), focusing on the necessities that are regionally identified.

MOE, Municipality of Egaleo, developed and app already available in google store for final users, **CAE**, for gathering and distributing information; (1) it will used to **crowdsource data** about **climate awareness** of citizens of MOE via questionnaire, (2) to disseminate TransformAr's MOE solution to the public and (3) to provide **notifications for climate related events**.

⁸ kfo.pik-potsdam.de/eur/index_en.html?language_id=en



City of Lappeenranta (LAPP), together with LUT, NTNU, Verhaert and the replicator municipality of Gjøvik (MOG), city of Lappeenranta was developing and implementing a citizen application, **CAF**, for **crowd sensing** and real time monitoring of **anomalies due to climate change events**. The overall objective of Citizen app is to **raise awareness of climate change** and **stormwater management** and enable **feedback** from citizens.

The implementation in LAPP, as a CitySen.App is a progressive web application which operates directly in the browser without downloading from app stores. The target audience of the application are the citizens, who can report anomalies e.g. flooding and upload photos of them or give feedback to the city. Citizens can also view the situation in storm water system: quantity and quality of storm water. Also, street works, air quality and weather information are distributed. Via CitySen.App citizens and especially schools can participate in citizen science. There is an observation form, where users can upload their own water sample data. Observations are visible to other users in the map.

Meanwhile, the replication in MOG, the Citizen app is a web app (mobile adaptive web page) where citizens can report flooding events to the municipality. The citizens can report locations, descriptions and upload photos. All observations from the app are visible to all users, including their status (Received, Investigating, Solved, etc..). The reporting citizen can choose how they want to be notified about the handling of the situation.

7.1.1 State of the art

First it includes the definition of the results defined by characteristics and the Key Words associated with each of them, updated at project month 40.

Table 7.1 Citizen App (CA) definition.

Characteristic	Key words
Mobile application	Mobile/Application/App
In city application	Citizen/City/Inhabitant
Detection and alert system	Alert
Extreme climate events	Flood/ Event/Climate
Monitoring system	Monitoring/Monitor/Detect
Crowdsensing	Crowdsensing
Reports	Location/Description/Photos
Web application	Web/Without downloading
Information	Street works/Air quality/Weather

Based on the key words defined, a set of search strategies were designed to identify technologies related to the topic. The results obtained from each search strategies were filtered by year (those with a prior date after 2021) to select the newest developments. The result number obtained was filtered by applying an analysis using key related words and the knowledge about the result definition itself.

Table 7.2 Citizen App (CA) search strategies and results obtained.



Strategy code	Search strategy	Result number	Results year filtered ⁹	Results key word filtered
CA.1	((FLOOD?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (EVENT?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (MONITOR+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (CITIZEN?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (ALERT)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	510	123	13

A total of **13 patent documents**, included in the next table, was selected as relevant available solutions in the State of the Art for the solution Citizen App (CA) - Mobile application for crowd sensing and real time monitoring of extreme flooding events due to CC events by citizens result, and were analysed to identify exploitation means considering the potential implementation on society identified.

⁹ 1 AND EAPD >= 2021

Table 7.3 Relevant patent document identified in the SoA related to Citizen App (CA).

Code	Title	Assignee	Summary
IN202341053708	Internet of things based smart flood monitoring and early alerting system	<p>Anish T P Hemavathi S Kavitha D Kiruthika S Lakshmi Muthu K Mubarakkaa Fathlma Prathipa S Sabena S Sabura Ummu H Velmurugan Jayasakthi K</p>	<p>The IoT Early Flooding Detection & Prevention System is an intelligent system that keeps a close watch on a variety of natural phenomena in order to anticipate a flood. This enables us to be cautious and lessen the harm brought on by the flood. For instance, floods are a terrible natural calamity, that can cause death and property destruction. In order to lessen the effects of flooding, the technology uses a range of environmental factors to identify flooding. To identify a flood, the system monitors a number of environmental variables, such as humidity, temperature, water level, and flow rate. Due to the system's wifi connectivity, IoT can be used to access the acquired data from any location. To learn more about the aforementioned natural components, the system comprises many sensors, each of which collects data for a particular parameter. The system includes a DHT22 Digital Temperature Humidity Sensor to keep track of temperature and humidity changes. It is an advanced sensor module that includes resistive temperature and humidity detecting parts. A float sensor continuously checks the level of the water by actuating circuits (dry contacts) as the water level rises and falls. It normally rests closed, signifying that the circuit is closed and that no current is flowing through the wires at this time. When the water level drops below a predefined threshold, the circuit completes itself and delivers electricity to sound an alert. The flow sensor in the system keeps track of water flow. The water flow sensor consists of a plastic valve body, a water rotor, and a hall-effect sensor. Water flowing through a rotor causes it to roll. Depending on the flow rate, it moves at a varied speed. Additionally, the system includes an HC-SR04 ultrasonic rangefinder distance sensor. According to the SONAR concept, an ultrasonic wave is used by the ultrasonic sensor to determine how far away an object is from it. Each sensor has a Raspberry Pi attached, which processes and saves data. The system's Wi-Fi function makes it simple to access the system and its data over the Internet of Things.</p>

IN202341057223	Integrated automatic flood alert system using iot	<p>Deepa R Jayaraj V Nageswari D Pavithra M Raja M A Saranya R Sivakami K Vasanth Siva R Vinay Sai K Yadav Narendra M</p>	<p>The integrated automatic flood alert system using IoT is an innovative solution that combines IoT technology, sensors, data analytics, and GIS integration to revolutionize flood monitoring and disaster management in vulnerable regions. Deployed in environmental monitoring and disaster management fields, the system continuously collects real-time data on crucial environmental parameters, such as water levels, rainfall, and river/stream flow rates. Advanced data analytics and machine learning algorithms process the data, identifying potential flood risks and triggering automated alerts to local authorities and residents at risk. The integration of GIS technology offers spatial visualization, aiding informed decision-making. With its proactive approach and timely warnings, this IoT-powered flood alert system enhances community resilience, minimizes damage, and saves lives during flood events.</p>
IN202141001048	Information dissemination system and method for failsafe broadcasting of emergency alert information to public	<p>Gottumukkala Shanmukha Teja Varma Kishan Sanku</p>	<p>Exemplary embodiments of an information dissemination system and method for failsafe broadcasting of emergency alert information to public, comprising an information dissemination device configured to receive an emergency alert information from a first computing device through a first network, the information dissemination device configured to analyse and decode the emergency alert information and broadcast the emergency alert information to at least one: a second computing device; and one or more public addressing systems through a second network, the second computing device and the public addressing systems are operated by public; and a cloud server configured to monitor one or more health parameters of the information dissemination device over the first network at regular intervals of time, the cloud server configured to troubleshoot the information dissemination device.</p>
IN202311013706	A system based on cloud, ml & internet of things for early warning of flooding disaster	<p>Aggarwal Mukul Aggarwal Priyanka Arti Ranjan Kaur Inderpreet Kumar Amit Kumar Satendra Kumar Vijay Nayak Sanjay Kumar Sharma Kamal Kant</p>	<p>Overflowing lakes and rivers cause flooding. Dams sometimes break, releasing massive amounts of water. Water enters the soil and "floods" the area. Stations involve riverbanks. Street infrastructure floodwater contains bacteria, sewage, and chemical spillage from waste sites, causing a variety of diseases. Real-time river stage data can help predict floods. Understanding the storm's length, intensity, and area helps determine the flood's severity. We use a raspberry pi with water and rain sensors to predict floods, alert authorities, and sound alarms in nearby villages using IOT. Water sensors measure water levels in three locations. Three different rain sensors measure rain levels in those three areas.</p>

		Sharma Swati Singh Atul Pratap Singh Rinki Yadav Neha	Arduino sends IOT sensor data. The system warns villages and areas that may be affected by flooding by predicting how long it will take. The system calculates the flood's arrival time and alerts people to evacuate. This system suggests a flood-alert system. It can also aid multiple government agencies in preventing floods and other natural disasters. The model has been tested and works. It will track every flood risk. It alerts immediately if water level and speed rise. It also facilitates recovery from this disaster. It will aid the community in making quick decisions and disaster preparation.
CN113110200	Urban inland inundation early warning system based on weather and rainfall flood model	CHENGDU CHANGDAO TECHNOLOGY	The invention discloses an urban waterlogging early warning system based on a weather and rainfall flood model . The urban waterlogging early warning system comprises an Internet of Things data acquisition end, a data processing system, a data processing cloud platform module, a weather data storage and analysis system, an early warning publishing module and a decision scheduling module. According to the invention, real-time early warning and monitoring of rain conditions, water conditions, working conditions and disasters can be realized, and real-time interaction of flood prevention business working conditions can be realized; besides, the remote monitoring of the operation of the pump gate station provides decision support for management work such as monitoring and early warning, flood prevention scheduling, post-disaster reconstruction and the like, so that the emergency capacity of urban management departments for coping with pipeline fracture, rainfall flood waterlogging and other crisis events is improved, and the stable operation of a drainage system is ensured.
KR20230005642	Urban flooding citizen support service provision system	CORETECHNOLOGY	The present invention relates to a system for providing a victim submersion citim support service , which enables prediction and prevention of submersion through prediction simulation on the basis of a risk region in which human and property damage are of concern when submersion occurs in the victim, and minimizes the damage to citim when submersion occurs through guidance of an epidermis/bypass path associated with an alternate state of the region and rapid real-time situation propagation.
US20220377522	Emergency data communications for citizen engagement	RAPIDSOS	Disclosed herein are systems, devices, media, and methods for providing emergency data communications for citizen engagement . An embodiment operates by providing an emergency data submission link regarding an emergency notification to a plurality of communication devices. Emergency data

			<p>submissions are received with the link, where each submission includes an emergency location. The embodiment verifies the submissions to generate a set of submitted emergencies incidents, and displays the incidents within a graphical user interface (GUI) of an emergency response application. An embodiment operates by receiving emergency data related to a plurality of emergency incidents. The embodiment generates a heatmap that graphically represents a density of a plurality of emergency incidents. The embodiment identifies clusters of emergency incidents on the heatmap and displays the heatmap within an interactive map within a GUI of an emergency response application accessed by an emergency service provider (ESP).</p>
US20220155071	Environment Sensor Platform, System and Method	GREEN STREAM TECHNOLOGY	<p>The instant innovation presents a real-time environmental-sensing platform and system and method for water level monitoring, reporting and human warning. The platform, system, and method monitor rising water levels throughout a given geographical area and provides real-time and trending data on flooding and flooding risks. The instant innovation utilizes an environmental sensing platform comprised of a plurality of sensor nodes that may be geographically dispersed for both collecting environmental data on a regular or variable-frequency schedule and transmitting the environmental data. The instant innovation further utilizes one or more wireless communication protocols configured to receive and transmit the environmental data, a cloud platform configured to receive, store, analyse and support real-time stream processing of the environmental data and generating environmental data reports thereof, and an external device for receiving, relaying and/or displaying report and alert information received from the cloud platform.</p>
CN115577908	Base-level emergency management mobile intelligent series platform and equipment	ZHOU JINGYI	<p>The invention relates to the technical field of intelligent emergency management and discloses a grassroots emergency management mobile intelligent series platform and equipment, and the platform comprises a first-stage management platform, a second-stage management platform and a third-stage management platform which are in communication with one another. The first-level management platform, the second-level management platform and the third-level management platform are each provided with a scene monitoring system, a command communication system, a rescue management system, a propaganda and warning system and a post-disaster disposal management system. The scene monitoring system is used for monitoring and collecting disaster accident information; the rescue management system is used for</p>

			comprehensively counting and updating rescue reserve information of each block of the base layer; the command communication system is used for intelligently managing disasters and accidents and commanding rescue; the propaganda warning system is used for commanding personnel to perform propaganda plan drilling; and the post-disaster disposal management system is used for performing post-disaster damage assessment and generating post-disaster reconstruction suggestions. According to the invention, a dynamic, reliable and systematized intelligent emergency management scheme can be provided, and a better emergency management effect is achieved.
IN202121040877	Sos-message based audio looping security system	Meshram Ashish Markhandi	The present invention relates to safety of family, people, women, children and senior citizens and extended to almost every specific purpose requiring emergency assistance . It might provide support to law protector agencies to act speedily to any distress signals. Inclusive, this could increase personal safety. Now-a-days the principal accountability for personal defences has continuously collapsed on the individuals. This is right irrespective of the community where one lives. Police departments aren't able to protect everyone. Today, many innocent people discovered themselves victims of crime. The nature of the crime varies from minor misdemeanours, such as theft to violent assault such as rape or murder. Typically, the victim of a crime is physically unable to avoid or prevent an occurrence. This invention brings with multi-security model to protect such kind of attacks.
US20220090927	Multi-Hazard Spatio-Temporal Zone-Based Evacuation Management Platform	GENASYS	Systems and methods providing for zone-based evacuation management . The systems and methods involve allowing a user to select zones from a user interface. The zones properties may be modified by the user. The user may create evacuation pre-plans for selected zones for different types of incidents. Different scenarios may be used in the creation of the plan. The scenarios may use simulation models to determine the affected zones and the rate of spread of the incident. The systems and methods may also generate and send notifications and alerts to the people residing within the affected zones as well as police departments and fire departments with jurisdiction over the affected areas.
IN202341088741	Real-time flood monitoring and alert system with modbus protocol integration	Glan Devadhas G Shinu M M Harinand K Manoharan Navami	The state of Kerala, grappling with the devastating impact of floods and landslides, necessitates an innovative approach to timely monitoring and alerting systems. Despite the presence of wireless monitoring systems, the existing alert mechanisms often falter due to a separation between data collection and processing. This invention introduces a comprehensive system designed for real-

		<p>Shahabas P P Dhanoj Mohan</p>	<p>time acquisition and statistical processing of measured data in flood-prone regions. By strategically placing wireless monitoring devices, the system continuously analyses flood levels and landslide indicators, instantly alerting the public when predetermined thresholds are breached. Utilizing the Modbus protocol for seamless communication, shared variables enable efficient data exchange between the monitoring devices and processing units within the SCADA system. This integrated approach ensures swift and reliable transmission of critical information, empowering communities to respond proactively to imminent threats, thereby minimizing loss and safeguarding lives and property.</p>
<p>KR10-2023-0005642</p>	<p>Urban inundation citizen support service providing system</p>	<p>ROH GYUN TAEK YUN YOUNG HAN</p>	<p>The present invention relates to an urban flooding citizen support service provision system, which allows flooding prediction and prevention to be made through predictive simulation for risky areas where human life and property damage are concerned when flooding occurs in an urban area, but can minimize damage to citizens in the event of flooding through evacuation/detour route guidance linked to local traffic conditions and rapid real-time situation propagation.</p>

7.1.2 Analysis of selected patents

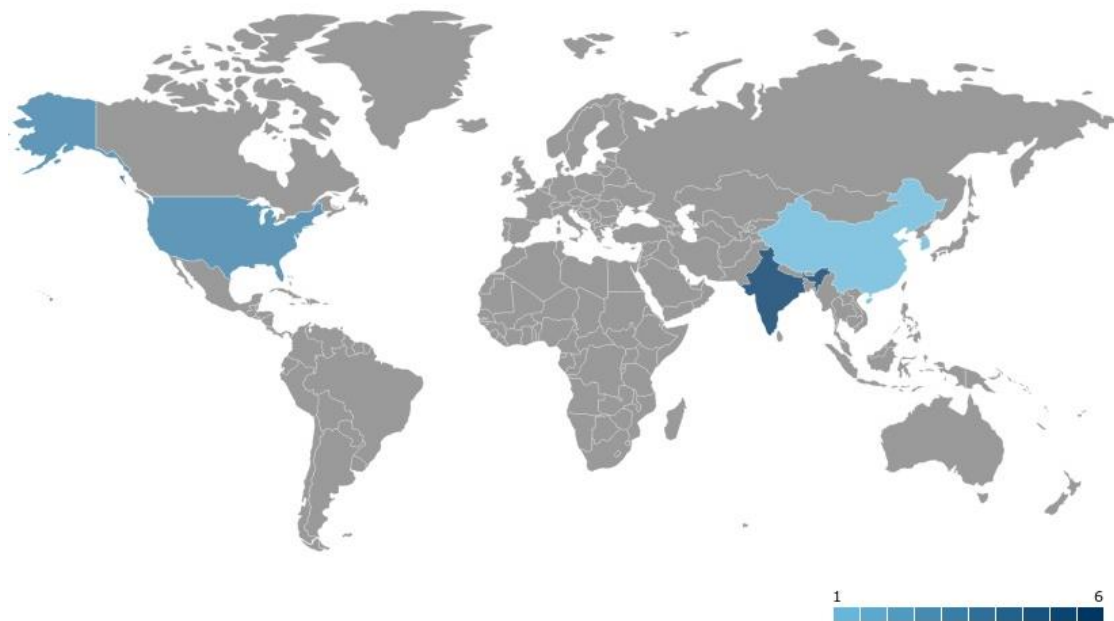


Figure 7.1 Geographical distribution of relevant patent document identified in the SoA related to Citizen App (CA).

In relation to the selected patents, figure 7.1 shows the countries where patents related to the topic were registered, being India the country with the highest number of patents.

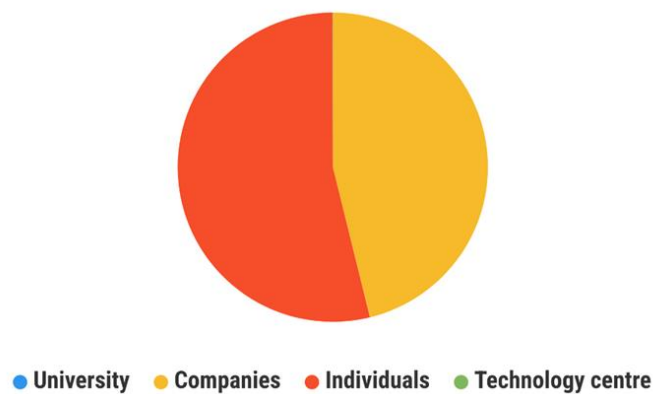


Figure 7.2 Distribution of the types of assignees of relevant patent document identified in the SoA related to Citizen App (CA)

The figure 7.2 shows that patents related to the topic were filed mainly by individuals, but also by a big number of private companies.

7.2 Restoration and creation of wetlands and creation of riparian buffers (RCRB) - Nutrient and soil management measures to demonstrably control farmyard run-off by catching nutrients, sequestering carbon and creating additional water for farmers.

The Westcountry region demonstrator sought to address the problems of **diffuse water pollution** and habitat loss relating to intensive agriculture, exacerbated by increasing rainfall and periods of drought caused by a changing climate. Initially, the solution was based in develop **Integrated Constructed Wetlands on farms, however, it was identified not to be an operative solution due to cost and the impossibility to face diffuse pollution**. Therefore, alternative solutions have been prioritised focusing on the objectives to deliver **nature-based solutions** in the form of **riparian buffers, floodplain wetlands** and **ponds** that will **capture sediment** and **reduce nutrient loading in rivers** and **increase water storage capacity** and riparian habitat in the target catchments.

7.2.1. State of the Art

First it includes the definition of the results defined by characteristics and the Key Words associated with each of them, updated at month 40.

Table 7.4 Integrated constructed wetlands (ICW) definition.

Characteristic	Key words
Riparian buffers	Riparian buffer
Floodplain wetlands	Floodplain wetland
Ponds	Pond
Sediment	Sediment
Nutrient	Nutrient
Pollution management	Capture / Reduce Management
Water storage capacity	Water capacity

Based on the key words defined, a set of search strategies were designed to identify technologies related to the topic. The results obtained from each search strategy were filtered by year (those with a prior date after 2021) to select the newest developments. The result number obtained was filtered applying an analysis using key related words and the knowledge about the result definition itself.

Table 7.5 Integrated constructed wetlands (ICW) search strategies and results obtained.

Strategy code	Search strategy	Result number	Results year filtered ¹⁰	Results key word filtered
ICW.1	(RIPARIAN BUFFER?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX	43	11	3

¹⁰ 1 AND EAPD >= 2021



ICW.2	(FLOODPLAIN WETLAND?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX	7	2	1
ICW.3	((POND?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (MANAG+ OR CONTROL OR CAPTURE)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (NUTRIENT?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (SEDIMENT?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (FARMS OR FARM OR FARMLAND)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	1688	390	9

A total of **12 patent documents**, included in the next table, was selected as relevant available solutions in the State of the Art for the solution Integrated constructed wetlands (ICW) - Nutrient and soil management measures to demonstrably control farmyard run-off by catching nutrients, sequestering carbon and creating additional water for farmers result, and were analysed to identify exploitation means considering the potential implementation on society identified.

Table 7.6 Relevant patent document identified in the SoA related to Integrated constructed wetlands (ICW).

Code	Title	Assignee	Summary
CN115977027	Method for constructing cold region riparian buffer zone for preventing and controlling agricultural non-point source pollution	JILIN UNIVERSITY	The invention is applicable to the technical field of ecological engineering , and provides a method for constructing a riverbank buffer zone for preventing and controlling agricultural non-point source pollution in a cold region, which comprises the following steps: step 1, trimming a riverbank side zone; 2, sequentially planting arbours, shrubs and herbaceous plants in the river shoreside zone; 3, an AMF fungicide is applied in the gradual freezing period and the spring thawing period; and 4, daily maintenance and management are conducted on the ecological buffer zone. After the riparian buffer zone is constructed, the vegetation coverage of the riparian zone is improved to 95% or above; the non-point source pollution interception effect is good, the load of pollutants such as TN and TP is reduced by 50% or above, the biodiversity of a shoreside zone is remarkably improved, soil erosion is effectively prevented, and water eutrophication is effectively prevented.
CN115745301	Composite short-cut denitrification aquaculture tail water treatment method	AQUACULTURE INSTITUTE OF GUIZHOU PROVINCE	The invention discloses a compound short-cut denitrification aquaculture tail water treatment method . The method comprises the following steps: pretreatment: carrying out solid-liquid separation on aquaculture tail water; short-range denitrification treatment: after at least two rounds of purification tank-filter dam treatment, entering a final-stage purification tank, and then entering an aeration tank through a bottom water passing partition wall at the tail part of the final-stage purification tank; the ecological treatment pond is used for further converting nutrient substances in the water body through wetland organisms; after being treated, the breeding tail water reaches the standard and is discharged or recycled. According to the technical method, nitrogen in the tail water can be directly and rapidly removed in the form of nitrogen, and the method has the advantages of being high in purification efficiency, good in controllability, high in practicability, convenient to manage and the like.

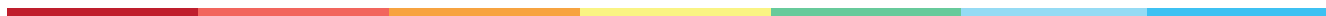
<p>CN115710879</p>	<p>Construction method of imitated natural river channel and floodplain wetland</p>	<p>RESEARCH CENTER FOR ECO ENVIRONMENTAL SCIENCES - CHINESE ACADEMY OF SCIENCES</p>	<p>The invention provides a construction method of a simulated natural river channel and floodplain wetland, which comprises the following steps: S1, constructing a simulated natural river channel and a three-level floodplain in a riverbed according to historical daily average flow statistical characteristics to adapt to river channel flow characteristics under different rainfall scenes; and S2, constructing floodplain wetlands with different characteristics according to the selected floodplain type. The ecological service function of the river channel is comprehensively improved by relying on the floodplain wetland; service functions of landscape, soil conservation, wind prevention, sand fixation and the like are realized in a non-rainfall scene; in a rainfall scene, the service functions of reducing non-point source pollution, stagnating and storing flood water, improving water environment quality and the like are mainly played.</p>
<p>CN115140893</p>	<p>Novel low-carbon water-saving recycling aquaculture farm and construction method thereof</p>	<p>HUADIAN FUXIN ENERGY DEVELOPMENT SHANGHAI WATER ENGINEERING DESIGN & RESEARCH INSTITUTE</p>	<p>The invention discloses a novel low-carbon water-saving recycling aquaculture farm and a construction method thereof, relates to the technical field of aquaculture farm structures, and aims to solve the problems that water resources are wasted and even discharged sewage pollutes the surrounding environment due to the fact that an existing aquaculture farm cannot well recycle the water resources. The system comprises an aquaculture farm, a culture fish pond is arranged in the aquaculture farm, a water inlet pump station is installed on one side of the aquaculture farm, a first power supply room is installed on one side of the water inlet pump station, a second power supply room is installed on the other side of the water inlet pump station, and solar photovoltaic panels are installed at the two ends of the culture fish pond. A water inlet pipeline is mounted on one side of the water inlet pump station, a tail water purification pond is arranged on the other side of the aquaculture farm, the tail water purification pond comprises an efficient precipitation pond, a contact oxidation pond and an aquatic plant pond, a drainage pump station is mounted on one side of the tail water purification pond, and a circulating pump station is mounted on the other side of the tail water purification pond.</p>
<p>CN115067105</p>	<p>Ecological pond system with pollution control and emission reduction effects and construction method of ecological pond system</p>	<p>EAST CHINA NORMAL UNIVERSITY</p>	<p>The invention discloses an ecological pond system with pollution control and emission reduction effects. The ecological pond system comprises a pond, a solar water pump, a rice wetland and other unit elements. Drained water of the surrounding farmland firstly converges into a pond, then a solar photovoltaic panel erected on the pond generates power and supplies the power to a water pump for operation, and the water is pumped into the rice wetland; ridges are</p>

			<p>arranged in the rice wetland to guide incoming water to fully flow through the rice field in a baffling form; a pipeline is arranged at the tail end of the rice wetland, and water is converged into the pond again, so that internal circulation is formed. Original ponds and paddy fields in the area are fully utilized, the ecological pond system is constructed, surrounding farmland drainage is purified, greenhouse gas emission is reduced, biological diversity is protected, and high-quality green ecological rice is produced.</p>
CN217148892	Small watershed river channel'pond separation 'type ecological conservation system	GUANGXI ZHUANG AUTONOMOUS REGION ECOLOGICAL ENVIRONMENT MONITORING CENTER	<p>The utility model discloses a small watershed river channel 'pond separation 'type ecological conservation system which comprises separated conservation ponds and a natural conservation pond, the separated conservation ponds are arranged on the two sides of the natural conservation pond at intervals, and river channel water is introduced through an ecological retaining dam arranged in a main river channel. And the river water treated in the separated conservation ponds returns to the main river and enters the next separated conservation pond, and ecological improvement of the river water can be carried out through such circulation. According to the utility model, a 'separated conservation pond 'and a 'main river channel sectional type conservation pond' are established in a 'river-pond separation 'mode, steady-state and dynamic combined operation of the conservation ponds is realized, damage of flood disasters to facilities is effectively avoided, and pollutants such as nitrogen and phosphorus in water are reduced to the greatest extent in an economic and ecological mode through multi-type and flexible design of the conservation ponds, so that the water conservation effect is improved. The long-acting treatment of the river channel is realized.</p>
WO2023/115781	Farmland drainage water treatment system and method based on ecological interception and cyclic purification	ZHEJIANG UNIVERSITY	<p>A farmland drainage water treatment system based on ecological interception and cyclic purification, the farmland drainage water treatment system comprising a sedimentation promotion tank (2), an ecological ditch (3), a multi-stage ecological regulation and storage pond (4), an automatic water quality testing system (7) and an intelligent water-saving irrigation system (8), wherein the sedimentation promotion tank (2) is arranged at a drainage port of a farmland, and farmland drainage water drained through the drainage port can all enter the sedimentation promotion tank (2) for preliminary sedimentation; and the multi-stage ecological regulation and storage pond (4) comprises a gradually expanding section and a main reaction zone section, which are in communication with each other. The main reaction zone section comprises an aeration tank (11), and a</p>

			<p>sedimentation tank (9), a first matter filter dam (101), a second matter filter dam (102) and a purification tank (12), of which surrounding slopes are provided with ecological protective slopes, wherein several biomimetic aquatic plants (16) suspended in a direction perpendicular to a water flow direction are evenly fixed in the purification tank (12); and the automatic water quality testing system (7) for testing whether the water quality reaches a certain standard is arranged at a water output end of the purification tank (12). The system is suitable for the interception of non-point source pollutants in farmland drainage water from growing regions of aquatic plants such as rice and <i>Zizania latifolia</i> and can effectively reduce the amount of farmland non-point source pollutants that enter a river. Further disclosed is a farmland drainage water treatment method based on ecological interception and cyclic purification.</p>
CN113772817	Pond wetland system for enhancing nitrogen and phosphorus removal of farmland recession	HOHAI UNIVERSITY	<p>The invention provides a pond wetland system for enhancing nitrogen and phosphorus removal of farmland recession. The pond wetland system structurally comprises a pond main body and an ecological water inlet ditch, the pond main body comprises an anaerobic zone, an anoxic zone and an aerobic zone; the ecological water inlet ditch is communicated with the anaerobic zone of the pond main body, the anaerobic zone is communicated with the anoxic zone, and the anoxic zone is communicated with the aerobic zone; farmland recession water firstly converges into an ecological drainage ditch for natural sedimentation and homogeneous regulation and storage, effluent water enters the pond main body through a first measuring weir, and a series of biochemical reactions such as nitrification and denitrification, dissimilatory reduction of nitrate into ammonium, anaerobic ammonia oxidation, iron autotrophic denitrification, microbial phosphorus accumulation and iron ore flocculation phosphorus removal are performed, so that the purpose of enhanced nitrogen and phosphorus removal is achieved. The method has the advantages that the method is adapted to local conditions, ponds in the existing farmland are utilized, other land resources do not need to be occupied, the structure is simple, operation management is convenient, the occupation area is small, meanwhile, the removal effect of nitrogen and phosphorus pollutants is enhanced, the effluent quality is stable, and the effluent can be reused for farmland irrigation.</p>
CN113115740	Funnel-shaped pond ecological circulating culture system and method	ZHENGZHOU AQUATIC TECHNOLOGY	<p>The invention relates to a funnel-shaped pond ecological circulating culture system. The funnel-shaped pond ecological circulating culture system is characterized in that a first circulating system is formed by a funnel-shaped fish</p>

		PROMOTION STATION	<p>pond, a fish manure separation device, an aquatic plant absorption pond and an ecological purification pond, and the circulating system is used for carrying out multi-stage purification on clear water obtained after fish manure separation and realizing cyclic utilization; a rotational flow power assisting device in the funnel-shaped fish pond accelerates the gathering speed of manure and residual feed from the conical side face of the fish pond to a sewage draining outlet in the centre of the bottom; tail water obtained after fish manure separation is subjected to multi-stage utilization and purification through the fish manure separation device, an ecological ditch, a lotus root pond, a rice field and the ecological purification pond, so that resource recycling is achieved; the fish manure collected by a sedimentation pond in the ecological ditch is fermented through a fish manure fermentation channel, so that fertilizer capable of being directly used for commercial crops is formed. According to the funnel-shaped pond ecological circulating culture system, zero emission of culture tail water is realized, the system has the advantages of energy conservation, land conservation, water conservation, high efficiency, high quality, environmental protection and the like, defects of traditional pond fish culture are overcome, and the system is a green and healthy aquatic product culture mode which is worthy of vigorous popularization at present.</p>
ZA202200501	Hydrological connectivity-based regulation and control method for water and soil conservation of riparian buffer strip	HENAN UNIVERSITY	<p>The invention discloses a riverbank buffer zone water and soil conservation regulation and control method based on hydrological connectivity. The method comprises the following steps: S1, data acquisition and processing: downloading DEM (Digital Elevation Model) and Landsat (Terrestrial Satellite) remote sensing image data of a riparian buffer zone of a research area through a geographic space data cloud platform, and obtaining a landscape configuration map of the research area through manual vectorization processing of the Landsat remote sensing image data; S2, calculating a hydrological connectivity index, namely a Flow length index, of the river bank buffer zone of the research area; S3, identifying and extracting a potential serious water and soil loss area; S4, setting a vegetation pattern scene; S5, selecting an optimal vegetation pattern; and S6, performing regulation and control based on the optimal vegetation pattern. The problems that an existing method is high in cost, time-consuming and labour-consuming, and operability is limited by various factors are solved. Therefore, the method is convenient to implement and operate, short in time consumption, small in error and high in controllability.</p>

			(From CN113052406 A)
CN113026668	Ecological sediment intercepting device for farmland ditch and maintenance method thereof	ZHEJIANG A & F UNIVERSITY	<p>The invention discloses an ecological sediment intercepting device for a farmland ditch and a maintenance method thereof. The ecological sediment intercepting device comprises a permeable dam and a sediment assembly, wherein the permeable dam is arranged in the ditch, the permeable dam is of a hollow box body structure, and an adsorption material is contained in the permeable dam; the permeable dam has water permeability in the water flow direction; and the sediment assembly is located at the upstream of the permeable dam and is arranged close to the permeable dam, the sediment assembly comprises a sediment bottom plate and a sediment bag, the sediment bag is arranged on the sediment bottom plate, a sediment bag hanging rope is connected to the sediment bag, and the sediment bag hanging rope extends out of the water surface of the ditch. The ecological sediment intercepting device is simple in structure and convenient to maintain in the later period, so that the ecological sediment intercepting device has a long-term stable intercepting and purifying effect; the permeable dam has the advantages of being light in weight, easy to produce, controllable in cost and the like; and the structure of a sediment pool is optimized, so that sediment can be cleaned only by dragging a pull rope of the device, the construction amount of sediment pool construction is reduced, and rapid cleaning of sediment in the sediment pool is realized.</p>
CN112347659	Riparian buffer zone water and soil conservation control method based on optimal vegetation pattern	ZHAO QINGHE XU SHANSHAN DING SHENGYAN QIN MINGZHOU	<p>The invention discloses a riparian buffer zone water and soil conservation control method based on an optimal vegetation pattern. The method comprises the steps that firstly, setting vegetation distribution patterns of different scenes; comparing and analysing the change of the permeability index LI under the vegetation distribution pattern of each scene in combination with the terrain condition of the riparian buffer zone site, so as to screen out an optimal vegetation pattern combination with the best blocking effect on runoff and sediment transport; and finally, based on the optimal vegetation pattern, performing simulation control on the vegetation distribution of the riparian buffer zone. According to the method, an improved permeability index LI is applied, on the basis of considering the possibility of water and sand transmission between landscape units, different vegetation distribution conditions are set through scene simulation by means of land utilization/coating and topographic space data, and an optimal vegetation pattern is screened out; and then the</p>



water and soil conservation function of the riparian buffer zone is controlled based on the optimal vegetation pattern.

7.2.1. Analysis of selected patents

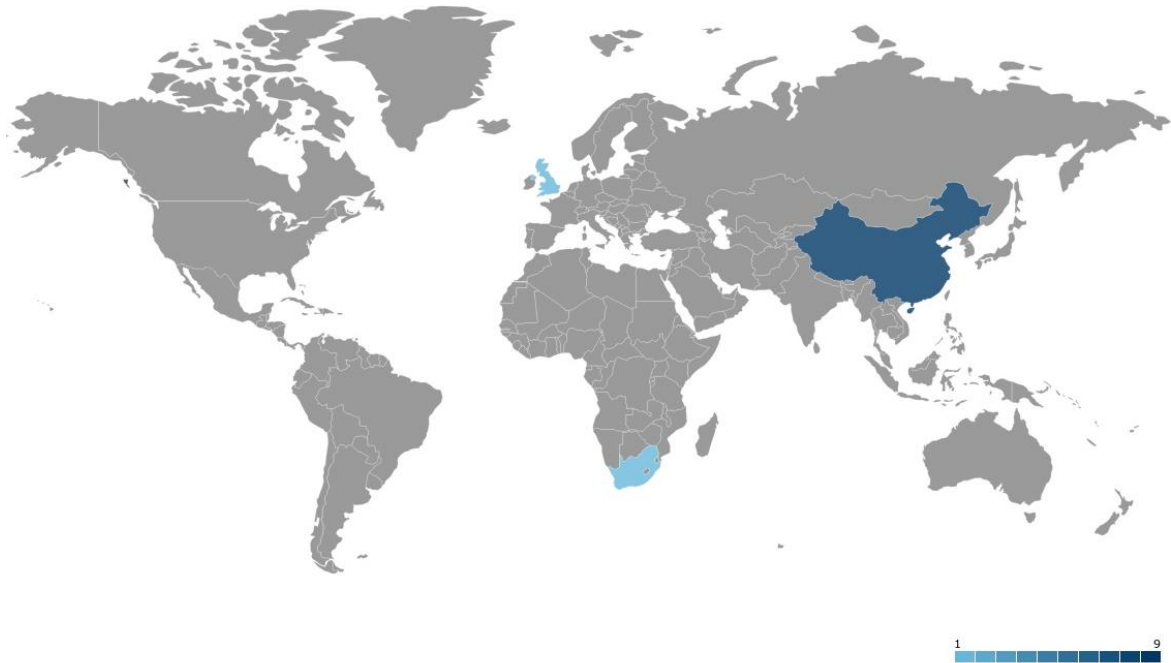


Figure 7.3 Geographical distribution of integrated constructed wetlands (ICW).

In relation to the selected patents, figure 7.4 shows the countries where patents related to the topic were registered, being China the country with the highest number of patents.

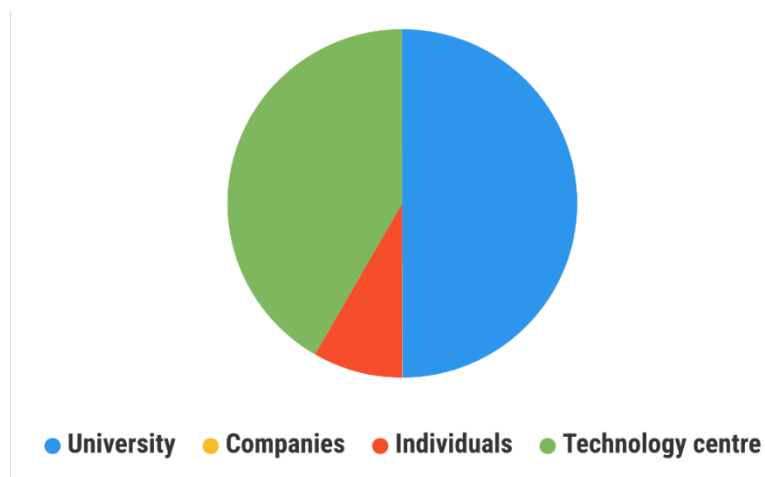


Figure 7.4 Distribution of types of assignees of integrated constructed wetlands (ICW).

The figure 7.5 shows that patents related to the topic were filed mainly by universities, but also by a big number of technology centres and a few individuals.

7.3 Smart Grid for coastal management (SG) - Smart sea-opening system using rapid unhooking grid and gates for emergency opening in case of extreme events.

In Oristano, the partners MEDSEA and CMCC worked on the implementation of a SMART GATE and a monitoring system. This system ensures efficiency, precision, and reliability in managing water flow within the lagoon as a prototype implemented in Marceddì lagoon and the San Giovanni pond replicable within the lagoon and in other areas with similar problems.

The TransformAr solution focused on testing a prototype of SMART GATE with a remote control based on a multi-parameter algorithm with the integration of a weather station with a monitoring system including monitoring systems as hydrometers and multi-parameter sensors to measure various factors such as pH levels, conductivity, redox potential, temperature, dissolved oxygen levels, turbidity, and hydrometric levels and installing a monitoring system into the lagoon, to collect key water quality parameters, support long-term assessments and improve water circulation management. The solution aims to regulate the water circulation between the mouth area and San Giovanni Pond, to guarantee the better condition in terms of ecological parameters and control the hydraulic levels. In a state of equilibrium, the SMART GATE will remain closed and will be opened only in the event of hydraulic risk or alteration of the chemical-physical state of the water, thus allowing a flow of freshwater from the mouth areas of various rivers and canals into the pond.

A will be integrated to support civil protection weather warning systems and enhance our understanding of weather conditions during SMART GATE operations. Thresholds for each parameter will be determined based on an analysis of the initial conditions and the optimal ecological lagoon conditions.

7.3.1. State of the Art

First it includes the definition of the results defined by characteristics and the Key Words associated with each of them, updated at project month 40.

Table 7.7 Smart Grid for coastal management (SG) definition.

Characteristic	Key words
Use of grids or gates	Sluice/ Sluicagate/Gate
Water management	Water
Risk or alteration triggered	Risk/Alteration
Hydraulic	Hydraulic
Chemical-physical state of the water	Chemical-physical
Automatic and smart system	Smart
Defining a model based on data monitoring system	Parameters/Quality/ Hydrometric level / Salinity / pH / Temperature

Based on the key words defined, a set of search strategies were designed to identify technologies related to the topic. The results obtained from each search strategies were filtered by year (those with a prior date after 2021) to select the newest developments. The result number obtained was filtered applying an analysis using key related words and the knowledge about the result definition itself.

Table 7.8 Smart Grid for coastal management (SG) search strategies and results obtained.

Strategy code	Strategy	Result Number	Results year filtered ¹¹	Results key word filtered
SG.1	((COAST)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (WATER)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (SLUICE)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	609	122	4
SG.2	((SMART)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (WATER)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (SLUICEGATE)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	11	3	1

A total of **5 patent documents**, included in the next table, was selected as relevant available solutions in the State of the Art for the solution Smart Grid for coastal management (SG) - Smart sea-opening system using rapid unhooking grid and gates for emergency opening in case of extreme events result, and were analysed to identify exploitation means considering the potential implementation on society identified.

¹¹ 1 AND EAPD >= 2021

Table 7.9 Relevant patent document identified in the SoA related to Smart Grid for coastal management (SG).

Code	Title	Assignee	Summary
CN114892585	Dam gate monitoring system and monitoring method thereof	STATE GRID ROBOT JIANGSU AUTOMATION EQUIPMENT	The invention discloses a monitoring method of a dam gate monitoring system . The dam gate monitoring system comprises a dam region data measurement module and the dam gate monitoring system, wherein a first water level data sensor, a first pressure sensor, a first rainfall sensor and a second water level data sensor are electrically connected; the remote processing module is composed of a first exchanger, a first DTU module, a cloud data storage module and an upper end machine, and multiple pieces of data in the same time period are uniformly stored in a first local data storage module and a second local data storage module in the local processing module, so that comprehensive data are provided for an operator; according to the system, data are extracted through the upper end machine, data loss is avoided, data chaos cannot be generated in the data extraction process, meanwhile, the monitoring system can be directly controlled and looked up through the upper end machine, a user can use the system conveniently, the state of the position of a dam gate is adjusted more effectively according to the monitored upstream condition, and prediction and operation can be conducted in advance.
CN115659781	Coastal gate station tide level prediction method and system	NANJING NARI WATER RESOURCES & HYDROPOWER TECHNOLOGY	The invention discloses a coastal sluice station tide level prediction method and system , which breaks away from the traditional hydraulic modelling thought, adopts a historical inland river water level sequence and a historical sea tide water level sequence to construct a sea tide and inland river water level overall prediction model, and adopts the model to predict a future inland river water level sequence and a future sea tide water level sequence. Solving is fast, calculation is accurate, and the requirement for real-time optimization scheduling of the coastal gate station can be met.
CN217174628	Large-span tide gate device	CHINA THREE GORGES SHANGHAI INVESTIGATION	The large-span tide gate device comprises a base which is arranged at the bottom of an estuary and stretches across the estuary , the two ends of the base are located at the bottoms of the two banks of the estuary respectively, retractable doors are symmetrically arranged on the two sides of the top face of the base, the upstream side of each retractable door is a water retaining side,

		DESIGN & RESEARCH INSTITUTE	and the downstream side of each retractable door is an inland river side. The retractable door is connected with a buoyancy supporting assembly on the inland river side, the outer side of the retractable door is coated with rubber waterproof cloth, the retractable doors on the two sides stretch out and are in butt joint to close the door, and a tide gate for blocking the estuary is formed. According to the tide gate, buoyancy generated by the buoyancy supporting assembly is used for supporting the retractable door, the overturning moment of the retractable door during tide blocking is resisted, overall stability of the retractable door is facilitated, the size of the retractable door can be effectively reduced, the weight of the retractable door can be greatly reduced, the opening and closing force of the retractable door can be reduced, and the opening and closing time can be shortened.
CN114837120	Double-gate regulation and control system with functions of water diversion, moisture absorption and silt flushing and regulation and control method of double-gate regulation and control system	HOHAI UNIVERSITY	The invention discloses a double-gate regulation and control system with functions of water diversion , tide receiving and silt flushing and a regulation and control method of the double-gate regulation and control system. The double-gate regulation and control system comprise a spur dike, a water diversion head hub, a tide gate, a rectification weir and a tide receiving gate which are sequentially arranged from the upstream to the downstream of the system. The spur dike plays a role in guiding river sediment and relieving siltation; the water diversion head hub is used for draining clear water and muddy water; the tide gate is used for retaining flood and preventing salt tide from upstream pollution to an upstream water body; the rectifying weir can effectively narrow a river channel, increase the flow velocity of water flow in an area and enhance the sand carrying capacity of the water flow; the tide receiving gates and the tide blocking gates are arranged in a staggered mode, the total clear width of the gates is smaller than that of the tide blocking gates, the clear width of the river channel is further shortened, and the water restraining and sand tapping effect is improved. The tide gate is used for achieving the water diversion irrigation function, the tide weather mode and the double-gate opening and closing system are combined to achieve the functions of high tide receiving and low tide silt flushing, the tide blocking and flood discharging capacity of the system is effectively enhanced, and certain economic benefits are achieved.
CN113152355	Tidal weir method	HUANG BINFU	The invention discloses a tidal weir method . In the damp-proof process of a river drainage sea area, river drainage carries sufficient and necessary sustainable cofferdam water and soil resources for reclamation flood control, a damp-proof

			<p>dam 1, a cofferdam damp-proof water area 2 and a damp-proof land 3 are impacted for a long time, and the cofferdam damp-proof function of zero water level of water area water storage is achieved by decreasing the maximum drop of tide, that is, the highest tide level is decreased by about 2-3 m; and the natural disasters such as river sediment, riverbed high position, river water flooding and sea water immersion can be effectively and radically treated, and the river water sediment is adopted to durably purify the coastal beach land and the urban water area until the alluvial moisture-proof self-irrigation fertile farmland is the ecological environment of the Canghai granary, the coastal plain and the sustainable development sea area which is indispensable with the natural fresh water.</p>
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7.3.2. Analysis of selected patents

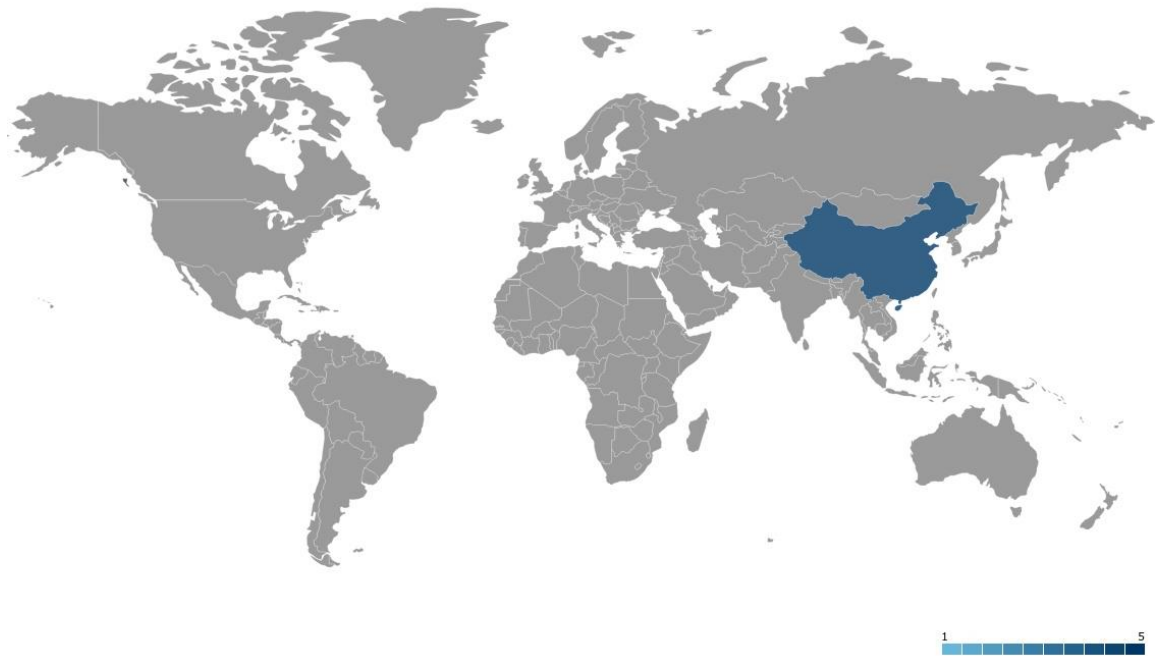


Figure 7.5 Geographical distribution of smart grid for coastal management (SG).

In relation to the selected patents, figure 7.7 shows the countries where patents related to the topic were registered, being China the country with the highest number of patents.

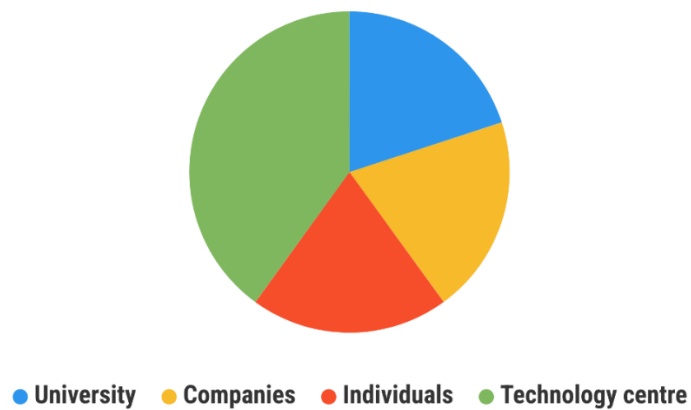


Figure 7.6 Distribution of types of assignees of smart grid for coastal management (SG).

The figure 7.8 shows that patents related to the topic were filed mainly by technology centres, but also there are a small number of patents registered by universities, private companies and individuals.

7.4 Urban run-off system (URB) – a biofiltration area, that captures and treats runoff and storm water from the surroundings street and sidewalk in the city centre of Lappeenranta.

As part of the stormwater management and monitoring solutions being developed in Lappeenranta it is the co-design of new integrative Nature-Based Solutions as part of new urban adaptation standards which is jointly developed with city planners, architects, and urban architecture responsible administrators applying plants and greeneries for reducing urban runoff.

Water is led through a biofiltration area that filters the stormwater and reducing pollutants. The aim is to **reduce the amount of water led to storm water sewer systems, to filter harmful substances**, such as heavy metals and nutrients, and to ensure the formation of groundwater. The water that enters the URB gets slowed down, and some, or **most of it gets adsorbed through the layers and finally reaches the groundwater**. The varied **vegetation in the green** area utilizes water that is not immediately absorbed through the filter layer. **In the case of severe rain, not all water gets adsorbed, and the overflow is directed back to the storm water drainage system**, in this case the area functions as a **buffering zone** to prevent flooding of the drainage system.

Due to the presence of groundwaters, any system it is intended to filter water through it must be designed in such a way that the filtrated water does not contaminate the groundwaters. Filtration fields can fit into a relatively small footprint and take load of the stormwater drainage and pollution load of the lake, where the stormwater is traditionally directed.

7.4.1. State of the Art

First it is included the definition of the results defined by characteristics and the Key Words associated with each of them, updated at month 40.

Table 7.10 Urban run-off system (URB) definition.

Characteristic	Key words
Applied to cities and urban areas	City/ Urban
Run-off manage	Run-off
Using channels	Channels
Zones of vegetation	Vegetation/ Bio*/Area/Zone
Pollutants elimination	Pollutant/Stormwater
Process of water filtration	Filtration
Type of pollutants	Heavy metals/Nutrients

Based on the key words defined, a set of search strategies were designed to identify technologies related to the topic. The results obtained from each search strategies were filtered by year (those with a prior date after 2021) to select the newest developments. The result number obtained was filtered applying an analysis using key related words and the knowledge about the result definition itself.

Table 7.11 Urban run-off system (URB) search strategies and results obtained.

Strategy code	Strategy	Result Number	Results year filtered ¹²	Results key word filtered
URB.1	((CIT? OR URBAN+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (RUN-OFF)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (FILTRATION)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (VEGETATION)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (CHANNELS)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	115	20	4
URB.2	((URBAN+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (RUN-OFF)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (BIO OR VEGETATION)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (ZONE OR AREA)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (CHANNEL+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	571	62	3

A total of **5 patent documents**, included in the next table, was selected as relevant available solutions in the State of the Art for the solution Urban run-off system (URB) – a biofiltration area, that captures and treats runoff and storm water from the surroundings street and sidewalk in the city centre of Lappeenranta result, and were analysed to identify exploitation means considering the potential implementation on society identified.

¹² 1 AND EAPD >= 2021

Table 7.12 Relevant patent document identified in the SoA related to Urban run-off system (URB).

Code	Title	Assignee	Summary
CN218405638	Rainwater recycling system for ecological campus construction	NANCHANG HANGKONG UNIVERSITY	The utility model discloses a rainwater recycling system for ecological campus construction , which comprises a confluence lake in a campus and an annular water channel taking the confluence lake as a center, and the annular water channel is communicated with the confluence lake through a plurality of confluence channels; a reservoir is arranged between the concave multi-stage filtering flower bed and the confluence lake, and keel waterwheels are respectively arranged between the confluence lake and the reservoir and between the reservoir and the concave multi-stage filtering flower bed; the concave multi-stage filtering flower bed comprises a first-stage filtering area, a second-stage turning area and a third-stage infiltration area which are sequentially settled stage by stage from an outer ring to an inner ring, and each of the first-stage filtering area, the second-stage turning area and the third-stage infiltration area comprises a vegetation layer, a soil layer, a water-permeable geotextile layer, a filtering gravel layer and a water storage pebble layer which are laid from top to bottom. Pollutants in rainwater can be treated, so that the rainwater can be used for irrigation and toilet flushing, the device is simple and reliable, the problem of resource utilization of the rainwater can be effectively solved, and the device has the advantages of being energy-saving, water-saving and environment-friendly.
US20220056684	Regenerative stormwater conveyance system and method	UNDERWOOD KEITH R	A regenerative stormwater conveyance (RSC) system for treating and dispersing stormwater runoff is disclosed which includes an upstream entry point where water enters the system and an entry pool downstream from the entry point that collects water from the entry point. The RSC system includes one or more shallow aquatic beds that receive water from the entry pool in a serial manner and each of which includes a filtration structure for filtering water from the aquatic bed. Riffle weir grade control structures are positioned between the aquatic beds and transition water overflowing from each upstream aquatic bed to a downstream aquatic bed. Accordingly, collected stormwater runoff traverses the series of

			<p>aquatic beds and riffle weir grading structures and is treated and safely detained, thus, conveying stormwater to groundwater through infiltration</p>
<p>CN113958069</p>	<p>Greening roof structure based on quick drainage of ceramsite materials and upward water supply of cotton core materials</p>	<p>GUANGXI UNIVERSITY</p>	<p>Disclosed is a green roof structure based on quick drainage of ceramist materials and upward water supply of cotton core materials. The green roof structure comprises assembly type green roof modules and quick drainage channels; the multiple assembly type green roof modules form an assembly type green roof module set, and the quick drainage channels are reserved between the adjacent assembly type green roof module sets; the assembly type green roof modules and the rapid drainage channels are installed on the building structure roof subjected to waterproof layer treatment according to the width ratio of 4: 6: 1; and each assembly type green roof module comprises a vegetation layer, a planting substrate layer, a vertical separation layer, an isolation filtering layer, a water storage and drainage plate and a cotton core. The quick drainage channels are filled in long-strip-shaped empty grooves reserved between the adjacent assembly type green roof modules through the ceramist materials, and drainage areas which are transversely and vertically crossed and communicated are formed after the ceramist materials are filled. Rainwater infiltration can be accelerated when a large amount of rainfall occurs, the roof can be fully utilized to store rainwater when a city does not rain for a long time, and the irrigation and maintenance cost is greatly saved.</p>
<p>CN219410742</p>	<p>Multifunctional urban river channel structure</p>	<p>BEIJING ZHONGBING GEOTECHNICAL ENGINEERING</p>	<p>The utility model relates to a multifunctional urban river channel structure, and relates to the technical field of hydraulic engineering structure design, the multifunctional urban river channel structure comprises a river embankment and a riverbed, the riverbed is provided with a water channel, the water channel comprises a deep water channel and a shallow water channel, and the outer side wall of the deep water channel is fixedly connected with the outer side wall of the shallow water channel; the outer side wall of the shallow water channel is fixedly connected with the river levee, the river levee comprises a protection slope, the protection slope is fixedly connected with the outer side wall of the shallow water channel, and a water gate for regulating and controlling the water passing area of the river channel is arranged in the deep water channel. The water passing area of the water channel is increased, and damage to the river levee and vegetation on the river levee caused by overhigh water level in the flood season is reduced; the method has the effect of protecting the ecological environment of the riverway.</p>

<p>CN113816491</p>	<p>Comprehensive remediation method for hard-base urban black and odorous river channel</p>	<p>NANJING NORMAL UNIVERSITY</p>	<p>The invention discloses a comprehensive remediation method for a hard-base urban black and odorous river channel. The method comprises the following steps: carrying out bank zone remediation at two sides of a river channel by utilizing ecological straw mat remediation; intercepting nitrogen and phosphorus of surface runoff by utilizing the rainwater runoff ecological flower bed; paving pebbles and gravels on the hard riverbed; planting aquatic plants on the hardened base of the black and odorous river channel by adopting a planting pad; using an aeration machine increasing dissolved oxygen in river water; and using the ecological floating bed for continuously purifying river water. According to the method, a comprehensive remediation method is adopted, bank zones at the two sides of the riverway are repaired, the black and odorous riverway base is improved, water is purified, the pollutant content in the water is reduced, the water transparency is improved, and finally the black and odorous phenomenon of the urban riverway with the hardened base is eliminated. The technical problem that the hard-base black and odorous river channel is difficult to carry out ecological management is solved, a healthy water ecological system is formed through organic combination of an environmental engineering technology and an ecological restoration technology, and the self-restoration capacity and the self-purification capacity of a water body are greatly improved.</p>
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7.4.1. Analysis of selected patents

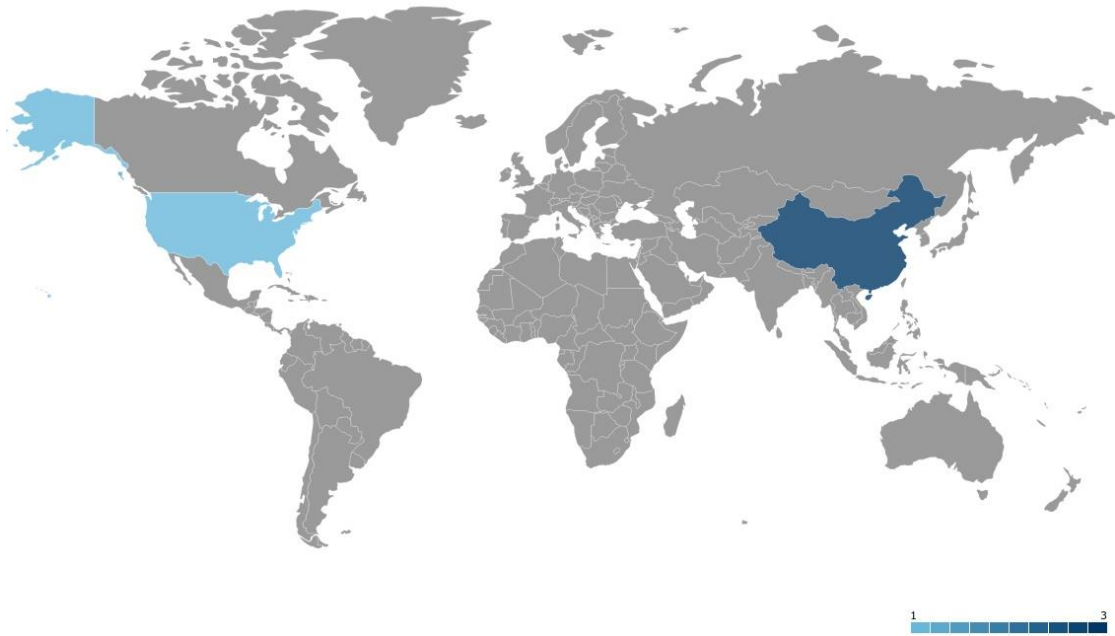


Figure 7.7 Geographical distribution of urban run-off system (URB).

In relation to the selected patents, figure 7,10 shows the countries where patents related to the topic were registered, being China the country with the highest number of patents.

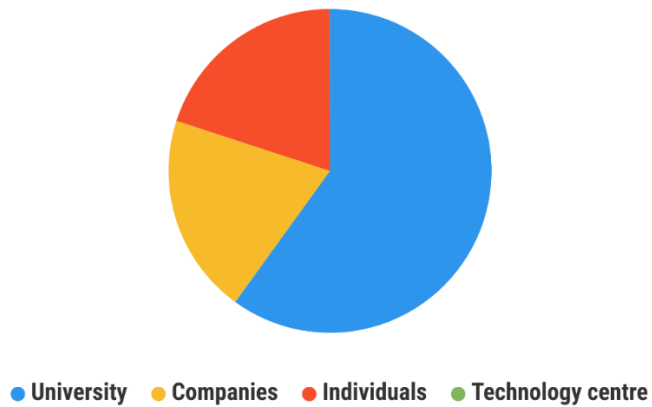


Figure 7.8 Distribution of types of assignees of urban run-off system (URB).

The figure 7.11 shows that patents related to the topic were filed mainly by universities, but also there are a small number of patents filed by private companies and individuals.



7.5 Digital monitoring (SWMM) - Monitoring system with simple probes to monitor flow rates and water quality through individual modules. The monitoring user interface will be made visual and browser-based, enabling access from any smartphone or laptop.

LAPP, supported by LUT, VERHAERT and its Linked Third Party Pegus Digital, were working on the couple first **set of new sensors, measuring water quality, flow and volume within the water pipe and drainage system, to a scalable digital platform.**

The monitoring activities are focused on **gathering information on the function of other NBS solutions, URB, implemented, water quality and water flow.** At the same time this monitoring campaign tests the **feasibility of implementing similar monitoring in other parts of the storm water drainage system.** This is done with **sensors attached to drainage system manholes** and with **openly available video feeds in the city.** Together with NTNU the camera feeds are utilized to **estimate the precipitation levels with more precise locations.** Various **indicators can then be calculated** from this data some for authorities and study purposes.

Monitoring the water flow in the drainage system can reveal potential **flooding risks.** In locations where there is a known risk of storm water sewer flooding, sensors to measure the variation in water level will be installed.

Selected information (e.g. quantity and quality of storm water in the system) is accessible via CitySen.App. (LAPP).

7.5.1. State of the Art

First it includes the definition of the results defined by characteristics and the Key Words associated with each of them, updated at month 40.

Table 7.13 Digital monitoring (SWMM) definition.

Characteristic	Key words
Applied to urban water	Urban water
Focus on monitoring parameters	Monitor/Risk
Flow rate detection	Flow rate
Allows to identify the water quality	Quality
Probes-based design	Probe
Identification of potential flooding risks	Flood

Based on the key words defined, a set of search strategies were designed to identify technologies related to the topic. The results obtained from each search strategies were filtered by year (those with a prior date after 2021) to select the newest developments. The result number obtained was filtered applying an analysis using key related words and the knowledge about the result definition itself.

Table 7.14 Digital monitoring (SWMM) search strategies and results obtained.

Strategy code	Strategy	Result Number	Results year filtered ¹³	Results key word filtered
SWMM.1	((URBAN W WATER)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (MONITOR+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (FLOW RATE)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	2169	1084	13
SWMM.1	((URBAN W WATER)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (MONITOR+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (QUALITY)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (PROBE?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	479	235	6

A total of 13 patent documents, included in the next table, was selected as relevant available solutions in the State of the Art for the solution Digital monitoring (SWMM) - Monitoring system with simple probes to monitor flow rates and water quality through individual modules. The monitoring user interface will be made visual and browser-based, enabling access from any smartphone or laptop. Publicly displayed information will be accessible to all and were analysed to identify exploitation means considering the potential implementation on society identified.

¹³ 1 AND EAPD >= 2021

Table 7.15 Relevant patent document identified in the SoA related to Digital monitoring (SWMM).

Code	Title	Assignee	Summary
CN116821272	Intelligent monitoring and early warning method and system for urban inland inundation	CCCC FHDI ENGINEERING	The invention discloses an urban inland inundation intelligent monitoring and early warning method and system , and the method comprises the following steps: constructing a road waterlogging scene database in different rainfall recurrence periods through a flood simulation method, determining the installation position of sensor monitoring equipment, associating the sensor monitoring equipment with an urban panoramic model, and carrying out the early warning of the urban inland inundation. On-site data acquisition and monitoring are carried out through the sensor monitoring device, processed and analysed monitoring data obtained after processing and urban weather information are displayed in an integrated mode on the urban inland inundation intelligent early warning platform, and the water level in a well in the processed and analysed monitoring data is judged in the urban inland inundation intelligent early warning platform. And calculating the rising rate and roof fall time of the water level in the well, generating three early warning levels of yellow, orange and red, obtaining urban waterlogging early warning information and meteorological disaster information, and issuing the urban waterlogging early warning information and the meteorological disaster early warning information by the urban waterlogging intelligent monitoring and early warning platform
CN116202576	Monitoring method and system for dynamic management of rivers and lakes of urban water conservancy	GUANGDONG GUANGYU SCIENCE & TECHNOLOGY DEVELOPMENT	The invention discloses a monitoring method and system for dynamic management of rivers and lakes of urban water conservancy and relates to the technical field of river and lake monitoring, and the system comprises an information acquisition module, a river and lake basic model establishment module, a flow data monitoring module and a dynamic point location monitoring module. The information acquisition module comprises a river and lake information base, parameter information of rivers and lakes is stored in the river and lake information base, the parameter information of the rivers and the lakes comprises the runoff volume of the rivers and the contour of a riverbed, and the parameter information of the lakes comprises the area of the lakes and the contour of the lakes; according to the method, the basic storage capacity of the

			<p>river and the lake is obtained, then the dynamic change condition is comprehensively analysed, the dynamic monitoring analysis result of the river and the lake can be obtained, and the problems that an existing river and lake monitoring mode is single, and the monitoring result is not comprehensive and accurate enough are solved</p>
CN116086570	Water level monitoring device with self-diagnosis function	CETC GUOHAI XINTONG TECHNOLOGY HAINAN	<p>The invention discloses a water level monitoring device with a self-diagnosis function. The water level monitoring device comprises a control box, a hydrological detection sensor and a solar power supply system, wherein the control box is used for controlling each monitoring module; the hydrological detection sensor is used for detecting the water level condition; the solar power supply system comprises a photovoltaic panel used for providing electric energy for the water level monitoring device and a driving assembly used for controlling the photovoltaic panel to turn over, expand and contract, the driving assembly is arranged in the middle of the top of the main board, and the driving gear drives the main board to turn over; by arranging the control box and the water quality sensor and the radar water level monitoring sensor which are electrically connected with the control box, and meanwhile, the control box is electrically connected with the adjusting supporting legs and the driving assembly, when a fault detection module in the control box detects a fault, the fault detection module gives an early warning in advance, so that loss caused by disasters such as drought and waterlogging can be avoided, and the safety of a user is improved. Real-time data tracking is carried out through fixed-point data acquisition of related detection devices in a hydrometric station</p>
CN217212654	Urban water quality index monitoring device	HANGZHOU CHANGFENG MUNICIPAL GARDEN CONSTRUCTION	<p>The utility model discloses an urban water quality index monitoring device which comprises a shell, a cover plate is arranged at the top end of the shell, a solar panel is arranged at the top end of the cover plate, a water quality monitoring controller is arranged at the top end in the shell, and a plurality of connecting arms are arranged at the bottom end of the water quality monitoring controller. A water quality detection probe is arranged at the bottom end of the connecting arm, a micro water pump is arranged at one end in the shell, a water pumping pipe is arranged at the bottom end of one side of the shell, a water storage tank is arranged in the middle of the bottom end of the shell, a water inlet pipe is arranged on one side of the top end of the water storage tank, and a water drainage pipe is arranged at one end of the bottom of the water storage tank. The device has the beneficial effects that urban water quality indexes can</p>

			<p>be regularly and automatically detected and monitored, the detection efficiency is effectively improved, precision reduction or damage caused by long-term soaking of a water quality detection probe in water is avoided, a detection result can be remotely transmitted, solar energy can be utilized for power generation, and meanwhile, the device has an anti-theft alarm function.</p>
CN216791277	Redundant flow monitoring equipment	BEIJING DRAINAGE EQUIPMENT	<p>The utility model discloses redundancy type flow monitoring equipment which comprises a contact type flow meter arranged at the pipe bottom of a pipe network to be measured, a non-contact type flow meter arranged at the pipe top of the pipe network to be measured, a pipe network monitoring instrument, a pipe network multifunctional monitoring instrument connected with the contact type flow meter and the non-contact type flow meter, and a monitoring terminal connected with the pipe network multifunctional monitoring instrument and the non-contact type flow meter. The pipe network multifunctional monitor is arranged on the wall of a vertical shaft of a measured pipe network, the redundant flow monitoring equipment performs redundant measurement in a contact type monitoring mode and a non-contact type monitoring mode, integrates self-adaption and compensation algorithms of the two sensors, establishes a model of surface flow velocity and section flow velocity, has no measurement blind area, and can monitor the flow velocity of the pipe network under different working conditions. The redundant flow meter can be separately configured, a contact flow meter is used under the working condition of normal high liquid level operation, and a non-contact flow meter is used under the working condition of a low liquid level pipe network, so that the monitoring stability and safety are effectively improved, and the monitoring effect is ensured.</p>
CN114594223	Real-time detection device for urban water environment ecological restoration	INSTITUTE OF GEOGRAPHIC SCIENCES & NATURAL RESOURCES RESEARCH CAS	<p>The invention discloses a real-time detection device for urban water environment ecological restoration, which comprises a detection head for water quality detection, an inductive probe connected to the top of the detection head, a data wire harness connected to the bottom of the detection head, and a data connecting plug connected to one end of the data wire harness, docking ports are distributed in the outer wall of the end part of the data connecting plug; the clamping dust blowing mechanism is used for clamping and fixing the data connecting plug in the connecting process and blowing dust in the butt joint port, and the clamping dust blowing mechanism is installed at the top of the data connecting plug; according to the invention, through the arrangement of the</p>

			<p>clamping dust blowing mechanism, clamping and fixing can be conveniently carried out in the plug-in connection process of the data plug connector; according to the structure, the pressing block is pressed in a reciprocating mode, the linkage is driven to drive the air pump to rotate continuously, the air pump works, air is blown into the butt joint opening through the air blowing main pipe and the air blowing branch pipes, and therefore dust in the butt joint opening is blown away.</p>
CN114236086	Floating type water quality sampling and monitoring equipment for urban water area water source monitoring	SHENZHEN WATER ENGINEERING TESTING	<p>The invention discloses floating type water quality sampling monitoring equipment for urban water area water source monitoring, and relates to the technical field of water quality monitoring, the monitoring equipment comprises a fixed insertion rod and a floating table; the fixed insertion rod is inserted into a water area to be monitored, a lifting hole is formed in the middle of the floating table, the floating table is installed on the fixed insertion rod through the lifting hole, a plurality of water quality detection heads are arranged at the bottom of the floating table, a threaded sliding rail is arranged on the fixed insertion rod, a threaded sliding groove is formed in the lifting hole, and the water quality detection heads are arranged in the threaded sliding groove. The fixed inserting rod and the floating table are in sliding connection through a threaded sliding rail and a threaded sliding groove, so that in the water rising season, the floating table can slide upwards under the buoyancy effect of water and rotate while sliding, water flow can enter a water conveying pipeline through a water inlet pipeline and then flow out through a water outlet hole, and the floating table is convenient to use. Impurities adhered to the surface of the water quality detection head are cleaned, and impurity adhesion to the surface of the water quality detection head is reduced</p>
CN215218783	Water quality monitoring system for purified rainwater on green roof	UNIVERSITY SOUTH SCIENCE & TECHNOLOGY CHINA	<p>The utility model discloses a water quality monitoring system for purified rainwater on a green roof, which comprises a purification device, a flow guide pipe, a water storage container and a monitoring device, a matrix layer and a filter layer are arranged in the purification box, vegetation is planted on the matrix layer, the filter layer is positioned below the matrix layer, two ends of the flow guide pipe are respectively communicated with the purification box and the water storage container, and the monitoring device is arranged in the water storage container. The water quality detection probe extends into the water storage container and is in contact with rainwater, and the monitoring module is used for receiving and displaying detection information of the water quality</p>

			<p>detection probe. According to the utility model, the purification box is used for simulating the real planting environment of the green roof, rainwater is discharged into the water storage container through the flow guide pipe to be collected, the purified rainwater can be detected by the water quality detection probe and fed back through the monitoring module, various parameters of the purified rainwater can be obtained in real time, and engineering construction of the green roof is guided; the rainwater purification capacity of the green roof is optimized</p>
CN215161757	Urban water environment quality evaluation system	HAINAN ZHENGRUN ENVIRONMENTAL TECHNOLOGY	<p>The utility model discloses an urban water environment quality assessment system, which comprises a detection station and a control terminal which are arranged beside a river channel, the detection station comprises a detection device, a monitoring device and a power supply device, and the detection device and the monitoring device are respectively and electrically connected with the power supply device. The output ends of the detection device and the monitoring device are electrically connected with the control terminal, and the detection device comprises a direct detection device and a reagent detection device. According to the utility model, the reagent is filled into the reagent tube through the reagent supply assembly in the reagent detection device, and then the river water is filled into the reagent tube through the water supply assembly, and the detection reagent is proportioned, so that the automatic proportioning of the detection reagent in the river water is realized, and the efficiency of water environment quality evaluation is improved.</p>
CN113554236	Smart city construction flood disaster real-time online monitoring and early warning management cloud platform	WUHAN ZHONGKE JISI GEOGRAPHIC INFORMATION TECHNOLOGY	<p>The invention discloses a smart city construction flood disaster real-time online monitoring and early warning management cloud platform, which monitors the water level of each water storage area in a to-be-monitored city, analyses the remaining safe water level in each water storage area in the to-be-monitored city, and obtains the predicted rainfall of each water storage area in each time period in the future. The flood disaster occurrence proportionality coefficient in each water storage area is estimated; meanwhile, the unit time drainage speed of each drainage port in each sub-area in the to-be-monitored city is detected, the unit time drainage amount difference value of each drainage port in each sub-area is obtained through comparison, and the real-time rainfall amount of each sub-area is monitored. The flood disaster occurrence influence proportionality coefficient of each sub-region is analysed, meanwhile, comprehensive flood disaster occurrence estimation coefficient of to-be-</p>

			<p>monitored city is comprehensively calculated, and if comprehensive flood disaster occurrence estimation coefficient is larger than set threshold value, early warning reminding is carried out, so that urban flood disaster situation can be truly reflected, disaster prevention and reduction measures can be made in advance, property loss is reduced, and casualties are avoided.</p>
CN113296550	Municipal monitoring system for rainwater drainage	DONGYING TIANCHENG BUILDING MATERIALS	<p>A municipal monitoring system for rainwater drainage relates to the technical field of environment monitoring and comprises a rainwater and sewage pipe network detector, a collection valve, a rainwater collection pool, a programmable logic control device, a signal transmission server, a drainage valve, a drainage sensor and a monitoring cloud platform system. The rainwater and sewage pipe network detector, the collection valve, the rainwater collection pool, the programmable logic control device, the signal transmission server, the discharge valve and the drainage sensor are in circuit connection; and the programmable logic control device collects information of the rain and sewage pipe network detector, the rainwater collection pool and the drainage sensor. Signal transmission can be realized through the monitoring cloud platform system, an instruction is sent to the programmable logic control device, the operation of the whole system is controlled, the accumulation capacity of the rainwater collection pool is automatically regulated and controlled, and the labour cost is saved</p>
CN113269352	Urban inland inundation monitoring and early warning method and system based on mobile internet and medium	HAGONG WISDOM WUHAN TECHNOLOGY	<p>The invention relates to an urban inland inundation monitoring and early warning method and system based on a mobile internet and a medium, and the method comprises the steps: constructing a mobile internet dynamic monitoring model, and obtaining a historical monitoring data set and a real-time monitoring data set through the mobile internet dynamic monitoring model; carrying out transfer learning on the real-time monitoring data set according to the historical monitoring data set to obtain an inland inundation risk pseudo label set; based on a graph embedding learning method, carrying out similarity feature learning according to the historical monitoring data set, the real-time monitoring data set and the inland inundation risk pseudo tag, and obtaining a target similarity matrix; obtaining a target inland inundation risk label set according to the target similarity matrix and the historical monitoring data set; and performing early warning judgment according to a preset early warning model and the target inland inundation risk label set to complete early warning. According to the method, the development trend and risk of inland inundation are evaluated, analyzed and predicted directly according to the similarity between the historical</p>

			<p>data and the real-time data, all condition factors do not need to be integrated, and the inland inundation prediction accuracy is high</p>
<p>CN113155201</p>	<p>Self-adaptive monitoring device for water quality pollutants of urban water network</p>	<p>WUDU INTELLIGENT TECHNOLOGY XUZHOU</p>	<p>The invention belongs to the technical field of urban sewage discharge pipe networks and particularly relates to a self-adaptive monitoring device for water quality pollutants of an urban water network, which comprises a body and a mounting frame. The bottom of the body is slidably connected with a probe rod; the top of the probe rod is fixedly connected with a rack; a gear is rotationally connected to the position, corresponding to the rack, in the body, the gear is driven by a gear motor, and the gear is meshed with the rack. A group of electrodes are uniformly distributed on one side, close to the lower end, of the probe rod, and each electrode is connected with the detection unit through a wire; one side, far away from the electrode, of the probe rod is fixedly connected with a graphite rod, and the graphite rod is connected with the detection unit through a wire; when the gear rotates, the rack and the probe rod are driven to slide up and down, the well descending depth of operators is reduced, the cleaning efficiency of stains on the probe rod is improved, meanwhile, the electrode replacement difficulty is reduced, and the maintenance efficiency of the monitoring device is improved.</p>

7.5.1. Analysis of selected patents



Figure 7.9. Geographical distribution of digital monitoring (SWMM).

In relation to the selected patents, figure 7.13 shows the countries where patents related to the topic were registered, being China the country with the highest number of patents.

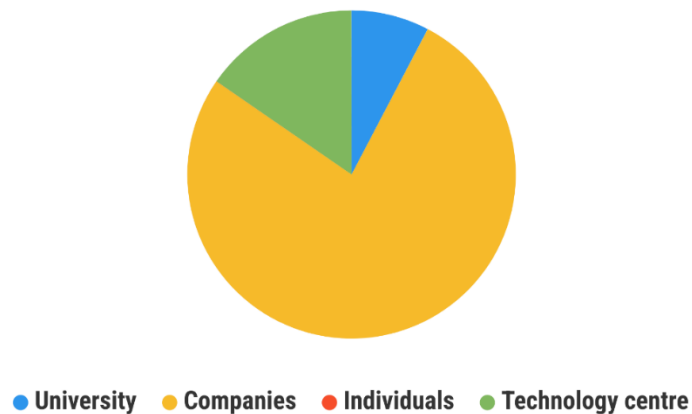


Figure 7.10 Distribution of types of assignees of digital monitoring (SWMM).

The figure 7.4 shows that patents related to the topic were filed mainly by private companies, but also there are a small number of patents registered by technology centres and universities.

7.6 Smart climate solutions (SCS) - To acquire a detailed view of the microclimatic conditions, with focus on better understating of the fine scale flows and heat exchanges leading to urban heat island, its diurnal variation and supporting studies apportioning its origins and determination factors.

The Municipality of Egaleo (MOE) will install smart climate stations (SCS) at key municipal buildings to acquire a view of the **microclimatic conditions**. MOE focuses on the installation of 21 Smart Climate Stations (SCS) around key areas of the city. The purpose of the SCSs is to **gather real-time data regarding the micro-climate of the city**, supporting the public administration office to ready the citizens in case of climate emergencies.

The **data is publicly available via the citizen app (CA)**. Data will be used in addition to existing environmental, transport, and energy data from the city forming a city-wide IoT to be used for the development of the MOE Digital twin.

Beyond the TransformAr initiative, the data collected through the Smart Climate Solutions (SCS) will be used to monitor the effectiveness of various actions and measures implemented in MOE. By comparing measurements and relevant indicators before and after implementation, this data **will facilitate the quantification and formulation of evidence-based policy recommendations**.

Weather and environmental data are used by NCSR D to be **fused with daily weather forecast** and produce a **high-resolution weather forecast** for the region of MOE. In addition, NCSR D will provide data management techniques to clean, process and visualize the environmental data. DSI analysis will utilize the infrastructure and services data of MOE and the statistical methods NCSR D to take the results of E3M socio-economic model and downscale the information to the municipality level.

7.6.1. State of the Art

First it is included the definition of the results defined by characteristics and the Key Words associated with each of them, updated at month 40.

Table 7.4 Smart climate solutions (SCS) definition.

Characteristic	Key words
Focus on urban heat islands	Urban heat island
Prediction of events	Predict
Acquire a view of the microclimatic conditions	Microclimatic conditions

Based on the key words defined, a set of search strategies were designed to identify technologies related to the topic. The results obtained from each search strategies were filtered by year (those with a prior date after 2021) to select the newest developments. The result number obtained was filtered applying an analysis using key related words and the knowledge about the result definition itself.

Table 7.16 Smart climate solutions (SCS) search strategies and results obtained.

Strategy code	Strategy	Result Number	Results year filtered ¹⁴	Results key word filtered
SCS.1	((URBAN W HEAT W ISLAND)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (PREDICT+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	450	265	6
SCS.2	((MICROCLIMA+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (URBAN OR CIT+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (PREDICT+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (CONDITION?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	966	399	2

A total of **8 patent documents**, included in the next table, was selected as relevant available solutions in the State of the Art for the solution Smart climate solutions (SCS) - To acquire a detailed view of the micro-climatic conditions, with focus on better understating of the fine scale flows and heat exchanges leading to urban heat island, its diurnal variation and supporting studies apportioning its origins and determination factors. Data will be used in addition to existing environmental, transport, energy data from the city forming a city-wide IoT to be used in other relevant action result and were analysed to identify exploitation means considering the potential implementation on society identified.

¹⁴ 1 AND EAPD >= 2021

Table 7.17 Relevant patent document identified in the SoA related to Smart climate solutions (SCS).

Code	Title	Assignee	Summary
CN116894524	Atmospheric temperature prediction method based on combined network model	CENTRAL SOUTH UNIVERSITY	The application discloses an atmospheric temperature prediction method based on a combined network model , which comprises the following steps: acquiring a meteorological information data set; performing feature selection on the weather information dataset to obtain an initial target weather index; dividing the initial target weather indexes, and carrying out normalization processing to obtain target weather indexes; and inputting the target meteorological indexes into a CNN-BiLSTM-random combination network model, obtaining a final prediction result, and finishing the atmospheric temperature prediction based on the combination network model. The CNN-BiLSTM-Random Forest temperature prediction model adopted by the application can be applied to future temperature short-term prediction in the city range, provides a new thought and method for air temperature prediction, has higher prediction accuracy and stability, can be applied to temperature prediction application, and has higher application value
CN115270638	Urban thermal environment downscaling space-time analysis and prediction method and system	NORTH CHINA INSTITUTE OF AEROSPACE ENGINEERING	The invention relates to an urban thermal environment downscaling space-time analysis and prediction method and system , and the system comprises the steps: obtaining an image data set of a to-be-measured target space, and carrying out the data preprocessing of the image data set, and obtaining a to-be-measured data set; inputting a to-be-measured data set into the trained prediction model to obtain surface temperature prediction data; performing spatial texture refinement on the surface temperature prediction data to obtain downscaling prediction information; the downscaling prediction information is used for reflecting the urban heat island intensity and spatial-temporal distribution; the determination method of the prediction model comprises the following steps: constructing a sample data set according to surface temperature and influence factor data; the influence factor data comprises a vegetation normalization index, relative humidity, solar radiation, atmospheric pressure, precipitation and air temperature; a CNN-LSTM prediction model is constructed; and training and verifying the CNN-LSTM prediction model according to the

			<p>sample data set to obtain a trained prediction model. According to the method, the comprehensiveness of the training model can be improved, so that high-precision prediction analysis is carried out on the surface temperature</p>
<p>CN114997490</p>	<p>Construction method of temperature profile prediction model, prediction method, device and equipment</p>	<p>BEIJING INSTITUTE ENVIRONMENTAL FEATURES</p>	<p>The embodiment of the invention relates to the technical field of computers, in particular to a construction method of a temperature profile prediction model, a prediction method, a device and equipment. The construction method comprises the following steps: acquiring a plurality of training sample pairs; the training sample pair comprises a plurality of original temperature tensors serving as input and a plurality of original temperature tensors serving as output; the original temperature tensor is the temperature tensor of a plurality of meteorological grid points at different isobaric heights; extracting and training spatial-temporal features of the temperature profile of the prediction neural network by using the plurality of training sample pairs so as to construct a temperature profile prediction model; the prediction neural network comprises a coding layer and a decoding layer, wherein the coding layer is composed of a high-attention mechanism coding sub-module and a periodic space-time convolution coding sub-module for isobaric height attention calculation, and the decoding layer is composed of an attention space-time convolution decoding module and a time sequence attention module. According to the method, the temperature profile prediction model can be constructed, and the prediction accuracy of the temperature profile is improved</p>
<p>CN114764533</p>	<p>Long-time-sequence urban heat island effect grading method for multi-source landsat image</p>	<p>TONGJI UNIVERSITY</p>	<p>The invention relates to a long-time-sequence urban heat island effect grading method for a multi-source Landsat image, and the method comprises the following steps: S1, screening an image to be inverted from a multi-source Landsat image set based on a substitutability criterion, and carrying out the data preprocessing; s2, performing surface temperature inversion on the pre-processed to-be-inverted image pairs in sequence by adopting a radiation transfer equation method to obtain corresponding surface temperature data; s3, performing land cover type classification on the to-be-inverted image by adopting an SVM algorithm, constructing a multi-source Landsat mapping model, and mapping a land temperature inversion result corresponding to a multi-source Landsat image in the to-be-inverted image to the same sensor reference; and S4, introducing relative temperature based on a surface temperature inversion mapping result under the same sensor reference, and grading the heat island intensity according to a threshold value. Compared with the prior art, the method</p>

			provided by the invention has the advantages that the influence of deviation of different-source remote sensing data on heat island grading is reduced, and the reliability is higher
CN114139398	Method for recommending heat island retarding measures according to heat island intensity grade	TIANJING UNIVERSITY	The invention belongs to the field of heat island effect and urban planning management and relates to a recommendation method for formulating retarding measures according to heat island intensity grades . The data mainly comprise air temperature data or surface temperature data and influence factor data. According to the method, a spatial quantile regression model considering spatial dependency and heterogeneity is adopted, the difference influence of urban elements on the heat island effect is mined, and differential retarding measures according to different heat island intensities are provided according to a regression result. Therefore, targeted and efficient slowing-down measures are selected in different regions according to the intensity of the heat islands in the regions instead of adopting a unified policy with other regions. By adopting the method, unnecessary waste of manpower, material resources and financial resources is reduced, resource elements are scientifically configured, and the utilization efficiency of resources is improved
CN113254554	Urban block heat island modelling method and system based on map capture and clustering learning	HARBIN INSTITUTE OF TECHNOLOGY	The invention discloses an urban block heat island modelling method and system based on map capture and clustering learning, and the method comprises the steps: S1, collecting building data, road data and vegetation data of an urban block, and carrying out the vectorization of the data; S2, clustering the buildings through an unsupervised learning method combining a principal component analysis method and a Gaussian mixture model; S3, calculating the hourly heat emission amount of each type of building; s4, acquiring suburban hourly weather data; s5, performing heat island effect modelling by taking the building type ratio, the hourly heat emission amount of each type of building, the road vector data, the vegetation vector data and the suburban hourly weather data as modelling input parameters, and simulating urban weather data; S6, collecting city hourly weather data; and S7, correcting the to-be-calibrated modelling parameters through a differential evolution algorithm to obtain a corrected heat island effect model. The urban heat island model can more accurately consider the influence of the urban heat island effect on the local microclimate in the urban organization

<p>CN116310972</p>	<p>Regional microclimate assessment method and system</p>	<p>LIGHT CONTROLS TESILIAN SHANGHAI INFORMATION TECHNOLOGY</p>	<p>The embodiment of the invention provides a regional microclimate assessment method. The regional microclimate assessment method comprises the following steps: acquiring video data of each target region of a target region; determining a microclimate element value of each target area according to the video data of each target area; obtaining microclimate data of the target regions according to the microclimate element values of the target regions; and pushing the microclimate data of the target area to a microclimate management terminal. According to the regional microclimate assessment method and system disclosed by the embodiment of the invention, by utilizing an existing video monitoring system, meteorological equipment does not need to be deployed, and meteorological personnel does not need to be arranged, so that the observation cost is greatly reduced; small-granularity data can be obtained by means of a video monitoring system, and fine regional microclimate data can be obtained</p>
<p>CN114154300</p>	<p>Urban thermal environment and air pollutant concentration real-time sensing map establishment method</p>	<p>CHINA CONSTRUCTION SCIENCE TECHNOLOGY GROUP HARBIN INSTITUTE OF TECHNOLOGY</p>	<p>The invention discloses an urban thermal environment and air pollutant concentration real-time sensing map establishment method, which comprises the following steps of: simulating an urban thermal environment and air pollutants by utilizing ENVI-met software, drawing a thermal comfort cloud picture and an air pollution cloud picture, automatically displaying the cloud pictures and parameters in an electronic map of ArcGIS software through programming and definition of picture coordinates, and establishing a real-time sensing map of the urban thermal environment and the air pollutant concentration. A thermal environment and air pollutant sensing map is formed, and real-time simulation of the urban microenvironment is achieved. According to the invention, real-time map display can be carried out on urban thermal environment and air pollutants, and data support is provided for reasonable planning and improvement of urban regional microenvironment</p>

7.6.1. Analysis of selected patents



Figure 7.11. Geographical distribution of smart climate solutions (SCS).

In relation to the selected patents, figure 7.16 shows the countries where patents related to the topic were registered, being China the country with the highest number of patents.

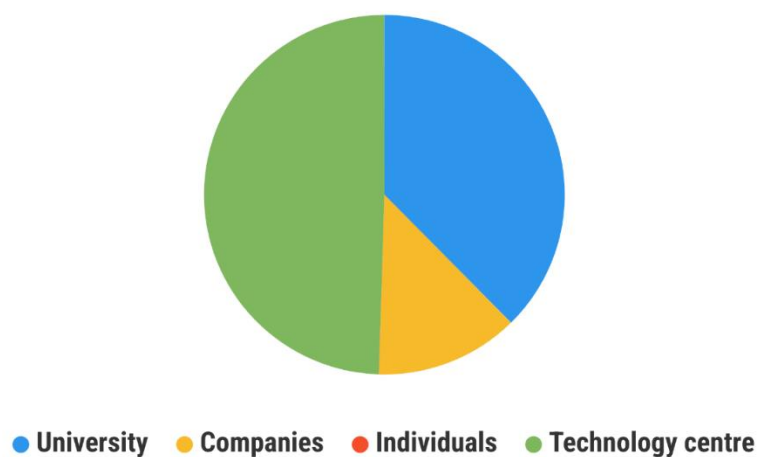


Figure 7.12. Distribution of types of assignees of smart climate solutions (SCS).

The figure 7.16 shows that patents related to the topic were filed mainly by technology centres, but also by a big number of universities and a little number of private companies.



7.7 Mussel raft monitoring (MRM) - Environmental and hydrodynamic sensors based on the implementation of IoT low-cost monitoring solutions powered by solar energy. Digitalization will allow knowing in real-time the state of the platform, alarms in case of risky water conditions, production monitoring and the construction of a comprehensive database.

CETMAR has pioneered the **digitalization of mussel rafts** to enable real-time production monitoring, in close collaboration with mussel production stakeholders, adapting to their needs. It focuses on the collection of extensive real-time data from mussel rafts to optimize the management of mussel production, particularly in response to climate-related challenges.

In this case, the solution developed in TransformAr includes the monitoring of environmental and production parameters (currently in two mussel-rafts), based on the implementation of IoT solutions powered by solar energy. Besides, the remote visualization of the data on an internet-based platform is also being developed, presenting the information for production management.

- **The first phase** consists of a **system that monitors the basic parameters** with IN-SITU data storage installation in a raft to define conditions that allows the new design of the installation architecture **to adapt it to a real-time data collection system**.
- **The second phase** develops the **communication protocols and the improvements** to be able to perform data acquisition autonomously and send the measurements to ground stations for further analysis. In addition to the **oceanographic monitoring sensors**, other **meteorological sensors** are added. Data analysis procedures are being improved as well to adapt to real time model. The designed installation is **feasible for the available infrastructure** and **resistant to the adverse conditions** of the marine environment and has a high degree of **autonomy**, both in terms of **energy** and in the **measurement** and **telematic transmission** of monitored data, as well as having systems for **detecting possible failures**.
- **The third phase**, implemented in 2024, **will improve the data analysis systems and the necessary implementations to visualise the data in a user-friendly web platform**. This dashboard will show real time data, as well as all the data history of the variables that are being collected. It is intended that data access, and the visualisation are affordable for stakeholders and useful in decision-making for **more effective and sustainable management of resources**.

7.7.1. State of the Art

First it is included the definition of the results defined by characteristics and the Key Words associated with each of them., updated at month 40.

Table 7.18 Mussel raft monitoring (MRM) definition.

Characteristic	Key words
Application of IoT technologies	IoT
Focus on mussels rafts in sea water	Sea water/Mussels raft
Implementation of sensors	Sensor/IMU/ GPS/ Load Cells/ Meteorological instruments/ CTD Water sondes/

	turbidimeter/ Bluetooth devices/ Ultrasonic distance meters
Designed system	System
Focus on quality measurements	Quality
For aquaculture application	Aquaculture
Aim to monitor parameters	Monitor/Position/ Raft movement/ Mussel wire weight/ Water agitation/ Rain/ Wind/ Air temperature/ Water Temperature / salinity/ Air sound/ Turbidity/ Intrusion system
Low-cost	Low cost
No interference with normal activities	No normal activities interference

Based on the key words defined, a set of search strategies were designed to identify technologies related to the topic. The results obtained from each search strategies were filtered by year (those with a prior date after 2021) to select the newest developments. The result number obtained was filtered applying an analysis using key related words and the knowledge about the result definition itself.

Table 7.19 Mussel raft monitoring (MRM) search strategies and results obtained.

Strategy code	Strategy	Result Number	Results year filtered ¹⁵	Results key word filtered
MRM.1	((IOT)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (SEA W WATER)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (SENSOR?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (SYSTEM?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (QUALITY)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	196	133	3
MRM.2	((AQUACULTURE)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (WATER W MONITOR+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (SEA)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	168	67	7

A total of 10 patent documents, included in the next table, was selected as relevant available solutions in the State of the Art for the solution Mussel raft monitoring (MRM) - Environmental and hydrodynamic sensors based on the implementation of IoT low-cost monitoring solutions powered by solar energy. Digitalization will allow knowing in real-time the state of the platform, alarms in case of risky water conditions, production monitoring and the construction of a comprehensive database result, and were analysed to identify exploitation means considering the potential implementation on society identified.

¹⁵ 1 AND EAPD >= 2021

Table 7.20 Relevant patent document identified in the SoA related to Mussel raft monitoring (MRM).

Code	Title	Assignee	Summary
CN116310972	Regional microclimate assessment method and system	LIGHT CONTROLS TESILIAN SHANGHAI INFORMATION TECHNOLOGY	The embodiment of the invention provides a regional microclimate assessment method . The regional microclimate assessment method comprises the following steps: acquiring video data of each target region of a target region; determining a microclimate element value of each target area according to the video data of each target area; obtaining microclimate data of the target regions according to the microclimate element values of the target regions; and pushing the microclimate data of the target area to a microclimate management terminal. According to the regional microclimate assessment method and system disclosed by the embodiment of the invention, by utilizing an existing video monitoring system, meteorological equipment does not need to be deployed, and meteorological personnel does not need to be arranged, so that the observation cost is greatly reduced; small-granularity data can be obtained by means of a video monitoring system, and fine regional microclimate data can be obtained
CN218956568	Aquaculture water quality monitoring device	GUANGDONG OCEAN UNIVERSITY	The utility model discloses a water quality monitoring device for aquaculture , which relates to the technical field of aquaculture and comprises a lifting box, a water tank, a sound wave receiver, a sensor and a servo motor are mounted on the inner wall of the lifting box, a submersible pump is mounted at the bottom of the lifting box, and a storage battery and a single chip microcomputer are mounted on the top and one side of the water tank respectively. According to the water quality monitoring device, a user controls the sound wave receiver through the sound wave controller, so that the submersible pump is remotely controlled through the single-chip microcomputer to feed and discharge water into and out of the water tank, the lifting box ascends and descends, the driving end of the servo motor rotates, the propeller is driven to rotate through the rotating shaft, and the four sensors are controlled to monitor water quality in multiple aspects; meanwhile, the water quality of aquaculture at different water depths can be conveniently recorded through the single chip microcomputer according to the water pressure, so that the lifting box can conveniently run, dive and float up in

			water, and the water quality of aquaculture at different areas and different depths can be conveniently monitored
IN202341001680	Remote aquatic environmental monitoring using internet of things	Alaskar Kamal; Getsy Mary D; Hajare Raju; Indhuja A; Kirubakaran Prema A; & 6 more	The utility model reveals an aquaculture water monitoring system that makes use of the internet of things . When it comes to aquaculture, the internet of things water monitoring system includes the following components: an oxygenation device, a water pump, a collecting system used for collecting water parameters, a wireless observe and control terminal, and a monitoring server. The wireless observe and control terminal is in communication with the collecting system and the monitoring server, and it is also responsible for operating the water pump and the oxygenation device. When used to aquaculture, an IoT-based water monitoring system increases the oxygenation unit's useful life, decreases operating expenses, and lessens power usage. Sharing the same wireless observe and control terminal and collecting system across many aquaculture sites increases the comparability of water quality parameters across sites and decreases the per-site device cost associated with monitoring water quality. The sensor is placed near the fishpond's bank on the common water exit line from the water pump, making it easy to access for cleaning or replacement
KR10-2487955	Natural seaweed and sea forest monitoring device.	INFINITY OCEAN	The seabed installed with sea installation is implemented as a method in which a previously skilled diver enters a seabed floor and photographed at a specific water depth, and then picks up photographing equipment and checks the photographing equipment in the seabed . Accordingly, it has been difficult to observe long term or photographing water in an oil-in-water environment above the water depth where the diver is submersible. By providing an artificial fish and marine farm monitoring device capable of collecting biological changes and monitoring marine farm change information in real time during a set period of time installed in the artificial farm and marine farm marine farm to be monitored in order to solve existing problems such as this, the post-composition post-mortem monitoring of artificial fish farm or seafood composition is possible, thereby enabling more efficient monitoring of fish
KR10-2399078	Device for monitoring artificial reef fishery and seaweed sea forest	GEMATEK	Conventionally, an underwater imaging system can't perform photographing at a fixed point because of a tidal current or a sea current when lowered from a ship and the like to a seabed . In addition, in a seabed area where a sea jungle landmark is established, skilled divers conventionally place a photographing device under the sea and allow the same to capture images at a particular depth of the sea, and then lift the same to check the images on the sea, so that it is

			<p>difficult to monitor or photograph an underwater environment for a long time at a deeper level than the water level where a diver can dive. In order to solve such a problem, provided is a device for monitoring an artificial reef fishery and a seaweed sea forest, which is installed at areas around an artificial reef fishery and a seaweed sea forest to be monitored, so that information on changes in organisms and sea areas can be collected in real time for a set period.</p> <p>Accordingly, a follow-up monitoring can be performed after the artificial reef complex or a sea jungle landmark are established, so that the fishery can be more efficiently monitored. The device for monitoring an artificial reef fishery and a seaweed sea forest comprises: an upper plate, an intermediate plate, and a lower plate spaced apart from one another at predetermined intervals; a plurality of supports connected to the above-mentioned plates to form a duplex structure; a mooring eyebolt installed on the upper plate to connect a mooring rope; and a buoy at one end of the mooring rope, which is disposed on the surface of the water.</p>
CN114154300	Urban thermal environment and air pollutant concentration real-time sensing map establishment method	CHINA CONSTRUCTION SCIENCE TECHNOLOGY GROUP HARBIN INSTITUTE OF TECHNOLOGY	<p>The invention discloses an urban thermal environment and air pollutant concentration real-time sensing map establishment method, which comprises the following steps of: simulating an urban thermal environment and air pollutants by utilizing ENVI-met software, drawing a thermal comfort cloud picture and an air pollution cloud picture, automatically displaying the cloud pictures and parameters in an electronic map of ArcGIS software through programming and definition of picture coordinates, and establishing a real-time sensing map of the urban thermal environment and the air pollutant concentration. A thermal environment and air pollutant sensing map is formed, and real-time simulation of the urban microenvironment is achieved. According to the invention, real-time map display can be carried out on urban thermal environment and air pollutants, and data support is provided for reasonable planning and improvement of urban regional microenvironment.</p>
CN215952651	Mariculture water quality salinity monitoring device based on internet of things	NANYANG NORMAL UNIVERSITY	<p>The utility model discloses a mariculture water quality salinity monitoring device based on internet of things, which comprises a box body fixedly connected to the outer wall of the top of a floating plate and a remote server, a winding assembly is arranged on the inner wall of one side of the box body, the winding assembly comprises a wire roller, a motor and a cable, and one end of the wire roller is rotatably connected to the inner wall of one side of the box body; the outer wall of the bottom of the motor is fixedly connected to the inner wall of the bottom of</p>

			<p>the box body, and the output end of the motor is connected with one end of a wire roller through a coupler; one end of the cable is arranged on the outer wall of the cable roller, an I-shaped column is fixedly connected to the outer wall of the cable, a protective cover is rotatably connected to the outer wall of the I-shaped column, and a water level sensor is fixedly connected to the outer wall of the top of the protective cover; the inner wall of the bottom of the protective cover is fixedly connected with a monitoring assembly. And the inner wall of one side of the box body is fixedly connected with a single chip microcomputer. According to the utility model, the monitoring assembly can be flexibly controlled to accurately monitor the water quality of different deep layers in real time, and the use is convenient.</p>
CN214748140	Deep-sea aquaculture monitoring system	<p>CSIC</p> <p>GUANGDONG ZHANJIANG PROVINCIAL LABORATORY OF SOUTHERN MARINE SCIENCE & ENGINEERING</p> <p>HUBEI OCEAN ENGINEERING EQUIPMENT RESEARCH INSTITUTE</p>	<p>The embodiment of the utility model provides a deep-sea breeding monitoring system. The system comprises an upper computer; the underwater monitoring assembly comprises a fish school behaviour detection unit, a seawater environment monitoring unit and a fish school safety monitoring unit, and the fish school behaviour detection unit, the seawater environment monitoring unit and the fish school safety monitoring unit are in communication connection with the upper computer; the overwater monitoring assembly comprises a meteorological monitoring unit and a net cage safety monitoring unit, and the meteorological monitoring unit and the net cage safety monitoring unit are in communication connection with the upper computer. The deep-sea culture monitoring system can provide data support for determining a culture scheme, and is beneficial to improving the yield of deep-sea culture</p>
CN214669025	Water body monitoring device for aquaculture	PUTIAN UNIVERSITY	<p>The utility model relates to the technical field of water body monitoring, in particular to a water body monitoring device for aquaculture, which comprises a monitoring outer box, a water body sampling pipe, a water body monitoring module and a fixing frame, a partition plate is fixedly connected inside the monitoring outer box, a water storage tank is fixedly connected to the left side of the top of the partition plate, and a water outlet pipe is fixedly connected to the bottom of the water storage tank. A disinfection box is installed on the right side of the top of the partition plate, a disinfection pipe is fixedly connected to the left side of the disinfection box, an electric telescopic rod is fixedly connected to the position, close to the right side, of the top of the inner wall of the monitoring</p>

			<p>outer box, and a pressing plate is fixedly connected to the bottom of the electric telescopic rod; a rotating rod is rotationally connected into the water sampling pipe, a cutting blade is fixedly connected to the surface of the rotating rod, and a first suction pump is fixedly connected to the left side of the water sampling pipe; according to the device, blockage in the monitoring process can be avoided, and meanwhile, the interior of the device can be disinfected to prevent microorganism residues</p>
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7.7.1. Analysis of selected patents

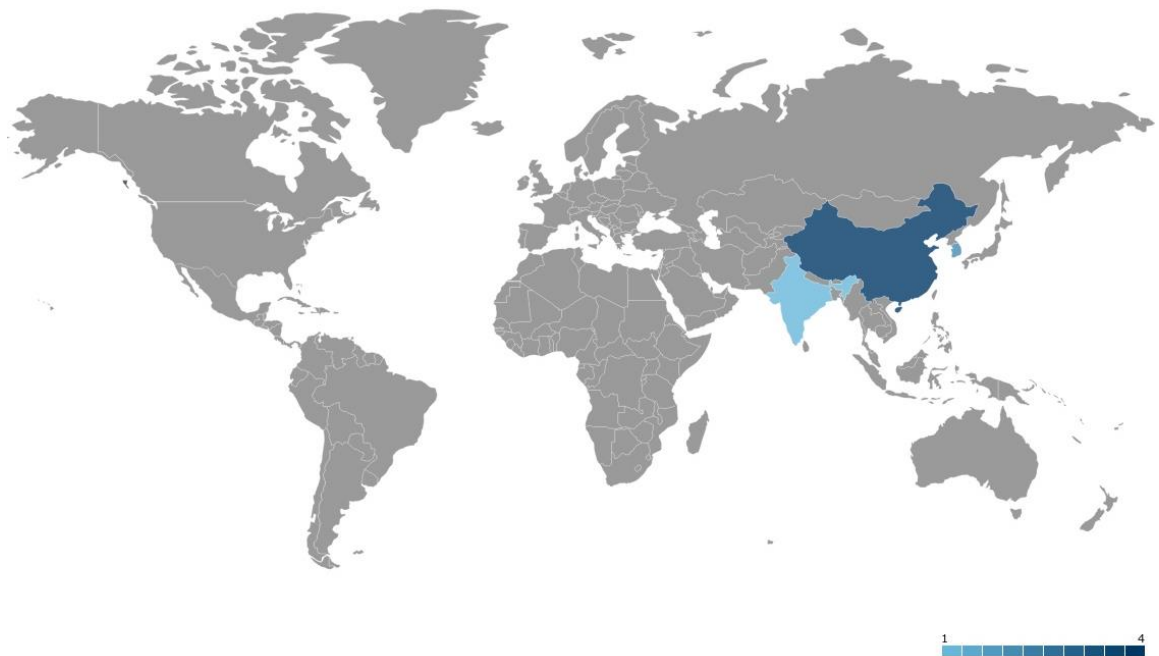


Figure 7.13. Geographical distribution of mussel raft monitoring (MRM).

In relation to the selected patents, figure 7.17 shows the countries where patents related to the topic were registered, being China the country with the highest number of patents.

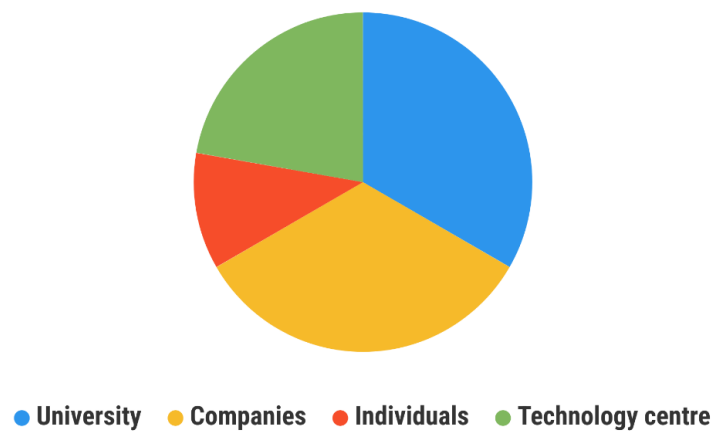


Figure 7.14. Distribution of types of assignees of mussel raft monitoring (MRM).

The figure 7.18 shows that patents related to the topic were filed mainly by universities and private companies, but also by a little number of technology centres and individuals.

7.8 Intertidal monitoring (INTERM) - To improve the knowledge of environment behaviour and numerical modelling to predict banks response under changing environmental conditions.

University of Vigo implements a **sedimentological monitoring of sandbanks at specific locations of clam exploitation** with the aim to improve the knowledge of the **sediment dynamics**, the stability of the **ecosystem substratum**, and its response to the **predicted Climate Change outcome**. An updated understanding will improve stakeholders and policymaker's basis for adequate adaptation solutions, efficient management currently hindered by the lack of information.

This solution directly responds to two aspects in the nature of the sandbank's substrate understanding:

- The **sedimentological context** of the Galician intertidal sandbanks, specifically **what drives their morphology** and **how their sediments seasonally behave**, and the **potential relationship with changes in shellfish productivity**.
- **Consequences of the Climate Change** on the Galician sandbanks terrain.

7.8.1. State of the Art

First it is included the definition of the results defined by characteristics and the Key Words associated with each of them, updated at month 40.

Table 7.21 Intertidal monitoring (INTERM) definition.

Characteristic	Key words
Design for intertidal environment	Intertidal
Definition characteristics conditions	Condition/ Parameters/Characteristics/ Deviations
Application of numerical hydrodynamic and morphological model	Model/ Numeric/ Mathematical/ DELFT3D/ Hydrodynamic/Morphodynamic
Sandbank changes identification	Erosion/ Accumulation/ Sediment/ Sediment texture/ Sedimentology / Sandbank/ Sand/ Mud / Geomorphology
Shellfish monitoring and oversee	Shellfish
Monitoring of alterations and normal parameters deviations	Changes/ Alterations
Monitor and identify condition alterations	Monitor/ Identify/ Detect

Based on the key words defined, a set of search strategies were designed to identify technologies related to the topic. The results obtained from each search strategies were filtered by year (those with a prior date after 2021) to select the newest developments. The result number obtained was filtered applying an analysis using key related words and the knowledge about the result definition itself.

Table 7.22 Intertidal monitoring (INTERM) search strategies and results obtained.

Strategy code	Strategy	Result Number	Results year filtered ¹⁶	Results key word filtered
INTERM.1	((CONDITION? OR PARAMETER?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (SANDBANK?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (MONITOR+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (SEA)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	56	14	1
INTERM.2	((CONDITION? OR PARAMETER? OR CHARACTERISTIC? OR DEVIATION? OR BEHAVIOUR?)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (INTERTIDAL)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (MODEL OR NUMERIC OR MATH+)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX AND (SEA)/TI/AB/CLMS/DESC/ODES/OBJ/ADB/ICLM/KEYW/TX)	1564	407	4

A total of **5 patent documents**, included in the next table, was selected as relevant available solutions in the State of the Art for the solution Intertidal monitoring (INTERM) - To improve the knowledge of environment behaviour and numerical modelling to predict banks response under changing environmental conditions result, and were analysed to identify exploitation means considering the potential implementation on society identified.

¹⁶ 1 AND EAPD >= 2021

Table 7.23 Relevant patent document identified in the SoA related to Intertidal monitoring (INTERM).

Code	Title	Assignee	Summary
WO2022/074643	Improving geo-registration using machine-learning based object identification	EDGY BEES	A Geo-synchronization system involves a video camera in a vehicle, such as a drone, that captures aerial images of an area. The success rate and the accuracy of the geo- synchronization algorithms is improved by using a trained feed-forward Artificial Neural Network (ANN) for identifying dynamic objects, that changes over time, in frames captured by the video camera. Such frames are tagged, such as by adding metadata. The tagged frames may be used in a geo synchronization algorithm that may be based on comparing with reference images or may be based on another or same ANN, by removing the dynamic object from the fame, or removing the tagged frame for the algorithm. A dynamic object may change over time due to environmental conditions, such as weather changes, or geographical changes. The environmental condition may change in response to the Earth rotation, the Moon orbit, or the Earth orbit around the SuN
CN218897965	Marine ranch breeding structure in intertidal zone	INSTITUTE OF OCEANOLOGY & MARINE FISHERIES JIANGSU	The utility model relates to a marine ranch culture structure in an intertidal zone , the marine ranch culture structure comprises an intertidal zone, a water storage tank is arranged on the intertidal zone, the water storage tank is used for storing water and culturing marine organisms, a water retaining embankment is formed on the intertidal zone, the water retaining embankment is of an annular structure, the water retaining embankment is close to a notch of the water storage tank, and the water retaining embankment is connected with the water storage tank. The water blocking embankment is constructed to be capable of blocking seawater in the water storage tank during ebb tide. According to the marine ranch culture structure, the characteristics of rising tide and falling tide of an intertidal zone are reasonably utilized, the arranged water blocking embankment can play a role in blocking seawater when the seawater falls, the seawater can be stored in the water storage tank, it is guaranteed that cultured marine organisms can survive during the falling tide, and the service life of the marine organisms is prolonged. And the waste mud flat area is fully utilized to realize the cultivation of marine organisms, and huge economic benefits are generated

EP4278276	Geologic analogue search framework	GEOQUEST SYSTEMS SCHLUMBERGER SERVICES PETROLIERS SCHLUMBERGER SCHLUMBERGER TECHNOLOGY	A method can include, responsive to receipt of a search instruction that includes one or more search criteria, accessing a data structure for subsurface geologic regions categorized at least in part according to parameters that describe depositional environments, where the data structure includes virtual distances between the parameters; generating a search result using the one or more search criteria and the data structure, where the search result represents an organization of at least a portion of subsurface geologic regions as closest analogues to the one or more search criteria; and transmitting search result information for graphically rendering the search result to a display as part of an interactive graphical user interface. (From WO2022154792 A1)
CN216821158	Offshore deep sea intertidal zone type cultivation supporting device	JIANGSU HAISENLIN OCEAN TECHNOLOGY	An offshore deep sea intertidal zone type cultivation supporting device comprises a hollow supporting rod, a drawing rod and a tubular pile supporting foundation, one end of the drawing rod is inserted into the hollow supporting rod and fixedly connected with the hollow supporting rod through an anti-disengaging connecting rope, a plurality of evenly-distributed pistons are further fixedly installed on the drawing rod, and the tubular pile supporting foundation is fixedly connected with the hollow supporting rod. The other end of the drawing rod is installed on the pipe pile supporting foundation in a gapped mode through a ball head, and a supporting tray matched with the ball head is arranged on the pipe pile supporting foundation. The culture supporting device can automatically float along with movement in high tide and slide down to support in low tide, so that a culture net field can vertically float automatically in high tide and always float on the sea surface, and cultured algae and other organisms receive sunlight to perform photosynthesis and absorb nutrients in seawater to breed and grow; in low tide, the device can automatically slide off, be dried and aired away from water, remove bacteria and impurities and promote material exchange, so that both the production and the income can be increased, the water quality can be purified, the environment can be treated, and a natural ecological system can be created
IN202141031081	lot based real physico-chemical parameters monitoring system in mangrove zone	ANAKATH	An IoT based real-time physico-chemical parameters monitoring system in a mangrove zone comprising: a monitoring segment (114) constituted to measure the physical-chemical condition parameters in the mangrove ecosystem and level of freshwater measurement in the lagoon and produce the measurement data of said parameters, a transmitting section (112) configured to transmit said

			<p>parameters together to the central server (201). A central server (201) is configured to store the measured data of said parameters, and the computing unit is configured to display the measured data remotely display unit (202) through remote login. The said real-time system physic-chemical parameters monitoring system in mangrove zone comprising said Insitu unit configured to measure the said parameters across mangrove distribution like Avicennia marina, Rhizophora apiculata, Rhizophora mucronata, and Aegecerias corniculatum zones comprising a central processor (111) and central server unit (201) configured to save and produce the said parameters remotely</p>
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7.8.1. Analysis of selected patents

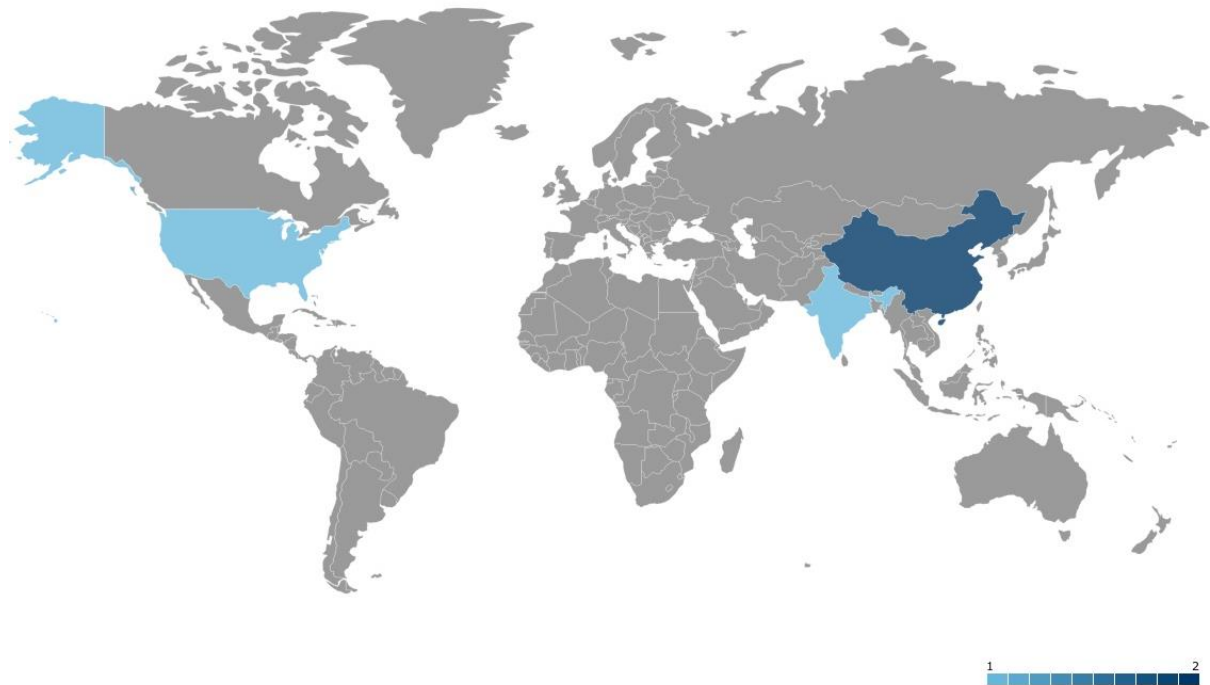


Figure 7.15. Geographical distribution of intertidal monitoring (INTERM).

In relation to the selected patents, figure 7.19 shows the countries where patents related to the topic were registered, being China the country with the highest number of patents.

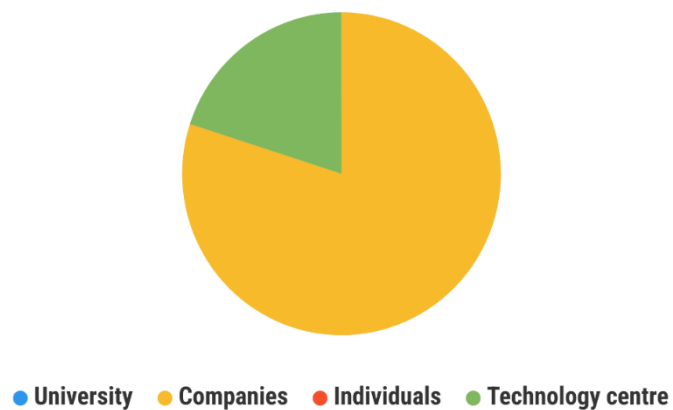


Figure 7.16. Distribution of types of assignees of intertidal monitoring (INTERM).

The figure 7.20 shows that patents related to the topic were filed mainly by private companies, but also by a little number of technology centres.

7.9 Behavioural change and awareness-raising solutions

- Nudging (**NUDG**) - refers to a behavioural strategy that subtly influences individuals to make choices that benefit themselves or society without restricting their freedom utilizing flyers, stickers, and sensors with data contributing to climate adaptation strategies in the region. Cognitive design artifacts and behavioural economics tools were delivered to end-users at specific moments, often triggered by their state of mind, to encourage the adoption of sustainable behaviours. This approach primarily targeted tourism, leveraging carefully timed interventions to foster lasting, environmentally friendly habits.
- Awareness-raising and behavioural change modules (**AWAR**) - monitoring the impact of project activities on the local population while fostering climate awareness and behavioural change. Educational materials were developed specifically for young people and school pupils to promote climate neutrality, enhance understanding of climate change (CC), and raise awareness of its potential impacts. Specifically, a 5-minute curriculum for pupils aged 13–15 was developed, additionally, a **living lab** is being created with active community participation.

This group of solutions are targeted at citizens aiming to **trigger better behaviour**, which is the case of the first solution or to **educate new generations** specifically on what is **climate change**.

7.9.1. State of the Art

First it is included the definition of the results defined by topics and the Key Words associated with each of them, updated at month 40.

Table 7.24 Behavioural change and awareness-raising solutions.

Characteristic	Key words
Climate change	Climate Change
Raise awareness	Awareness
Promotion of better behaviour	Behaviour
Didactical material	Didactic/Education/Cognitive
Targeted in students and tourism	Tourism/Students/Children

This topics with the key words associated where used to identify key related trends.

Table 7.25 Behavioural change and awareness-raising solutions related publications.

EU related I+D+I projects	
<u>CAPACITY FOR CHANGE AND IMPLEMENTATION INSTRUMENTS IN TOURISM ARCHITECTURE DESIGN TOWARDS MORE INNOVATIVE, INTEGRATED AND SUSTAINABLE MODELS</u>	
<p>Program: Specific programme "People" implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013)</p> <p>Duration: 01 May 2014 – 30 April 2017</p> <p>EU Funds: € 254 925,90</p> <p>Coordinator: UNIVERSITAT POLITECNICA DE CATALUNYA</p>	<p>The project aims to boost growth in Europe through tourism architecture. The two tourism models, hotels and resorts, most implemented on the European coastline will be studied from innovation, integration and sustainability perspectives. A new architecture model based on customer and staff experience will develop more intelligent, competitive and sustainable opportunity elements. The results will contribute to the transfer of methods and architecture techniques between outgoing and return institutions. The Research Associate position as offered by the institution will enable the researcher to extend his work with hospitality industry institutions and leaders in research projects.</p>
<u>Urban strategies for Waste Management in Tourist Cities</u>	
<p>Program: SOCIETAL CHALLENGES - Climate action, Environment, Resource Efficiency and Raw Materials</p> <p>Duration: 01 June 2016 – 31 May 2019</p> <p>EU Funds: € 4 248 782,50</p>	<p>Europe's cities are some of the world's greatest tourism destinations. The socio-economic impact of tourism is extraordinary and urban tourism, but it brings at the same time a range of negative externalities, including high levels of unsustainable resource consumption and waste production. In comparison with</p>

<p>Coordinator: GOBIERNO DE CANARIAS</p>	<p>other cities, tourist cities must face additional challenges related to waste prevention and management due to their geographical and climatic conditions, the seasonality of tourism flow and the specificity of tourism industry and of tourists as waste producers.</p> <p>UrBAN-WASTE will support policy makers in answering these challenges and in developing strategies that aim at reducing the amount of municipal waste production and at further support the re-use, recycle, collection and disposal of waste in tourist cities. In doing so UrBAN-WASTE will adopt and apply the urban metabolism approach to support the switch to a circular model where waste is considered as resource and reintegrated in the urban flow.</p>
<p>Future of Reefs in a Changing Environment (FORCE): An ecosystem approach to managing Caribbean coral reefs in the face of climate change</p>	
<p>Program: Specific Programme "Cooperation": Environment (including Climate Change) Duration: 01 January 2010 – 31 May 2014 EU Funds: € 6 474 632,00 Coordinator: THE UNIVERSITY OF EXETER</p>	<p>The Future of Reefs in a Changing Environment (FORCE) Project partners a multi-disciplinary team of researchers from Europe and the Caribbean to enhance the scientific basis for managing coral reefs in an era of rapid climate change and unprecedented human pressure on coastal resources. The overall aim is to provide coral reef managers with a toolbox of sustainable management practices that minimise the loss of coral reef health and biodiversity. An ecosystem approach is taken that explicitly links the health of the ecosystem with the livelihoods of dependent communities, and identifies the governance structures needed to implement sustainable development.</p>
<p>Interreg Euro-MED - HERIT ADAPT</p>	
<p>Program: Interreg Euro-MED Coordinator: Universidad de Granada</p>	<p>HERIT ADAPT is an EU funded project that will foster cooperation among key stakeholders by activating Interdisciplinary Territorial Working Groups to co-design the data-driven HERIT ADAPT Sustainable Tourism Model that will be tested in 8 pilot Euro-MED regions of different typologies, including UNESCO sites and lesser-known monuments in coastal, hinterland and mountainous areas. The Sustainable Tourism Model will consider territorial needs and visions, existing frameworks and plans and the global technology offer, enabling the use of existing tools and solutions and the valorisation of transnational knowledge gained from other projects.</p>
<p>Smart Cultural Tourism as a Driver of Sustainable Development of European Regions SmartCulTour Project News & Multimedia H2020 CORDIS European Commission</p>	
<p>Program: SOCIETAL CHALLENGES - Europe In A Changing World - Inclusive, Innovative And Reflective Societies Duration: 1 January 2020 – 30 June 2023 EU Funds: € 2 980 000,50 Coordinator: KATHOLIEKE UNIVERSITEIT LEUVEN</p>	<p>SmartCulTour fostered sustainable cultural tourism by developing updated concepts, measuring impacts through indicators and a Decision Support System, and engaging stakeholders via arts-based tools and Living Labs. It delivered 107 case studies, a data-driven platform, and a toolkit, enhancing resilience and inclusivity in rural and urban regions across Europe.</p>
<p>Home - FU-TOURISM</p>	
<p>Program: EU COSME SMP-COSME-2022-TOURSME-01 SMP Action Grant Budget-Based [SMP-AG] Duration: 1 September 2023 – 1 September 2026 EU Funds: € 3 999 998,98 Coordinator: EUPOLIS GRUPA D.O.O.</p>	<p>FU-TOURISM is a groundbreaking program that empowers tourism SMEs to thrive in the green and digital era. By creating a network of business support organizations in six European countries, FU-TOURISM provides funding and expertise to 102 SME projects that aim to transform their tourism practices. FU-TOURISM helps tourism SMEs to become more sustainable, resilient, and innovative, while contributing to the European Green Deal and Digital Single Market.</p>
<p>EDUCation about ClimATE change and polar science EDUCATE Project Fact sheet HORIZON CORDIS European Commission</p>	
<p>Program: Marie Skłodowska-Curie Actions (MSCA) Duration: 1 June 2022 – 31 May 2023 EU Funds: € 149 125,00 Coordinator: TURKIYE BILIMSEL VE TEKNOLOJIK ARASTIRMA KURUMU.</p>	<p>Polar regions face the consequences of climate change in an acute way as they are important for global climate regulation. However, the public has limited basic knowledge of the relationship between climate change and polar regions. Funded by the Marie Skłodowska-Curie Actions programme, the EDUCATE project will increase awareness about polar regions and global climate change and break the stereotypes around researchers. The project will present the conducted studies and results in an appropriate language, demonstrate the impacts of these studies on our world and daily life and introduce researchers and their professions. Moreover, it will focus on the young generation organising science workshops, exhibitions, seminars and concerts in Istanbul and Gaziantep.</p>
<p>Individual Change of HABits Needed for Green European transition I-CHANGE Project Fact sheet H2020 CORDIS European Commission</p>	
<p>Program: SOCIETAL CHALLENGES - Climate action, Environment, Resource Efficiency and Raw Materials Duration: 1 November 2021 – 30 April 2024 EU Funds: € 4 949 998,00 Coordinator: CENTRO INTERNAZIONALE IN MONITORAGGIO AMBIENTALE - FONDAZIONE CIMA</p>	<p>Impacts related to climate change are evident in many sectors of human life, including health, economy and security. The European Green Deal has set the blueprint for a transformational change that will make Europe the first climate-neutral continent in the world. However, this will be difficult to achieve without the active involvement of citizens. With that in mind, the EU-funded I-CHANGE project will promote the strong participation and creative role of citizens and civil society towards environmental protection, as well as changes in habits and the development of more sustainable standards. To that end, it will adopt a multi-</p>



	disciplinary, participatory approach and create a set of living labs to increase the public's awareness of the scientific processes underlying climate change.
#ClimateofChange: the human face of climate change - European Commission	
<p>Program: DEAR: Development Education and Awareness Raising Programme Duration: 1 Jan 2020 - 1 May 2023 EU Funds: € 9 227 700</p>	<p>#ClimateofChange places the voices of youth and the most affected communities at the heart of its campaign. It highlights the connection between migration, climate change and the need to transform our economy. Its vision promotes and protects the human rights of all people, without harming others or destroying the environment. It fights for effective policies that work toward socially and ecologically just economies</p>
News, publications, available material and activities	
<p>NASA reviewed list of organizations providing students and education resources related to global climate change.</p>	<p>The following organizations provide reviewed listings of the best available student and educators resources related to global climate change, including NASA products.</p> <ul style="list-style-type: none"> • NASA's Climate Kids • Climate Change Lessons: JPL Education • NASA Wavelength • NASA's Goddard Institute for Space Studies: STEM Educator Resources • NOAA: Teaching Climate • Climate Literacy & Energy Awareness Network • Living Landscapes Climate Science Project • U.S. Department of Energy Education Resources • Earth Science Week: Education Resources
<p>Climate Change Toolkit for Teachers UNEP - UN Environment Programme</p>	<p>The impetus for writing this book was to advance our understanding of the atmospheric science and help to elucidate the fundamentals of teaching and learning about climate change. The intent was to provide a basic understanding of the subject matter so that teachers could meaningfully understand and teach climate change. The book contains wealth of information on basics principles of climate change. It provides background information on Earth's climate system, global warming, the scientific principles that govern climate, climate variability and climate change, adaptation and mitigation. Also covered are national policies of relevance to climate change in Lesotho.</p>

7.10 Governance schemes

- Resilience index (RI) - comprehensive assessment tool developed by UVIGO-REDE to evaluate the adaptive capacity of the Galician mussel aquaculture sector in response to climate change. By integrating scientific data, expert consultations, stakeholder input, and data modelling, the RI identifies key resilience factors that can support adaptation to climate-induced risks. The tool aims to stimulate behavioural change by providing practitioners and policymakers with critical insights into risk scenarios and offering a solid foundation for informed decision-making. Ultimately, the RI helps define effective strategies to enhance the sustainability and resilience of the Galician mussel aquaculture production processes, encouraging proactive actions within the sector to adapt to climate challenges.
- Coastal contracts (COAST) - Instrument for ensuring greater coordination between different levels of spatial planning and authorities in charge of coastal wetlands management, while limiting conflicts between preservation issues and economic activities. Promotes voluntary agreements between public institutions and private individuals, new forms of institutional cooperation, new ways of integrating the different practices of spatial and sectoral planning.
- Demand Analysis for Social Services/Infrastructure (DSI) involves a continuous assessment of the "deep resilience" of social services and infrastructure, following the methodology developed by the H2020-EU-CIRCLE project. The aim is to strengthen social networks and reduce inequality while adapting to the impacts of climate change. As the demand for social and health services is expected to shift due to climate-related challenges, a comprehensive analysis will be conducted to ensure the continuity of services and address future needs.
- Climate Innovation Hub (CIH), developed within the Municipal Innovation Hub, promotes green, resilient, and climate-friendly entrepreneurship. The Ministry of Environment (MOE) is transforming a multi-purpose facility into the hub by establishing a permanent climate change exhibition, showcasing real-time data from Smart City Systems, and organizing events like datathons. These initiatives aim to provide public

access to climate-related data, encourage innovative solutions, and are supported by green bonds to address the municipality's climate challenges.

The three first solutions of this group are focused to be a decision-making support system for policy authorities mainly designed for each specific local region where it was developed, and the last one is an example of poly action implementation based on climate change necessities identified.

7.10.1. State of the Art

First it is included the definition of the results defined by topics and the Key Words associated with each of them., updated at month 40.

Table 7.26 Governance schemes.

Characteristic	Key words
Resilience index design for economic relevant sectors	Resilience Index/Economic sector
Coas management	Coast
Social services	Social services
Climate change adaptation	Climate change
Entrepreneurship	Entrepreneurship
Decision support system for authorities	Decision support/Authorities

This topics with the key words associated where used to identify key related trends.

Table 7.27 Governance schemes related publications.

EU related I+D+I projects	
SOLUTIONS for ENVIRONMENTAL CONTRASTS in COASTAL AREAS	
<p>Program: Specific Programme "Cooperation": Environment (including Climate Change) Duration: 01 December 2009 – 30 November 2013 EU Funds: € 6 159 118,44 Coordinator: SAPIENZA INNOVAZIONE CONSORZIO</p>	<p>Urban settlements, following the economic crisis of the 70s, entered in a process of regional and urban restructuring to gain a new image at the international level. As a result of the renewed economic success new flows of permanent, semi-permanent, temporary and daily "human mobility" followed: (i) for consumption (leisure and tourism), (ii) for production (economic migration). The world competition among metropolitan areas highlighted the essential importance of natural and cultural resources. The proposal considers the effects of human mobility on urban settlement growth and restructuring in coastal areas where (i) environment is more fragile and space limited, (ii) every phenomenon is more concentrated and (iii) effects on natural and cultural environment are more acute. Problems are multiplied since the climate change affecting environmental parameters - as sea levels - augments risks of flooding, propagation of pollutants, dislocation of a great number of settlers. Controlling and reducing unwanted consequences is contributing to growing conflicts among stakeholders. An integrated ecosystem approach incorporating social, economic and natural disciplines is essential in understanding and dealing with the complex and dynamic problems facing the coastal city environments. The proposal intends to: (i) identify conflicts, (ii) analyse their quantitative and qualitative effects on the environment, (iii) create models to synthesize the complexity of the different social, economic and environmental systems, (iv) compare the priority of each typology through taxonomy. Outcomes include (i) elaboration of an analysis methodology, (ii) creating tools for appropriate policies, (iii) scenario building, (iv) dissemination–exploitation of results for users' needs. The project will analyse 8 metropolitan areas of global importance and 8 of local importance in European and Asian countries (Belgium, Portugal, Italy, Sweden, United Kingdom, Israel, India, and Vietnam)</p>
Innovative coastal technologies for safer European coasts in a changing climate	

<p>Program: Specific Programme "Cooperation": Environment (including Climate Change) Duration: 01 December 2009 – 30 November 2013 EU Funds: € 6 530 000,00 Coordinator: ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA</p>	<p>Coastal areas are vital economic hubs in terms of settlement, industry, agriculture, trade and tourism to mention some key sectors. There are already many coastal problems including erosion, flood risk and long-term habitat deterioration. As economies continue to develop the asset base at risk will grow, while accelerating climate change will increase the likelihood of damaging extreme events, as well as accelerate habitat decline.</p> <p>Existing coastal management and defence approaches are not well tuned to these challenges as they assume a static situation.</p> <p>THESEUS will develop a systematic approach to delivering both a low-risk coast for human use and healthy habitats for evolving coastal zones subject to multiple change factors.</p> <p>The innovative combined mitigation and adaptation technologies to be considered will include ecologically-based mitigation measures (such as restoration and/or creation of habitats), hydro-morpho dynamic techniques (such as wave energy converters, sediment reservoirs, multi-purpose structures, overtop resistant dikes), actions to reduce the impact on society and economy (such as promotion of risk awareness or spatial planning) and GIS-based software to support defence planning.</p> <p>To integrate the best of these technical measures in a strategic policy context we will develop overarching THESEUS guidelines which will considers the environmental, social and economic issues raised in any coastal area.</p> <p>It is in this spirit that THESEUS will advance European and international experience in applying innovative technologies to reducing coastal risks.</p> <p>THESEUS activities will be carried out within a multidisciplinary framework using 8 study sites across Europe, with specific attention to the most vulnerable coastal environments such as deltas, estuaries and wetlands, where many large cities and industrial areas are located.</p>
<p>Impacts and risks from higher-end scenarios: Strategies for innovative solutions</p>	
<p>Program: Specific Programme "Cooperation": Environment (including Climate Change) Duration: 1 November 2013 – 31 October 2018 EU Funds: € 8 914 935,00 Coordinator: UNITED KINGDOM RESEARCH AND INNOVATION</p>	<p>IMPRESSIONS will provide empirically-grounded, transformative science that quantifies and explains the consequences of high-end climate scenarios for both decision-makers and society. IMPRESSIONS will develop and apply a novel participatory methodology that explicitly deals with uncertainties and strong non-linear changes focussing on high-end climate change, but also including intermediate warming levels. This new methodology will build on the representative concentration pathways (RCPs) and shared socio-economic pathways (SSPs) to create a coherent set of high-end climate and socio-economic scenarios covering multiple scales. These scenarios will be applied to a range of impact, adaptation and vulnerability models that build on theories of complex systems and address tipping elements as key characteristics of such systems. The models will be embedded within an innovative multi-scale integrated assessment approach to improve analysis of cross-scale interactions and cross-sectoral benefits, conflicts and trade-offs. Model results will inform the development of time- and path-dependent transition pathways. These will include mechanisms to foster synergies between adaptation and mitigation and will aim to build resilience in the face of uncertainty. Methods will be applied within five linked multi-sectoral case studies at global, European and regional/local scales. Stakeholders within these case studies will be fully engaged in the research process through a series of in-depth professionally facilitated workshops which maximise their active participation in defining high-end scenarios and adaptation and mitigation pathways, and in analysing the inherent risks and opportunities of new policy strategies. This will build the capacity of stakeholders to understand the risks, opportunities, costs and benefits associated with different adaptation and mitigation pathways under high-end scenarios, and how they might be effectively embedded within decision-making processes.</p>
<p>Climate change and European aquatic RESources CERES Project Fact sheet H2020 CORDIS European Commission</p>	
<p>Program: SOCIETAL CHALLENGES - Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy Duration: 1 March 2016 – 29 February 2020 EU Funds: € 5 586 851,25 Coordinator: UNIVERSITY OF HAMBURG</p>	<p>The CERES project aims to assess how climate change will affect Europe's fish and shellfish populations, ecosystems, and related industries. It provides high-resolution projections of environmental changes, integrates knowledge on ecological impacts, and uses risk-assessment methodologies to guide adaptation in aquaculture. The project develops tools for fisheries and policymakers to promote sustainable growth, analyses market responses, and formulates adaptation strategies, while communicating results to stakeholders for effective decision-making.</p>
<p>Co-creating a decision support framework to ensure sustainable fish production in Europe under climate change ClimeFish Project Fact sheet H2020 CORDIS European Commission</p>	



<p>Program: SOCIETAL CHALLENGES - Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy Duration: 1 March 2016 – 29 February 2020 EU Funds: € 5 586 851,25 Coordinator: UNIVERSITY OF HAMBURG</p>	<p>The ClimeFish project aims to promote sustainable seafood production by identifying areas and species with growth potential under climate change. It uses biological models, forecasting, and socio-economic analysis to create production scenarios, identify risks, and develop early warning systems. The project involves 16 case studies across 3 production sectors and 25 species, addressing climate impacts. It will develop management plans and a Decision Support Framework to guide stakeholders in adapting to climate change while minimizing economic and social impacts.</p>
<p>Collaborative Land Sea Integration Platform COASTAL Project Fact sheet H2020 CORDIS European Commission</p>	
<p>Program: SOCIETAL CHALLENGES - Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy Duration: 1 May 2018 – 31 October 2022 EU Funds: € 4 999 943,75 Coordinator: VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK N.V.</p>	<p>The goal of the COASTAL project is to formulate and evaluate business solutions and policy recommendations aimed at improving the coastal-rural synergy to foster rural and coastal development while preserving the environment. Rural development in the EU is increasingly affected by changing market developments, decreasing population densities, urban sprawl, lack of employment, desertification and other environmental, economic and social pressures. On the other hand, coastal areas provide interesting business opportunities but are also influenced by economic activities in the hinterland. Multi-Actor Approaches will be combined with System Dynamics to analyse the environmental, economic, and social interactions of rural and coastal areas in a holistic manner. The underlying feedback structures governing the dynamics, vulnerabilities, limitations, and business opportunities of the land-sea system will be identified and analysed, taking into consideration the regulatory frameworks, stakeholder priorities and social-economic conditions at the local, regional and macro-regional scale levels. Multi-Actor Labs using qualitative and quantitative tools will be set up to support the co-creation exchanges between scientific experts, stakeholders, business entrepreneurs, sector- and administrative representatives. The project will be structured around six closely interacting work packages with six complementary case studies in Sweden, Belgium, France, Spain, Greece and Romania.</p>
<p>Project - Coordinated Wetland management in Italy-Croatia cross border region</p>	
<p>Program: Programme 2014 - 2020 INTERREG V-A Italy - Croatia Duration: 1 December 2018 – 31 August 2021 EU Funds: € 1 479 062.66 Coordinator: Università IUAV Venezia</p>	<p>CREW project aims at achieving the following objectives: set up a cross border Observatory to monitor best practices and data on Italian and Croatian coastal wetlands; protect the biodiversity in Italian and Croatian coastal wetlands by the implementation of a coordinated methodology for wetlands management (Wetland Contract); share a cross border strategy and strengthen synergies among Italian and Croatian coastal wetlands; improve the public awareness about the value of the wetlands ecosystems among policy makers, managers, professionals, and general public and strengthen their active engagement in territorial governance.</p>
<p>Modelling RESTORation of wEtlands for Carbon pathways, Climate Change mitigation and adaptation, ecosystem services, and biodiversity, Co-benefits RESTORE4Cs Project Fact sheet HORIZON CORDIS European Commission</p>	
<p>Program: Horizon Europe Climate, Energy and Mobility Duration: 1 January 2023 – 31 December 2025 EU Funds: € 6 644 837,00 Coordinator: UNIVERSIDADE DE AVEIRO</p>	<p>Healthy wetlands have a remarkable capacity to store carbon, being the most effective carbon sinks on our planet. However, human-impacted wetlands represent a major source of greenhouse gases. There is a need to assess the role of restoration action on wetlands' climate change mitigation capacity using an integrative socio-ecological systems approach. The EU-funded RESTORE4Cs project will assess how the restoration of degraded wetlands can help halt greenhouse gas emissions and even reverse them while improving the condition of its habitats and species and the provision of ecosystem services, in addition to providing co-benefits to stakeholders in and around the wetlands. Bringing together 16 partners from across Europe, the project will design standardised methodologies and approaches for the prioritisation of wetland restoration.</p>
<p>MARket Research for a Climate Services Observatory MARCO Project Fact sheet H2020 CORDIS European Commission</p>	
<p>Program: Horizon 2020 SOCIETAL CHALLENGES - Climate action, Environment, Resource Efficiency and Raw Materials Duration: 1 November 2016 – 31 December 2018 EU Funds: € 1 520 303,75 Coordinator: CLIMATE-KIC HOLDING BV</p>	<p>Climate-related tools, products, data and services may greatly contribute to climate change mitigation and adaptation. However, current strategies face knowledge gaps, lack of visibility of climate services, and low awareness of key potential customers for using key information and the associated economic benefits. This reality triggers the need and potential for developing a global market for climate services. The 'MARket Research for a Climate services Observatory' (MARCO) proposal gathers market research firms, climate scientists, climate services practitioners, and innovation actors, around the Climate-KIC, to provide a detailed insight into the market for climate services in Europe, in line with the challenge of enabling market growth outlined in the EC's "R&I roadmap for climate services". The project's key objectives are to: assess the EU market of climate services; validate and enrich the market assessment with case studies; forecast future user</p>

	<p>needs and assess market growth until 2030; unveil opportunities and promote market growth.</p> <p>To achieve this, MARCO will build on a phased approach with feedback loops between several methodologies to ensure validation of findings. This will start with defining the framework for market characterisation, followed by exhaustive, integrated market research combining climate vulnerability analysis deriving into potential market estimation, confronted to actual transactional market quantification, qualitative surveys, and nine case studies on specific sectors and regions. This will be followed by a gap analysis and innovation modelling to reveal the untapped market. A foresight exercise will then outline market growth till 2030. Finally, recommendations for market observation and facilitation will be expressed.</p> <p>Stakeholders will be involved at all points of the process, with a continuous dialogue network and two workshops. The Climate KIC and partners will ensure sound dissemination of results, all made public.</p>
<p>Controlling microBiotomes Circulations for better food Systems CIRCLES Project Fact sheet H2020 CORDIS European Commission</p>	
<p>Program: Horizon 2020 SOCIETAL CHALLENGES - Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy</p> <p>Duration: 1 November 2018 – 31 October 2024</p> <p>EU Funds: € 9 999 964,8</p> <p>Coordinator: ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA</p>	<p>The smart microbiome food systems (SMFSs) represent a solution for responsible, competitive and secure EU food systems. The EU-funded CIRCLES project intends to discover and deploy innovative microbiomes-tailored circular actions into concrete applications to increase the sustainability of the EU food system. The project will create real-world labs in the field of six food systems relevant to the EU market – tomatoes, spinach, poultry, pigs, Atlantic salmon, and seabream aquacultures – to understand the role of the food system microbiomes in productivity, quality, safety and sustainability. The circular actions will rely on the integrative use of different smart microbiome modulators. The results will provide the EU with innovative and cost effective commercial applications.</p>
<p>News, publications, available material, and activities</p>	
<p>APPLYING CLIMATE INFORMATION FOR ADAPTATION DECISION-MAKING</p>	<p>The development and publication of this guidance document was made possible through funding contributions from the Swiss and US governments to the National Communications Support Programme (NCSP). The NCSP, a GEF-funded project implemented jointly by UNDP and UNEP, provides technical support to non-Annex I Parties to the United Nations Framework Convention on Climate Change. This document does not necessarily reflect the views of UNDP, UNEP nor the GEF Secretariat.</p>
<p>ADAPT2CLIMA Decision Support Tool</p>	<p>The aim of the ADAPT2CLIMA Decision Support Tool is to enhance understanding of climate change and its impacts on agriculture to support farmers, policy makers and other relevant stakeholders (agronomists, agribusiness industry, etc.) in adaptation planning.</p> <p>The impacts of climate change on crop performance, water availability and on the agricultural sector in general are presented through interactive visualization maps and graphs by means of the ADAPT2CLIMA Tool. Moreover, the tool may be applied to explore the available adaptation options for addressing climate change impacts and their efficiency in increasing the resilience of agriculture. The tool has been developed in the framework of the project LIFE ADAPT2CLIMA - Adaptation to Climate change Impacts on the Mediterranean islands' Agriculture, which is co-financed by the LIFE programme for the Environment and Climate Action (2014-2020).</p> <p>The tool is currently applied in Cyprus, Crete (Greece) and Sicily (Italy) but it may be used by anyone wishing to develop a regional adaptation strategy for the agricultural sector of Italy, Greece and Cyprus, through the "apply the tool to your area" feature.</p>
<p>Decision Making Guides: Climate Change Adaptation</p>	<p>The following resources have been compiled for natural resource managers, scientists, and students in the fields of natural resource management, ecology, and conservation biology, who are confronted with complex and difficult decision making problems related to climate change mitigation and adaptation. Below are some books, reports, and online tools to guide the process.</p>
<p>Role-play simulations for climate change adaptation education and engagement</p>	<p>In order to effectively adapt to climate change, public officials and other stakeholders need to rapidly enhance their understanding of local risks and their ability to collaboratively and adaptively respond to them. We argue that science-based role-play simulation exercises — a type of 'serious game' involving face-to-face mock decision-making — have considerable potential as education and engagement tools for enhancing readiness to adapt. Prior research suggests role-play simulations and other serious games can foster public learning and encourage collective action in public policy-making contexts. However, the effectiveness of such exercises in the context of climate change adaptation</p>

	<p>education and engagement has heretofore been underexplored. We share results from two research projects that demonstrate the effectiveness of role-play simulations in cultivating climate change adaptation literacy, enhancing collaborative capacity and facilitating social learning. Based on our findings, we suggest such exercises should be more widely embraced as part of adaptation professionals' education and engagement toolkits.</p>
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7.11 Insurance, financial and economic schemes

- Green bonds (**GB**) - The identification and use of change-agents as a broker between private buyers and private sellers that allow for complex and layered environmental goods and services to be transacted by delivering partnerships. The role of the change-agent is to pull together all stakeholders and seek agreement on the protocols needed to assess the costs and the benefits either to secure future public funding or the measurement, accounting and verification needed to make goods and services bankable.
- Adaptation fund (**AF**) - Financial mechanism designed to support the development and implementation of projects that help vulnerable communities adapt to the impacts of climate change. Unlike traditional funds focused on mitigation, the Adaptation Fund specifically targets efforts to build resilience against climate risks such as floods, droughts, and extreme weather events. In Guadeloupe, the **Local Adaptation Fund (FLAG)** was established as part of the **TransformAr** project to fill the gap where most funding was previously directed toward mitigation efforts. FLAG is France’s most advanced adaptation fund, aiming to reallocate resources for local climate solutions, foster partnerships, and bridge public-private gaps. FLAG has already supported six adaptation projects totalling €1.24 million, with contributions from both public and private investors.
- Choice experiment for investors (**CEI**) - Choice experiments for stormwater management system upscaling, a survey for citizens (homeowners etc.), to find out their willingness to pay for storm water solutions on their own property was created and applied.
- Insurance mechanism (**INSUR**) - Attention to insurance schemes is important to address uncertainty in climate events. It is impossible to protect ourselves against the impact of climate events perfectly. Therefore, there is a need to provide insurance and protect us against the extreme risks that climate events can have. In TransformAr, demonstrators develop damage functions to assess the impact of climate risk. Damage functions can quantify the risk of climate events, e.g., flooding of a certain area or a specific building. Climate change might alter the current risk and lead to more damage. The insurance industry needs or know if and where damage is expected to increase in the upcoming decades to create healthy insurance schemes. In this way, the effectiveness of the other financial schemes is secured, and the risk of disruption is limited

7.11.1. State of the Art

First it is included the definition of the results defined by topics and the Key Words associated with each of them, updated at month 40.

Table 7.28 Insurance, financial and economic schemes related publications.

Characteristic	Key words
Green bonds that allow for complex and layered environmental goods and services to be transacted	Green bonds
Adaptation fund for better cohesion to direct existing flows into specific types of adaptation’s actions	Adaptation fund

Choice experiment for investors for stormwater management system upscaling	Investors / Climate Change
Insurance mechanism in the context of development and validation of damage functions	Insurance/ Climate Change

This topics with the key words associated where used to identify key related trends.

Table 7.29 Insurance, financial and economic schemes related publications.

EU related I+D+I projects	
<u>Green finance for sustainable farming in Europe - SOLARFARM</u>	
<p>Program: H2020 - INDUSTRIAL LEADERSHIP - Innovation In SMEs Duration: 01 July 2018 – 31 December 2018 EU Funds: € 50 000,00 Coordinator: ELA, INGENIERIA Y MEDIO AMBIENTE SL</p>	<p>Warming up investors to solar irrigation projects Crops need sunlight to grow. Water is also essential. Bringing these two resources together can make all the difference for today’s farmers. Enter the solar water pumping system. There are proven solutions using photovoltaic systems, but they are also expensive. The EU-funded SOLARFARM project will provide the technological and financial solutions for photovoltaic irrigation (PVI) projects that allow them to be financed directly by institutional investors, reducing drastically the costs and uncertainty for farmers. The web-based solution is the result of in-house technological developments for PVI and a tailored business model, including a set of standardised contracts, technical specifications and management protocols. SOLARFARM’s solution includes enhanced systems monitoring and reporting to guarantee transparency for investors.</p>
<u>On the financialisation of green: Chinese operations along the Belt and Road Initiative (BRI) - CHINGREEN</u>	
<p>Program: H2020 - EXCELLENT SCIENCE - Marie Skłodowska-Curie Actions Duration: 1 November 2021 - 31 October 2024 EU Funds: € 267 282,24 Coordinator: UNIVERSITA CA' FOSCARI VENEZIA</p>	<p>In Chinese operations along the Belt and Road Initiative (BRI), the extent of Chinese-led green credit is evident and expected to make-or-break the Paris Agreement emission-reduction targets. One hurdle in this process, however, is the lack of a ‘green’ language needed to define financial products. The EU-funded CHINGREEN project will shed light on the financialisation of nature. Specifically, it will investigate the characterisation of Chinese ‘green’ financial capital and how it deploys out of the Chinese domestic borders. It will study the issuance of a Chinese green bond by the Chinese bank ICBC in Thailand, and a case of green securitisation by the Chinese multilateral bank AIIB in Turkey.</p>
<u>Energy efficiency Data Protocol and Portal - EeDaPP</u>	
<p>Program: SOCIETAL CHALLENGES - Secure, clean and efficient energy; Market uptake of energy innovation - building on Intelligent Energy Europe; Reducing energy consumption and carbon footprint by smart and sustainable use Duration: 1 March 2018 - 31 August 2020 EU Funds: € 1 500 000,00 Coordinator: COVERED BOND & MORTGAGE COUNCIL</p>	<p>Energy efficiency projects are doomed to fail without financial support, and the latter cannot be obtained without reliable data for risk analysis. The EeDaPP project, which is part of the wider Energy Efficient Mortgages Initiative, provides a market-led protocol to record such data and make it available to stakeholders.</p>
<u>Nordic Energy Efficiency Mortgages - NEEM</u>	
<p>Program: SOCIETAL CHALLENGES - Secure, clean and efficient energy Duration: 1 June 2021 - 31 May 2023 EU Funds: € 1 485 000,00 Coordinator: COPENHAGEN ECONOMICS AS</p>	<p>Private investments in the energy efficiency of building stock, electrification of heating and smart energy systems are essential for the success of the climate targets of the Nordic governments. However, high transaction costs make energy renovation complex and unattractive for family houses. Also, a lack of data impedes the identification of buildings in need of energy efficiency renovation. The EU-funded NEEM project will develop and market test specific support solutions. It will establish a Nordic hub for energy-efficient mortgages to promote already developed solutions. It will also introduce blueprints for financial institutions on how to implement solutions overcoming the detected obstacles to energy renovation, and this will be advanced through the Nordic banking sector.</p>
<u>Economics of climate change adaptation in Europe - ECONADAPT</u>	

<p>Program: Specific Programme "Cooperation": Environment (including Climate Change) Duration: 1 October 2013 - 30 September 2016 EU Funds: € 2 928 617,50 Coordinator: UNIVERSITY OF BATH</p>	<p>The aim of the ECONADAPT project is to provide user-orientated methodologies and evidence relating to economic appraisal criteria to inform the choice of adaptation actions using analysis that incorporates cross-scale governance under conditions of uncertainty. The project will work intensively with stakeholders from e.g. relevant DGs, Member States, Regional or local policy makers, and seek to learn from, and inform, experience. The methods and approaches will be co-developed with the diverse user groups engaged in using economic data within adaptation decision making. A two-tier approach is proposed to provide detailed guidance and empirical data: first, to other economists or private sector organisations with adaptation needs, and second, to other users who may want to use 'light-touch' methods, with the empirical data to help in scoping decision making outcomes. A strong link will be made with the European Climate Adaptation Platform (Climate-ADAPT), with the guidance and economic information designed for a wide range of users.</p>
<p><u>Food security, Agriculture, Climate Change ERA-NET plus - FACCE ERA NET PLUS</u></p>	
<p>Program: Specific Programme "Cooperation": Food, Agriculture and Biotechnology Duration: 1 October 2013 - 30 September 2018 EU Funds: € 4 000 000,00 Coordinator: INSTITUT NATIONAL DE RECHERCHE POUR L'AGRICULTURE, L'ALIMENTATION ET L'ENVIRONNEMENT</p>	<p>The main goal of the FACCE-ERA-NET+ Action is to organise, implement and fund a joint call for transnational research projects on the topic of climate change adaptation, which is a core research theme of the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) and thus to contribute to the delivery of the FACCE-JPI Strategic Research Agenda. It will thereby also contribute to the overall EU objective of building the European Research Area through enhanced cooperation and coordination of national research programmes. This FACCE-ERA-NET+ Action, in providing the means for a joint call, will be one of the actions of the JPI aimed at aligning research programming among its members over the long term so as to increase the efficiency of research funding, cover gaps, avoid duplications and provide high-level innovative research in Europe. It will contribute to the goal of FACCE-JPI to organise multiple simultaneous joint actions toward the achievement of its goals.</p>
<p><u>Development, Implementation and Evaluation of Index-Based Insurance Schemes for Optimal Risk Management in Agriculture - AGINSURANCE</u></p>	
<p>Program: Specific programme "People" implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities Duration: 1 October 2009 - 30 September 2013 EU Funds: € 100 000,00 Coordinator: MIDDLE EAST TECHNICAL UNIVERSITY</p>	<p>This project aims to develop, implement, and evaluate an optimal index-based revenue insurance mechanism which will allow the agricultural households to manage and minimize their risks. The index developed will not be affected by households or the insurance agency, thereby eliminating the possibility of adverse selection and moral hazard. Unlike the current insurance schemes, the suggested innovative system will be market-based, self-sustainable, and easily scalable to the entire EU Region and the Associates. It will address both of the major risks faced by farmers while minimizing the need for government involvement in the market. Successful establishment of the proposed insurance mechanism will provide European farmers with the tools necessary to compete in the world markets.</p>
<p><u>Capacity Development for Hazard Risk Reduction and Adaptation - CATALYST</u></p>	
<p>Program: Specific Programme "Cooperation": Environment (including Climate Change) Duration: 1 October 2011 - 30 September 2013 EU Funds: € 843 931,57 Coordinator: FONDAZIONE ENI ENRICO MATTEI</p>	<p>A core activity of CATALYST is the convening of stakeholders including researchers and practitioners in a think tank allowing virtual and face-to-face exchange on areas of concern such as methodological limitations and data gaps, as well as best practices. This coordinating action will also establish and maintain during the project's duration, an information archive (as part of the project website) that is easily accessible to the research community for finding out more about existing NH/DRR resources and research work. The archive will be transferred together with the website to an existing organisation or SME concerned with NH/DRR to ensure that it is maintained and enhance.</p>
<p><u>Protecting the aquatic environment from urban runoff pollution StopUP Project News & Multimedia HORIZON CORDIS European Commission</u></p>	
<p>Program: Horizon Europe Food, Bioeconomy Natural Resources, Agriculture and Environment Duration: 1 September 2022 - 31 August 2025 EU Funds: € 3 766 439,50 Coordinator: RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN</p>	<p>Stormwater overflows, such as urban surface runoff and combined sewer overflows, are of high risk when entering the aquatic environment untreated due to their substantial pollutant loads. European urban wastewater treatment infrastructure rarely has appropriate treatment processes for these polluted water streams. Therefore, new strategies and technologies are needed to mitigate these pollutant emissions effectively. The EU-funded StopUP project tackles the lack of options for managing stormwater overflows in decentralized and centralized systems (see Figure below). With eleven consortium partners, including nine beneficiaries and two associated partners, StopUP aims to characterize pollutant sources and pathways. Employing cutting-edge monitoring techniques, including online sensors and advanced data analysis, the project seeks to enhance the understanding of pollutants. Upon that, it pioneers new technologies for pollution prevention,</p>

	along with providing decision-making tools to aid in selecting and implementing mitigation measures.
News, publications, available material, and activities	
European Green Bonds: Council adopts new regulation to promote sustainable finance	The Council adopted a regulation creating a European green bond standard . The regulation lays down uniform requirements for issuers of bonds that wish to use the designation ‘European green bond’ or ‘ EuGB ’ for their environmentally sustainable bonds. Environmentally sustainable bonds are one of the main instruments for financing investments related to green technologies, energy efficiency and resource efficiency as well as sustainable transport infrastructure and research infrastructure. European green bonds will be aligned with the EU taxonomy for sustainable activities and made available to investors globally.
What are green bonds and why is this market growing so fast?	Tackling the climate crisis won’t come cheap . The United Nations’ Intergovernmental Panel on Climate Change estimates that limiting the temperature increase to 1.5°C, the goal of the Paris Agreement, will require over \$3-6 trillion of investment every year to 2050. To raise those vast sums, governments and corporations are increasingly turning to green bonds.
Explaining green bonds	The green bond market has seen exponential growth . It reached its most substantial milestone yet, with USD 1 trillion in cumulative issuance since market inception in 2007. The milestone was passed in early December 2020. You can see the updated cumulative totals on the Green Bond Market on our market widget on the homepage. In the 13 years since market inception we have calculated the average annual growth rate at approximately 95%.
Green bonds	Bonds used to finance activities that address climate change and environmental issues — known as green bonds — provide a means to increase green investment. Green bonds accounted for only 0.6% of all bonds issued in the EU in 2014, rising to 8.9% in 2022. This increase reflects the financial sector’s growing interest in offering products that support sustainability and the increasing demand among investors to finance environmentally sustainable projects. Various types of entities — government, corporate, supranational, and subnational entities — can issue green bonds , and issuance by all types has increased since 2014, although at different rates. Green bond issuance may increase further in the coming years, partly because of the ambitious environmental and climate goals of the European Green Deal.
Adaptation Fund	United Nations Framework Convention on Climate Change (UNFCCC), Climate Finance Data Portal: In particular, it aims to assist Parties in tracking the Financial Mechanism of the Convention and to inform the intergovernmental process under the UNFCCC and relevant stakeholders on the mobilization of resources to support developing countries in the implementation of adaptation and mitigation projects and other activities under the Convention. The Adaptation Fund (AF) was established in 2001 to finance concrete adaptation projects and programmes in developing country Parties to the Kyoto Protocol that are particularly vulnerable to the adverse effects of climate change. The Adaptation Fund is financed with a share of proceeds from the clean development mechanism (CDM) project activities and other sources of funding. The share of proceeds amounts to 2 per cent of certified emission reductions (CERs) issued for a CDM project activity.
Storm Water Management Model (SWMM)	Helps predict runoff quantity and quality from drainage systems EPA’s Storm Water Management Model (SWMM) is used throughout the world for planning, analysis, and design related to stormwater runoff, combined and sanitary sewers, and other drainage systems. It can be used to evaluate grey infrastructure stormwater control strategies, such as pipes and storm drains, and is a useful tool for creating cost-effective green/grey hybrid stormwater control solutions. SWMM was developed to help support local, state, and national stormwater management objectives to reduce runoff through infiltration and retention, and help to reduce discharges that cause impairment of waterbodies.



<p>Lessons learned: The role of national financial institutions and trust funds in providing climate adaptation</p>	<p>The Adaptation Fund (AF) approved its five-year Medium-Term Strategy (MTS) and Action Plan in 2018 based on the pillars of Action, Innovation and Knowledge and Sharing. Through the Knowledge and Sharing pillar, the AF Secretariat has conducted a series of analysis and produced brief reports consisting of lessons learned from the accreditation process. Within this context, the Fund commissioned a study Bridging the Gaps in Accreditation in 2019. The overarching goal of the study was to help reduce the time required for the completion of accreditation and reaccreditation applications from applicant national and regional implementing entities (IEs) by sharing the experiences of others in the process.</p>
<p>Innovative insurance to manage climate risks</p>	<p>Severe storms, record heat waves, intense droughts, and floods—the impact of climate change rises every year and economic and financial losses rise with it. Insurance plays a major role in helping businesses in advanced economies mitigate the consequences of the changing climate and prepare for policy changes ahead. But insurance in emerging markets isn’t yet able to make the same contribution, despite the fact that natural disasters disproportionately affect people and firms in these countries. Recently, however, a number of new business and donor initiatives have begun to create innovative approaches to using insurance to address climate change.</p>
<p>EU funding of adaptation</p>	<p>The EU finances adaptation to climate change in Europe through a wide range of instruments. The Multiannual Financial Framework 2021-2027 ensures that at least 25% of the European budget is climate-related expenditure. Therefore, Climate adaptation actions have to be integrated into all the major EU spending programs, and a tracking system is put in place to guarantee these objectives are met.</p>

8. Market analysis

8.1 Citizen App (CA) - Mobile application for crowd sensing and real time monitoring of extreme flooding events due to CC events by citizens

The Citizen App (CA) addresses a critical gap in Europe’s climate change adaptation framework by allowing citizen participation and digital technology to improve flood monitoring and response. The demand for such solutions is expected to grow as extreme flooding events become more frequent, making it an attractive tool for public agencies, private sector stakeholders, and local communities alike.

Estimating the precise market size for a mobile application like the Citizen App (CA), designed for crowd sensing and real-time monitoring of extreme flooding events in Europe, is challenging due to the niche and emerging nature of such solutions. However, insights can be drawn from related markets:

- **Real-Time Flood Monitoring and Warning Systems:** The global market for these systems was valued at over **\$184.1 million in 2020** and is projected to reach approximately **\$359.5 million by 2031**, with a compound annual growth rate (CAGR) of **6.2%** during this period¹⁷.
- **Climate Risk Digital Solutions:** This broader market, encompassing various digital tools for climate risk management, was valued at **\$880 million in 2021** and is expected to grow to more than **\$4 billion by 2027**, indicating a CAGR of **30%**¹⁸.

While these figures provide a general understanding of the market landscape, the specific segment for mobile applications that leverage citizen participation for flood monitoring is still developing. The increasing frequency of extreme weather events in Europe and the growing emphasis on community engagement in disaster response suggest a rising demand for innovative solutions like the Citizen App.

¹⁷ [Real-time Flood Monitoring & Warning System Market Outlook 2031](#)

¹⁸ [Market Size And Forecast: Climate Risk Digital Solutions 2021-2027 \(Global\)](#)

- **Target Market:**
 - **Primary Users:** European citizens residing in flood-prone areas, including urban and rural regions. These individuals are often directly affected by extreme flooding events and can benefit from real-time monitoring and reporting tools.
 - **Government Agencies:** Local, regional, and national disaster management authorities seeking tools to enhance citizen engagement in monitoring and responding to climate-related emergencies.
 - **Environmental and Climate Organizations:** NGOs and institutions focused on climate adaptation and public safety initiatives.
 - **Insurance Companies:** Firms that could use the data for risk assessment, pricing policies, and damage evaluation.
- **Applications:**
 - **Crowd Sensing:** The app enables citizens to report real-time data on flooding events, including water levels, damage locations, and affected areas, contributing to crowd-sourced data collection.
 - **Real-Time Monitoring:** The app aggregates reports and provides live updates, maps, and alerts to users, helping them avoid high-risk areas and stay informed during extreme weather events.
 - **Public Awareness:** Enhances climate change awareness by involving citizens directly in monitoring efforts, fostering a sense of shared responsibility.
 - **Integration with Authorities:** Governments and disaster management agencies can use the data for more accurate situational awareness and efficient resource deployment during flooding events.
- **Demand:**
 - **Rising Climate Events:** With Europe experiencing an increasing frequency of extreme weather events due to climate change, tools like the Citizen App are becoming essential for proactive risk management and response.
 - **Urbanization and Flood Risks:** The growing urban population and inadequate drainage infrastructure in many cities exacerbate flooding risks, driving demand for real-time monitoring solutions.
 - **Community Participation:** There is an increasing emphasis on citizen engagement in climate adaptation strategies, aligning with EU directives to involve communities in disaster preparedness.
 - **Insurance and Risk Management:** The data collected through the app can support insurance companies and policymakers in assessing risks, allocating resources, and formulating adaptive measures.

8.2 Restoration and creation of wetlands and creation of riparian buffers RCRB - Nutrient and soil management measures to demonstrably control farmyard run-off by catching nutrients, sequestering carbon and creating additional water for farmers.

The challenges to estimate the precise market size for **Restoration and Creation of Wetlands and Riparian Buffers (RCRB)** in Europe are related to the multifaceted nature of these environmental initiatives. However, insights can be drawn from related sectors and the increasing emphasis on sustainable agricultural practices:

1. Target Market

- **Agricultural Sector:** Farmers and landowners seeking to implement nutrient and soil management measures to control farmyard runoff, sequester carbon, and enhance water resources.
- **Environmental Agencies and NGOs:** Organizations focused on ecosystem restoration, biodiversity conservation, and climate change mitigation.
- **Government Bodies:** Local, regional, and national authorities responsible for environmental regulation, water management, and agricultural policies.

2. Applications

- **Nutrient Management:** Wetlands and riparian buffers act as natural filters, reducing nutrient runoff into water bodies, thereby improving water quality.
- **Carbon Sequestration:** These ecosystems capture and store carbon dioxide, contributing to climate change mitigation efforts.
- **Water Resource Enhancement:** Restored wetlands and buffers help in groundwater recharge and provide additional water resources for agricultural use.
- **Biodiversity Conservation:** Such areas serve as habitats for various species, promoting biodiversity.

3. Demand

- **Environmental Regulations:** The European Union's policies, such as the **Nature Restoration Regulation (NRR)**, emphasize the restoration of natural ecosystems, driving demand for RCRB initiatives.¹⁹
- **Carbon Farming Initiatives:** The EU's focus on carbon farming encourages practices that enhance carbon sequestration in soils and biomass, aligning with RCRB activities.²⁰
- **Sustainable Agriculture:** There's a growing trend towards sustainable farming practices that integrate environmental conservation, increasing the adoption of RCRB measures.

¹⁹ [Solutions for restoring Europe's agricultural ecosystems | European Environment Agency's home page](#)

²⁰ [d3529f84-0f18-40ee-ab72-124ba786fb5a_en](#)

- **Funding and Incentives:** Various EU funding mechanisms and payment schemes support the implementation of wetland restoration and riparian buffer projects, incentivizing stakeholders.

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While specific market size data for RCRB in Europe is limited, the convergence of environmental policies, sustainable agricultural practices, and available funding suggests a growing market potential for these initiatives.

8.3 Smart Grid for coastal management (SG) - Smart sea-opening system using rapid unhooking grid and gates for emergency opening in case of extreme events.

The **Smart Grid for Coastal Management (SG)** involves implementing smart sea-opening systems equipped with rapid unhooking grids and gates for emergency openings during extreme events. Here's an analysis of its target market, applications, and demand:

- **Target Market**
 - **Coastal Municipalities and Governments:** Authorities responsible for coastal infrastructure and public safety.
 - **Port Authorities:** Entities managing harbours and maritime activities.
 - **Environmental Agencies:** Organizations focused on coastal ecosystem preservation.
 - **Private Sector Stakeholders:** Businesses operating in coastal zones, such as resorts and industrial facilities.
- **Applications**
 - **Flood Prevention:** Rapid deployment of sea-opening systems to mitigate flooding during extreme weather events.
 - **Coastal Erosion Control:** Managing water flow to reduce erosion and protect shorelines.
 - **Ecosystem Management:** Maintaining natural water circulation to support coastal habitats.
 - **Emergency Response:** Providing quick access for rescue and relief operations during coastal emergencies.
- **Demand**
 - **Increasing Frequency of Extreme Weather Events:** Climate change has led to more frequent and severe storms, heightening the need for effective coastal management solutions.
 - **Economic Considerations:** Protecting coastal infrastructure and properties from damage can result in significant cost savings.
 - **Regulatory Requirements:** Governments are implementing stricter regulations for coastal protection, driving the adoption of advanced management systems.
 - **Technological Advancements:** Innovations in automation and smart grid technologies make these systems more efficient and accessible.

While specific data for smart sea-opening systems is limited, related markets provide context:

²¹ [International review on payment schemes for wet buffer strips and other types of wet zones along privately owned land](#)



- **Automatic Floodgate Market:** Valued at approximately **\$1.89 billion in 2023**, projected to reach **\$3.29 billion by 2030**, with a CAGR of **7.5%**.²²
- **Flood Break Automatic Floodgates Market:** Estimated at **\$788.1 million in 2023**, expected to grow to **\$1.8 billion by 2032**, exhibiting a CAGR of **9.6%**.²³

These figures indicate a growing demand for automated flood management solutions, suggesting a positive outlook for smart sea-opening systems in coastal management.

The convergence of environmental challenges, economic imperatives, regulatory pressures, and technological progress is driving the demand for smart sea-opening systems in coastal management. Stakeholders across various sectors are increasingly recognizing the value of these systems in enhancing resilience against extreme events and safeguarding coastal regions.

8.4 Urban run-off system (URB) – a biofiltration area, that captures and treats runoff and storm water from the surroundings street and sidewalk in the city centre of Lappeenranta.

The **Urban Run-off System (URB)** is a biofiltration area designed to capture and treat runoff and stormwater from surrounding streets and sidewalks in the city centre in Lappeenranta. Here's an analysis of its target market, applications, and demand:

- **Target Market:**
 - **Municipal Governments:** Cities and towns seeking sustainable urban drainage solutions to manage stormwater and improve water quality.
 - **Urban Planners and Developers:** Professionals involved in designing infrastructure that incorporates green solutions for stormwater management.
 - **Environmental Agencies:** Organizations focused on reducing urban runoff pollution and enhancing ecosystem health.
 - **Construction and Engineering Firms:** Companies specializing in the implementation of biofiltration systems and related infrastructure.
- **Applications:**
 - **Stormwater Management:** Capturing and treating urban runoff from streets, sidewalks, roofs, and yards to reduce flooding risks.
 - **Water Filtration and Pollution Control:** Filtering out pollutants, including nutrients, and utilizing them for vegetation growth while ensuring groundwater protection.
 - **Green Infrastructure:** Incorporating nature-based solutions, such as biofiltration fields and vegetation, into urban spaces to improve sustainability and resilience.
 - **Flood Buffering:** Acting as a buffer zone during heavy rainfall, redirecting excess water to stormwater drainage systems and alleviating pressure on existing infrastructure.
- **Demand:**
 - **Regulatory Compliance:** Stricter environmental regulations are driving municipalities to adopt effective stormwater management practices.

²² [Automatic Floodgate Market Size, Share, Trends, and Forecast 2024-2032](#)

²³ [Flood Break Automatic Floodgates Market Size | Report 2024-32](#)



- Urbanization Challenges: Increasing urban development leads to higher impervious surface areas, necessitating efficient runoff management solutions.
- Environmental Awareness: Growing public concern for environmental sustainability encourages the adoption of green infrastructure.
- Technological Advancements: Innovations in biofiltration materials and design enhance system efficiency and appeal.

Market Size Insights

The European biofilter market, which includes systems like urban biofiltration areas, is experiencing significant growth: The market generated a revenue of approximately **USD 700.1 million in 2024** and is expected to reach **USD 1,201.5 million by 2030**. A compound annual growth rate (CAGR) of **9.7%** is anticipated from 2025 to 2030²⁴.

This growth reflects increasing investments in sustainable urban drainage systems and biofiltration technologies across Europe.

8.5 Digital monitoring (SWMM) - Monitoring system with simple probes to monitor flow rates and water quality through individual modules. The monitoring user interface will be made visual and browser-based, enabling access from any smartphone or laptop. Publicly displayed information will be accessible to all

- **Target Market:**
 - **Municipalities and Local Governments:** Entities responsible for urban water management seeking efficient, real-time monitoring solutions.
 - **Environmental Agencies:** Organizations focused on water quality assessment and environmental protection.
 - **Industrial Facilities:** Companies requiring continuous monitoring of water discharge and quality for compliance and operational efficiency.
 - **Research Institutions:** Academic and research bodies studying hydrology, water quality, and environmental science.
- **Applications:**
 - **Stormwater Management:** Monitoring flow rates and water quality to manage runoff and prevent pollution.
 - **Wastewater Treatment:** Ensuring treated water meets environmental standards before discharge.
 - **Environmental Compliance:** Providing data for regulatory reporting and compliance with water quality standards.
 - **Flood Forecasting and Management:** Collecting data to predict and manage flood events.
- **Demand:**
 - **Regulatory Requirements:** Increasing environmental regulations necessitate continuous water quality monitoring.
 - **Urbanization:** Growing urban areas require advanced water management solutions to handle increased runoff and pollution.

²⁴ [Europe Biofilter Market Size & Outlook, 2030](#)

- **Technological Advancements:** Advances in IoT and sensor technologies make real-time monitoring more accessible and cost-effective.
- **Public Awareness:** Rising public concern for environmental issues drives demand for transparent and accessible water quality data.

The European stormwater management market, which includes digital monitoring systems like SWMM, is experiencing significant growth, was valued at approximately **USD 3.54 billion in 2022** and is projected to reach **USD 5.82 billion by 2028**, with a compound annual growth rate (CAGR) of **7.92%**. This growth is driven by increasing urbanization, stricter environmental regulations, and the adoption of advanced technologies for water management.²⁵

The Digital Monitoring (SWMM) system addresses the growing need for efficient, real-time water quality and flow monitoring solutions. Its browser-based interface and public accessibility align with current trends toward transparency and data-driven decision-making in water management. The expanding European market for stormwater management solutions indicates a strong demand for such technologies.

8.6 Smart climate solutions (SCS) - To acquire a detailed view of the microclimatic conditions, with focus on better understating of the fine scale flows and heat exchanges leading to urban heat island, its diurnal variation and supporting studies apportioning its origins and determination factors.

Smart Climate Solutions (SCS) aim to provide a detailed understanding of microclimatic conditions, focusing on **fine-scale flows and heat exchanges that contribute to urban heat islands (UHIs)**. These solutions are essential for analysing diurnal variations and identifying the origins and determining factors of UHIs. Here's an analysis of the target market, applications, and demand for SCS:

- **Target Market:**
 - **Municipalities and Urban Planners:** Cities seeking to mitigate UHI effects and enhance urban liveability.
 - **Environmental Agencies:** Organizations focused on climate change adaptation and urban sustainability.
 - **Research Institutions:** Academic bodies studying urban climatology and environmental science.
 - **Technology Providers:** Companies developing IoT devices, sensors, and data analytics platforms for climate monitoring.
- **Applications:**
 - **Urban Heat Island Mitigation:** Identifying UHI hotspots to implement cooling strategies like green roofs and urban greening.
 - **Climate Change Adaptation:** Informing policies and urban planning to adapt to changing climate conditions.
 - **Public Health:** Assessing heat exposure risks to protect vulnerable populations.
 - **Micro-Climatic Monitoring:** The installation of 21 Smart Climate Stations across key city locations to gather real-time data on temperature, airflows, and heat exchanges.

²⁵ [Europe Stormwater Management Market By Tools Type, By Segment, By Application, By Country, Competition Forecast & Opportunities, 2018-2028](#)

- Predictive Weather Modeling: Using high-resolution data to provide more accurate weather forecasts and support city-level climate action plans.
- **Demand:**
 - **Climate Change Awareness:** Growing recognition of UHI impacts health and energy consumption.
 - **Urbanization Trends:** Increasing urban populations necessitate effective climate management solutions.
 - **Technological Advancements:** Advances in IoT and data analytics enable detailed microclimatic monitoring.
 - **Regulatory Pressures:** Stricter environmental regulations drive the adoption of climate monitoring solutions.

The European market for smart climate solutions, particularly those addressing urban heat islands, is experiencing significant growth: the **Smart Climate Control Market** is projected to reach **USD 8.33 billion by 2025**, with a compound annual growth rate (CAGR) of **16.85%**, reaching **USD 18.15 billion by 2030**. This growth is driven by increasing urbanization, climate change awareness, and technological advancements in climate monitoring²⁶.

8.7 Mussel raft monitoring (MRM) - Environmental and hydrodynamic sensors based on the implementation of IoT low-cost monitoring solutions powered by solar energy. Digitalization will allow knowing in real-time the state of the platform, alarms in case of risky water conditions, production monitoring and the construction of a comprehensive database.

Involves deploying environmental and hydrodynamic sensors powered by solar energy to monitor mussel farming platforms. This digitalization enables real-time assessment of platform conditions, alerts for hazardous water conditions, production monitoring, and the creation of a comprehensive database.

- **Target Market:**
 - **Mussel and Shellfish Farmers:** Producers seeking to optimize operations and ensure product quality.
 - **Aquaculture Industry:** Companies involved in shellfish farming operations.
 - **Environmental Monitoring Agencies:** Organizations focused on water quality and ecosystem health.
 - **Technology Providers:** Companies developing IoT devices, sensors, and data analytics platforms for aquaculture.
- **Applications:**
 - **Water Quality Monitoring:** Tracking parameters like salinity, temperature, and pH to ensure optimal mussel growth.
 - **Production Optimization:** Collecting data to enhance farming practices and yield.
 - **Regulatory Compliance:** Providing data for adherence to environmental standards and regulations.
 - **Environmental Impact Assessment:** Evaluating the ecological effects of mussel farming activities.
- **Demand:**

²⁶ [Smart Climate Control Market Size & Share Analysis - Industry Research Report - Growth Trends](#)

- **Sustainable Aquaculture Practices:** Growing emphasis on environmentally responsible farming methods.
- **Technological Advancements:** Increased adoption of IoT and sensor technologies in aquaculture.
- **Regulatory Pressures:** Stricter environmental regulations necessitate continuous monitoring.
- **Market Competitiveness:** Demand for data-driven insights to improve efficiency and product quality.

The global market for IoT in fisheries and aquaculture is experiencing significant growth, valued at **USD 854.62 million in 2022**, projected to reach **USD 1,589.8 million by 2030**, with a compound annual growth rate (CAGR) of **8.07%**.²⁷

Aquaculture Monitoring Market: Valued at **USD 37,296.5 million in 2023**, expected to reach **USD 54,978.5 million by 2030**, growing at a CAGR of **5.7%**.²⁸

These figures indicate a robust and expanding market for monitoring solutions in the aquaculture sector, driven by technological advancements and increasing demand for sustainable practices.

8.8 Intertidal monitoring (INTERM) - To improve the knowledge of environmental behaviour and numerical modelling to predict bank responses under changing environmental conditions.

Focuses on enhancing the understanding of environmental behaviour and developing numerical models to predict the response of intertidal zones under changing environmental conditions. This approach is crucial for managing and preserving these dynamic coastal areas.

- **Target Market:**
 - **Environmental Agencies:** Organizations responsible for coastal and marine ecosystem management.
 - **Coastal Zone Managers:** Professionals overseeing the sustainable use and conservation of coastal areas.
 - **Research Institutions:** Academic and scientific bodies conducting studies on marine and coastal environments.
 - **Policy Makers:** Government officials involved in environmental regulation and policy development.
- **Applications:**
 - **Coastal Erosion Assessment:** Evaluating the impact of environmental changes on shoreline stability.
 - **Habitat Conservation:** Protecting intertidal ecosystems that support diverse marine life.
 - **Climate Change Impact Studies:** Understanding how rising sea levels and temperature variations affect intertidal zones.
 - **Marine Spatial Planning:** Informing the sustainable development of coastal areas, including infrastructure projects.

²⁷ [IoT for Fisheries and Aquaculture Market Size, Research \[From 2023 to 2030\]](#)

²⁸ [Aquaculture Monitoring Market Size, Share & Growth Report 2030](#)

- **Demand:**
 - **Climate Change Awareness:** Increasing recognition of the need to monitor and adapt to environmental changes affecting coastal regions.
 - **Regulatory Requirements:** Growing demand for data-driven insights to inform environmental policies and regulations.
 - **Technological Advancements:** Availability of advanced modelling tools and monitoring technologies enhances the capacity to study intertidal zones.
 - **Public Interest:** Rising public concern over coastal conservation and the health of marine ecosystems.

While specific market size data for intertidal monitoring is limited, the broader environmental monitoring market is experiencing significant growth, valued at **USD 17.9 billion in 2020**, projected to reach **USD 26.2 billion by 2027**, with a compound annual growth rate (CAGR) of **5.6%**. This growth is driven by increasing environmental concerns, regulatory pressures, and technological advancements in monitoring and modelling.²⁹

8.9 Behavioural change and awareness-raising solutions

The European market applicable to **Nudging (NUDG)** and **Awareness-raising and Behavioural Change Modules (AWAR)** can be categorized into several key sectors and stakeholder groups where these strategies can have a significant impact. Below is an overview of the potential markets:

1. Sustainable Tourism (for NUDG)

- **Target Market:** Tourism organizations, sustainable destinations, tour operators, and cities looking to integrate sustainable practices.
- **Applications:**
 - Designing interventions to improve tourists' behaviour towards eco-friendly practices (e.g., recycling, water or energy conservation).
 - Partnering with hotels, airlines, and operators to encourage sustainable choices through nudges (e.g., incentives for public transportation use or reducing plastic consumption).
- **Demand:**
 - Sustainable tourism is growing in Europe due to environmental regulations and travelers' preferences for responsible experiences.
 - The European tourism industry generates high activity volumes, and nudges can add value by promoting environmentally responsible practices.

2. Climate Education and Awareness (for AWAR)

- **Target Market:** Schools, universities, environmental NGOs, educational programs, and local governments.
- **Applications:**
 - Developing and distributing educational materials for youth and educators.

²⁹ [Global Environmental Sensing and Monitoring Technologies](#)

- Implementing brief and effective modules such as the "5-minute curriculum" in European schools.
- Creating living labs in local communities to encourage active participation in climate action.
- **Demand:**
 - Climate education programs are supported by EU policies like the European Green Deal and the Sustainable Education Strategy.

3. Local Governments and Sustainable Urban Planning (for NUDG and AWAR)

- **Target Market:** Local authorities, municipalities, and urban planners.
- **Applications:**
 - Implementing sensors and cognitive design tools in smart cities to promote sustainable behaviours in transportation and energy consumption.
 - Developing community engagement programs to integrate climate-neutral practices into citizens' daily lives.
- **Demand:**
 - Sustainable urban planning strategies are priorities in many European cities as part of local climate initiatives.

4. Innovation and Circular Economy (Both Approaches)

- **Target Market:** Circular economy businesses, green technology startups, and manufacturers of sustainable products.
- **Applications:**
 - Using nudging strategies to drive the adoption of recycled or sustainable products.
 - Developing awareness modules targeted at employees and consumers to foster a more robust circular economy.
- **Demand:**
 - The circular economy is a key focus area in Europe, supported by various EU initiatives and funding programs.

5. EU Programs and Cooperation Networks

- **Target Market:** EU-funded projects such as Horizon Europe, Erasmus+, and DEAR.
- **Applications:**
 - Integrating nudging and climate awareness approaches into existing European programs.
 - Creating consortia and transnational collaborations to apply these strategies across different regions.
- **Demand:**
 - There is strong support for innovative and collaborative projects within the EU framework, providing ample opportunities for implementing NUDG and AWAR strategies.

8.10 Governance schemes

Related to various sectors that can be adapted to several markets in Europe and beyond. Here are the key markets to which these initiatives could apply:

1. Resilience Index (RI) for Aquaculture:

- **Aquaculture and Fisheries Market:** The RI tool can be applied to the aquaculture industry, particularly in regions that rely on shellfish production like mussels. This market includes production, research, and innovation around sustainable aquaculture practices.
- **Climate Adaptation and Environmental Consulting:** Consultants working with aquaculture sectors to develop adaptive strategies and sustainability plans.
- **Policymaking and Research:** Government and research institutions focused on climate change impacts, risk assessments, and sustainable practices.

2. Coastal Contracts (COAST):

- **Coastal and Wetland Management:** This market targets local governments, environmental agencies, and private stakeholders involved in managing coastal and wetland areas, particularly for biodiversity protection and climate resilience.
- **Urban and Rural Planning:** This initiative could be applied to urban planners, municipalities, and real estate developers working on coastal zone development projects.
- **Environmental NGOs and Conservation:** These organizations working on preserving coastal habitats can implement COAST to enhance coordination and cooperation among stakeholders.

3. Demand Analysis for Social Services/Infrastructure (DSI):

- **Social Services and Healthcare Market:** The analysis could be applied to healthcare providers, public health agencies, and social services departments that need to adapt to shifts in demand due to climate change.
- **Urban Resilience and Infrastructure Development:** Municipalities and urban planners can use the DSI methodology to assess infrastructure vulnerabilities and design more resilient public services and healthcare systems.
- **Risk and Vulnerability Assessments:** Firms and research institutes that focus on risk assessments and climate change adaptation strategies for social infrastructure.

4. Climate Innovation Hub (CIH):

- **Green Entrepreneurship and Innovation:** The CIH promotes entrepreneurship in the green technology sector, which includes sustainable startups, climate innovation, and clean-tech ventures.
- **Smart Cities and Urban Development:** The real-time data showcasing and the promotion of climate solutions are directly applicable to the smart cities market, including IoT solutions for urban climate management and sustainable infrastructure.
- **Climate-Financing and Green Bonds:** Investors and financial institutions supporting green bonds and sustainable finance in climate adaptation and innovation projects.

- **Public Sector and Municipalities:** Local governments and city planners can adopt CIH strategies for promoting local climate action, public-private partnerships, and community engagement in climate solutions.

Each of these initiatives fits into markets focused on **climate change adaptation, sustainable development, resilience building, environmental management, public policy, and innovation**. These markets span both private and public sectors and can be particularly beneficial in **coastal, rural, and urban** contexts.

8.11 Insurance, financial and economic schemes

1. Green Bonds (GB)

- **Target Market:**
 - Financial institutions, governments, and private investors focused on sustainable projects.
 - Urban developers, renewable energy companies, transportation sectors.
 - Municipalities and national governments involved in climate adaptation or mitigation projects.
- **Applications:**
 - Financing large-scale infrastructure projects such as green energy, sustainable transportation, and climate-resilient urban development.
 - Funding for environmental conservation and reforestation programs.
 - Climate adaptation and mitigation initiatives, like flood control systems and low-carbon technologies.
- **Demand:**
 - Rising investor interest in sustainable finance and ESG (Environmental, Social, and Governance) standards.
 - Growing demand from municipalities and businesses for green funding solutions.
 - Increasing pressure from stakeholders (governments, consumers, investors) to incorporate sustainability into corporate strategies.

2. Adaptation Fund (AF)

- **Target Market:**
 - Vulnerable regions and communities, particularly in developing countries or coastal areas.
 - Local governments, public institutions, and non-governmental organizations (NGOs) focused on climate resilience.
 - Agricultural, tourism, and infrastructure sectors.
- **Applications:**
 - Climate adaptation projects in sectors like agriculture, water management, and infrastructure (e.g., flood protection).
 - Coastal resilience projects to protect vulnerable communities.

- Supporting local economic activities through sustainable and climate-resilient development plans.

- **Demand:**

- High demand for financial mechanisms to support climate resilience in communities facing rising flood risks, droughts, and extreme weather events.
- Need for reallocation of funding towards adaptation strategies due to the growing impact of climate change on vulnerable sectors.

3. Choice Experiment for Investors (CEI)

- **Target Market:**

- Urban planners, local government authorities, and private landowners in cities prone to stormwater management challenges.
- Developers, property owners, and insurance companies.
- Environmental consultancies and project managers in flood risk management.

- **Applications:**

- Survey-based assessments to understand citizens' willingness to pay for stormwater management solutions.
- Informing local governments and policymakers on public preferences for flood mitigation investments.
- Upscaling stormwater management systems in cities using feedback from citizens and property owners.

- **Demand:**

- Increasing urbanization and the frequency of extreme weather events creating demand for effective stormwater management systems.
- Growing interest in climate-resilient infrastructure investments and improving urban planning for flood risk management.

4. Insurance Mechanism (INSUR)

- **Target Market:**

- Insurance companies, particularly in the property and casualty sectors.
- Risk management firms, financial institutions, and reinsurance companies.
- Government bodies involved in disaster recovery and climate resilience strategies.

- **Applications:**

- Developing climate risk models to help insurers quantify and validate damage from extreme weather events, providing a foundation for insurance products.
- Enhancing climate-proofing efforts in industries vulnerable to climate impacts (e.g., agriculture, real estate, energy).
- Offering customized insurance solutions for businesses and communities facing climate-induced risks (floods, droughts, storms).

- **Demand:**

- Increasing demand for climate-risk insurance products due to more frequent extreme weather events and climate-induced damages.
- Governments and businesses seeking more reliable and innovative risk assessment tools to protect assets and investments against climate change impacts.
- Rising pressure to create climate-resilient insurance portfolios as climate risks become more evident.

Overall Demand and Market Trends:

- **Climate Risk and Resilience:** A surge in the demand for climate resilience funding across sectors, especially in vulnerable regions.
- **Sustainable Finance:** An increasing push for sustainable investment products such as green bonds, as investors seek to align their portfolios with climate-positive projects.
- **Public-Private Partnerships:** A growing need for collaborative financial solutions, combining public funds and private investments to tackle climate adaptation challenges.
- **Urbanization and Climate Resilience:** As cities grow and face more extreme weather, urban adaptation strategies (like stormwater management) and insurance products targeting climate risks will see rising demand.

After collecting and analysing all the potential outcomes the analysis of the possible exploitation strategies will take place. At the present project stage, an expected exploitation strategy was outlined and is included in this deliverable indicated the including the expected exploitation pathways to be followed by project results.

9.0 IPR, exploitation plan and final recommendations

All the decisions and conclusions should be taken as recommendations resulting from the work carried out in WP6 led by FEUGA in which all partners have participated. These recommendations should be taken into account for the final implementation of the exploitation plan for the project's results. The analysis and studies included in D6.7 will determine the exploitation of the novel TransformAr innovations. After extracting and analysing the data obtained in the previous studies - analysis of the state-of-the-art, IP landscaping and market analysis - the main steps in the generation of the exploitation plan for TransformAr are detailed in Figure 9.1.

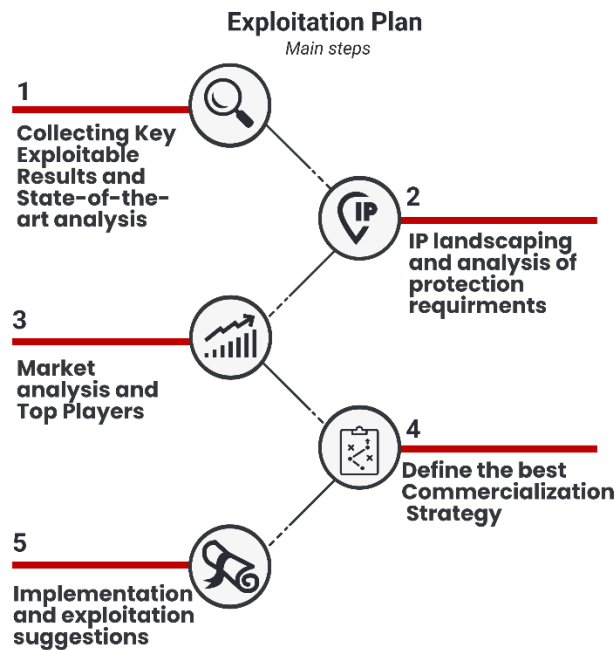


Figure 9.1. TransformAr exploitation plan infographic

The present document has so far reflected the analysis and results obtained in steps 1-3 of the previous infographic. In the following sections, an introduction to step 4 is included, this will be completed as part of deliverable 6.8, and step 5. The consortium members will decide the ongoing and future steps to finally reach the market and attract investors.

9.1 Intellectual property protection possibilities

Intellectual Property (IP) is a broad concept that encompasses and covers a wide range of activities related to creations of the mind: from audiovisual works to inventions, computer programs to trademarks, designs to symbols, names and images used in commerce and plays a significant role to economic activity. In the context of TransformAr project, the results generated through the research and the development actions are considered key assets that may fall under IP protection.

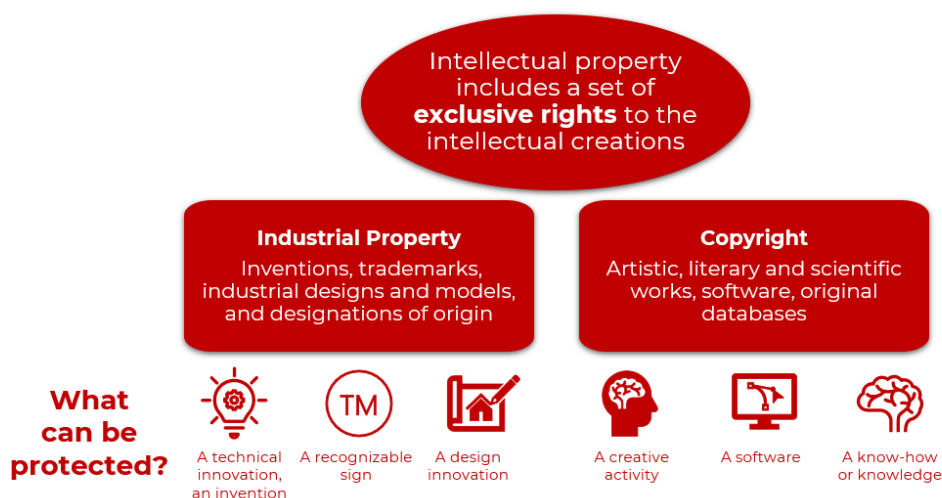


Figure 9.2. Intellectual Property, Industrial Property and Copyright brief definition

Building on this idea, the **Intellectual Property Rights (IPR)** are the specific **legal rules** that give creators or authors the exclusive right to control the use of their intellectual creations, they can be viewed like any other property right and allow the creators or owners of IP to benefit from their work or from their investment in a creation by giving them control over how their property is used³⁰.

In this vein, the basic concepts of the most important types of intellectual property protection will be presented.

1. Patents: this type of IPR protects **inventions, products or processes that provide new solutions to a technological problem.**

A patent is a title providing the ‘inventor’ and/or the ‘applicant’ with the exclusive right to exploit an invention on an exclusive basis, this also includes the right to prevent others from possessing, using, selling, manufacturing, and importing the patented invention or offering to do any of these things within a territory, without the owner's consent.

To qualify for patent protection, the invention must display the ‘conditions of patentability’:

Novelty: the invention must be globally new and is considered new if it is not part of the state of the art (SoA)³¹

Inventive step: being inventive implies that it is not based on something obvious which would be obvious to a person skilled in the art.

Industrial applicability (utility): not abstract, which can be carried out in any type of industry, including agriculture.

Pure **theories, mathematical formulas** or **discoveries** are **not patentable on their own**, but, when they are put into a practical context and if they also have novelty and inventive step could be patentable.

The **utility models** are another form of IPR which share characteristics with **patents**, since they are also a property title that recognizes the right to exploit an invention exclusively, the difference lies in that **protects technical innovations which might not qualify for a patent**. A utility model protects ‘minor inventions or minor improvements of existing products (changes in configuration, structure, and constitution...). Protection is granted through a similar system to patent, but cheaper, simpler, and faster. The requirements for protection vary from country to country, however, most countries will only grant utility models for products, not for methods or processes and medicines.

2. Copyright: this IPR is meant to protect original works of authorship, such as literary works, music, graphic works, artistic works, computer software, original databases, among others.

This type of protection extends **only to physical expressions, not to ideas, procedures, methods of operation or mathematical concepts as such**. To qualify for copyright protection, a work must be **original**, in the sense that it is the author's own intellectual creation: it has been created independently and not copied.

It gives authors, composers, computer programmers, web designers and other creators (all of whom are referred to as “creators”) legal protection for their literary, artistic, dramatic, or other creations

³⁰ https://www.wipo.int/edocs/pubdocs/en/wipo_pub_450_2020.pdf

³¹ The state of the art is everything that was accessible to the public before the date of a patent application.



("works"). These rights, generally, include copying, translating, adapting, and altering, communicating, and performing to the public, distributing, and renting and lending copies.

- 3. **Industrial design:** an industrial design covers any **new, original, ornamental design for an article of manufacture**, it may consist of two-dimensional features (patterns, lines, or colour) or three-dimensional features (shape or surface of an article).

This type of IPR concerns merely the appearance of a product and not the product per se. Finally, to qualify for protection, it must be new and have an original character, which means that it is different from what is already protected.

- 4. **Trademark:** is a distinctive **sign or symbol capable of distinguishing** products and/or services of one enterprise from those of another one. Its purpose is to differentiate and individualize, to give identity to those goods or services and to associate them directly with the trademark owner.

Different kinds of signs or symbols can be used as trademarks, such as words, letters, numbers, colors, images, logos, even sounds, smells and three-dimensional signs (like shapes and packaging).

A degree of originality is also required, since the basic principle for obtaining protection is that a sign must be distinctive (not simply a generic description of the goods or service) and not identical or similar to an existing trademark for the same type of goods or services.

- 5. **Trade secrets:** are also a type of IPR, in this case on confidential information that may be susceptible to being sold or licensed to third parties and can provide to an enterprise a competitive edge.

Generally, for information to be protected as a trade secret, the following requirements must be met:

Has commercial value

Only a limited group of people knows it

The rightful owner has taken reasonable steps to keep it secret (such as confidentiality agreements with business partners and employees, among other steps).






	 PATENT	 COPYRIGHT	 INDUSTRIAL DESIGN	 TRADEMARK	 TRADE SECRET
What do they protect?	A new and innovative way of doing something or a technical solution to a problem.	An original intellectual expression of an idea	An original ornamental or aesthetic aspect of a product or article	A sign or symbol capable of distinguishing the goods or services of a company.	Any type of information which may be sold or licensed and that is kept confidential
Examples	Inventions with practical use not part of the existing knowledge	Audio-visual Works, literature, pictures, databases, software , etc.	Packages, containers, graphic symbols, computer icons, logos, etc.	Words, letters, names, shapes, colors, sounds, etc. or its combinations	R&D data, financial information, know-how , etc.

Figure 9.3 Basic concepts of the most important types of intellectual property protection.

Depending on the business and exploitation strategy it could be recommendable to protect the TransformAr outcomes by the different types of IPR described above. Selection of the most appropriate form of IPR depends on the one hand, on the Consortium's strategy and, on the other hand, on the market potential. **Using this as a basis, specific recommendations and strategies were developed.**

9.2 Non-industrially exploitable/protectable results: Open Access

As stated in TransformAr project GA, for non-industrially exploitable/protectable results, the consortium will follow the Horizon Europe guidelines on open access, the preferred option will be Open Access publishing and self-archiving.

This dissemination will be applied to scientific/technical publications resulting from the project. During the project execution, no patenting process was started, so, none of the expected publications needed to be put under embargo period before providing open access to them.

The knowledge developed during the project will be available to all partners, particularly the developed adaptive blocks, the knowledge produced from test and experimentation. Other results, such as the developed adaptive products, solutions and services, will be subject to commercial exploitation, whose conditions will be set in the business model defined during the project (part of Task 6.4 and will be summarized in D 6.8).

Knowledge and prototypes with no IPR issue (e.g., no direct market potential) will fall in the public domain immediately; and only results validated by the whole consortium will be publicly released on the “Open data” and on the project web portal.

9.3 IPR possibilities for TransformAr project

Considering the project results, selected for exploitation analysis, in the following table, the different type of Intellectual Property Rights introduced in section 9.1 are listed, including if they can be applicable to TransformAr project results.

Table 9.1 Types of intellectual property rights and application to TransformAr project.

IPR	What for?	Reasonable for TransformAr
Patents	Inventions	Yes
Utility models	Inventions	Yes
Trade Secrets	Confidential Business Information	Yes
Copyrights	Original databases, Scientific Works, Software	Yes
Database rights	Not original databases	Yes
Domain names	Internet addresses	
Industrial Designs	Outwards appearance of products	Yes
Trademarks	Distinctive signs	Yes
Geographical Indications	Sign for products with specific geographical origin	No

For establishing a robust Intellectual Property Plan (table 9.2), it is fundamental to keep in mind the Result Ownership List, that establish, which partners is involved in each of the results, so must be considered part to define Intellectual Property Rights.

Table 9.2 Results Ownership List for TransformAr results.

SOLUTION	INVOLVED PARTNERS
<p>Citizen App (CA):</p> <p>CAF - Mobile application for crowd sensing and real time monitoring of extreme flooding events due to CC events by citizens.</p> <p>CAE - Augmentation of existing Municipal app for citizen to conduct a vulnerability and resilience assessment to climate change in terms of social services demand and the supported infrastructure.</p>	<p>LAPP MOG VERHAERT MOE NCSR</p>
<p>Restoration and creation of wetlands and creation of riparian buffers RCRB - Nutrient and soil management measures to demonstrably control farmyard run-off by catching nutrients, sequestering carbon and creating additional water for farmers.</p>	<p>CZU WRT CMCC</p>
<p>Smart Grid for coastal management (SG) - Smart sea-opening system using rapid unhooking grid and gates for emergency opening in case of extreme events</p>	<p>CMCC MEDSEA</p>
<p>Urban run-off system (URB) – a biofiltration area, that captures and treats runoff and storm water from the surroundings street and sidewalk in the city centre of Lappeenranta.</p>	<p>LAPP</p>
<p>Digital monitoring (SWMM) - Monitoring system with simple probes to monitor flow rates and water quality through individual modules. The monitoring user interface will be made visual and browser-based, enabling access from any smartphone or laptop. Publicly displayed information will be accessible to all</p>	<p>LUT LAPP</p>
<p>Smart climate solutions (SCS) - To acquire a detailed view of the microclimatic conditions, with focus on better understating of the fine scale flows and heat exchanges leading to urban heat island, its diurnal variation and supporting studies apportioning its origins and determination factors.</p>	<p>MOE NCSR</p>
<p>Mussel raft monitoring (MRM) - Environmental and hydrodynamic sensors based on the implementation of IoT solutions powered by solar and wind energy. Digitalization will allow knowing in real-time the state of the platform, alarms in case of risky water conditions and the construction of a comprehensive database.</p>	<p>CETMAR</p>
<p>Intertidal monitoring (INTERM) - To improve the knowledge of environment behaviour and numerical modelling to predict banks response under changing environmental conditions.</p>	<p>CZU WRT UVIGO</p>
<p>Nudging (NUDG) - Nudge design and understanding the factor of personalisation (based on the Lytics programme)</p>	<p>ADEME ACTERRA</p>
<p>Awareness-raising and behavioural change modules (AWAR) - Monitor the impact of the project activities on the local population - educational material to be developed for the young and school pupils to promote climate neutrality and awareness, perception of CC and potential impacts</p>	<p>NCSR MOE</p>
<p>Resilience index (RI) - Stimulate behavioural change through the creation of a resilience index for the mussel aquaculture sector</p>	<p>UVIGO</p>
<p>Coastal contracts (COAST) - Instrument for ensuring greater coordination between different levels of spatial planning and authorities in charge of coastal wetlands management, while limiting conflicts between preservation issues and economic activities. Promotes voluntary agreements between public institutions and private individuals, new forms of institutional cooperation, new ways of integrating the different practices of spatial and sectoral planning</p>	<p>CMCC MEDSEA</p>

Demand analysis for social services/infrastructures (DSI) - Continuous assessment of climate “deep resilience” of SI, following H2020-EU-CIRCLE project methodology, creating stronger social networks and reducing inequality	MOE
Climate Innovation Hub (CIH) - Within the existing Municipal Innovation Hub, promoting green, resilient and climate friendly entrepreneurship towards the creation of a Climate Innovation Hub.	MOE
Green bonds (GB) - The identification and use of change-agents as a broker between private buyers and private sellers that allow for complex and layered environmental goods and services to be transacted. The role of the change-agent is to pull together all stakeholders and seek agreement on the protocols needed to assess the costs and the benefits either to secure future public funding or the measurement, accounting and verification needed to make goods and services bankable	WRT
Adaptation fund (AF) - Various financial flows exist, from the French public agencies at local and national level, but also EU-wide. For investments at local level, in this case the overseas region of Guadeloupe, there is no harmonised vision on financing in climate change adaptation. A need exists for better cohesion to direct existing flows into specific types of adaptation’s actions. Mechanisms will be setup, resulting in a fund, on how to bundle and catalyse financial flows in Guadeloupe with the specific aim of climate adaptation	ADEME
Choice experiment for investors (CEI) - Choice experiments for stormwater management system upscaling	UA LUT NTNU LAPPERANTA
Insurance mechanism (INSUR) - Development and validation of damage functions, as part of climate proofing	MOE LAPPERANTA CETMAR ADEME WRT CMCC MEDSEA
D3.2.1. Adaptive Transformation Playbook	VERHAERTACTERRA CMCC E3M PIK UA

9.4 IP suggestions and TransformAr partner’s feedback

In this section the recommendation of the most appropriate strategy, developed from the analysis and study of the data obtained from previous sections, is detailed. First, a summary of the protection possibilities of the results analysed in previous sections is provided, according to the patentability requirements; followed by recommendations for the best protection way and a commercialization strategy.

After analysing the prior art of the results, no patented technology has been found in patent databases that meet all the specific characteristics presented in several TransformAr results. Although in some cases patent documents with characteristics close to these results have been found, it can’t be said that they address all the needs the TransformAr results address. On the other hand, even if Technological Results could be potentially protected by themselves it was found a highly added value on the development of a combined strategy for Knowledge Results.

Table 9.3. Summary of protection possibilities for all the results analysed previously in this document.

SOLUTION	INVOLVED PARTNERS	PROTECTION POSSIBILITY	EXPLOITATION
<p>Citizen App (CA):</p> <p>CAF - Mobile application for crowd sensing and real time monitoring of extreme flooding events due to CC events by citizens.</p> <p>CAE - Augmentation of existing Municipal app for citizen to conduct a vulnerability and resilience assessment to climate change in terms of social services demand and the supported infrastructure.</p>	<p>LAPP MOG VERHAERTMOE NCSR</p>	<p>Copyright: protects the software code, design elements, and any original content developed for the app.</p> <p>Trademark: Protects the app's branding, including its name, logo, and tagline, ensuring it is uniquely identifiable.</p> <p>Database Rights: Protects the structure and organization of data if the app creates substantial datasets or databases through crowdsourcing.</p>	<p>Licensing and Collaboration Agreements:</p> <ul style="list-style-type: none"> ○ Define usage rights for the app components between MOE, Lappeenranta, and other stakeholders. ○ License specific functionalities or regional adaptations of the app to other municipalities.
<p>Restoration and creation of wetlands and creation of riparian buffers (RCRB) - Nutrient and soil management measures to demonstrably control farmyard run-off by catching nutrients, sequestering carbon and creating additional water for farmers.</p>	<p>CZU WRT CMCC</p>	<p>Copyright: Protects written materials, methodologies, and designs associated with the implementation and operation of wetlands and riparian buffers.</p> <p>Trademark: Protects branding and project identity.</p> <p>Trade Secrets: Protects proprietary knowledge or methods that provide a competitive advantage.</p>	<p>Licensing and Collaboration Agreements: Governs the sharing and use of the solutions and associated knowledge among stakeholders.</p>
<p>Smart Grid for coastal management (SG) - Smart sea-opening system using rapid unhooking grid and gates for emergency opening in case of extreme events</p>	<p>CMCC MEDSEA</p>	<p>Copyright: Protects original written, visual, and software-based elements.</p> <p>Trademark: Protects the branding and identity of the SMART GATE system.</p> <p>Patent: Protects technical innovations that meet the criteria of</p>	<p>Licensing and Collaboration Agreements: Ensures clarity on intellectual property ownership and use rights among stakeholders.</p>

		<p>novelty, inventiveness, and industrial applicability.</p> <p>Trade Secrets: Safeguards proprietary know-how, processes, or innovations that provide a competitive advantage.</p>	
<p>Urban run-off system (URB) – a biofiltration area, that captures and treats runoff and storm water from the surroundings street and sidewalk in the city center of Lappeenranta.</p>	LAPP	<p>Copyright: Protects original written content, visual materials, and software designs.</p> <p>Patent: Protects technical innovations that meet the criteria of novelty, inventiveness, and industrial applicability.</p> <p>Trademark: Protects the branding and identity of the URB system.</p> <p>Trade Secrets: Protects proprietary processes, methods, or innovations that provide a competitive edge.</p>	<p>Licensing and Collaboration Agreements: Ensures clear allocation of ownership and use rights among partners.</p>
<p>Digital monitoring (SWMM) - Monitoring system with simple probes to monitor flow rates and water quality through individual modules. The monitoring user interface will be made visual and browser-based, enabling access from any smartphone or laptop.</p>	LUT LAPP	<p>Copyright: Protects original written content, software, and user interface designs.</p> <p>Patent: Protects technical innovations with novelty and industrial applicability.</p> <p>Trademark: Protects branding and identity of the monitoring system.</p> <p>Trade Secrets: Protects proprietary processes, methods, and systems that provide a competitive edge.</p>	<p>Licensing and Collaboration Agreements: Ensures clear allocation of ownership and use rights among partners.</p>
<p>Smart climate solutions (SCS) - To acquire a detailed view of the microclimatic conditions, with focus on better understating of the fine scale flows and heat exchanges leading to urban heat island, its diurnal variation</p>	MOE NCSR	<p>Copyright: Protects original content, software, and data visualization tools.</p> <p>Trademark: Protects branding and identity.</p> <p>Database Rights: Protects structured datasets generated by the system.</p>	<p>Licensing and Collaboration Agreements: Establishes rights and responsibilities among collaborators.</p>

and supporting studies apportioning its origins and determination factors.		Trade Secrets: Protects proprietary methods and techniques.	
Mussel raft monitoring (MRM) - Environmental and hydrodynamic sensors based on the implementation of IoT solutions powered by solar and wind energy. Digitalization will allow knowing in real-time the state of the platform, alarms in case of risky water conditions and the construction of a comprehensive database.	CETMAR	Copyright: Protects original works, such as software and digital interfaces. Patent: Protects new inventions or technological innovations. Trademark: Protects brand names, logos, and other identifiers. Database Rights: Protects collections of data that are structured or organized in a way that provides value.	Licensing and Collaboration Agreements: Establishes the terms under which IP can be used by other entities.
Intertidal monitoring (INTERM) - To improve the knowledge of environment behaviour and numerical modelling to predict banks response under changing environmental conditions.	CZU WRT UVIGO	Copyright: Protects original works such as software, reports, research findings, and databases. Patent: Protects novel inventions or processes. Trade Secrets: Protects confidential business information, processes, or systems. Trademark: Protects branding elements such as logos, names, and product identifiers.	Licensing and Collaboration Agreements: Facilitates the use of the technology under agreed terms.
Nudging (NUDG) - Nudge design and understanding the factor of personalisation (based on the Lytics programme)	ADEME ACTERRA	Copyright: Protects original works such as educational content, software, and multimedia. Educational material, curricula and content, multimedia and software and digital tools. Trademark: Protects branding elements such as logos, names, and product identifiers. Branding and Logos, campaigns and programs.	Licensing and Collaboration Agreements: Facilitates the use of the technology under agreed terms. License the Tools: Licensing the nudging interventions or educational materials to other municipalities, schools, or organizations that wish to replicate the initiatives.
Awareness-raising and behavioural change modules (AWAR) - Monitor the impact of the project activities on the local population - educational material to be developed for the young and school pupils to promote climate neutrality and awareness, perception of CC and potential impacts	NCSR MOE	Design Rights: Protects the visual design or aesthetic appearance of products or systems. Design of	Collaborations with Partners: Working with external organizations, such as tourism companies, schools, or NGOs, to implement and scale the

		<p>Educational Materials, Interface Design and Sensor and Display Design.</p> <p>Data and Database Rights: Protects collections of data that provide value due to their organization or structure.</p> <p>Behavioural Data: The data collected from participants in the nudging interventions or from schools participating in the educational modules could be protected under database rights.</p> <p>Monitoring and Feedback Data: The real-time data gathered from monitoring systems or user feedback on the effectiveness of nudges could be protected as part of a structured database.</p>	<p>nudging and awareness-raising solutions through licensing agreements.</p> <p>Software Licensing: If there is any software developed to support nudging or behavioural tracking (e.g., mobile apps or monitoring tools), it could be licensed to other parties for broader deployment.</p>
<p>Resilience index (RI) - Stimulate behavioural change through the creation of a resilience index for the mussel aquaculture sector</p>	<p>UVIGO</p>	<p>Copyright:</p> <p>Resilience Index (RI): applied to the documentation and methodologies related to the development and application of the RI, reports, guides, and digital tools that describe the index's usage.</p> <p>Demand Analysis Reports: Any written reports, studies, or publications related to the continuous assessment of resilience for social services and infrastructure could be copyrighted.</p> <p>Climate Innovation Hub (CIH): Educational content, exhibition materials, and reports related to the activities (such as real-time data</p>	<p>Licensing and Collaboration Agreements:</p> <p>Licensing of Tools: Tools or methodologies developed for governance schemes (e.g., the Resilience Index tool, climate forecasting models, or CIH platforms) can be licensed to other municipalities or organizations for broader implementation.</p> <p>Collaborations with Stakeholders: Collaborative agreements between public institutions, private companies, and research institutions (e.g., those involved in the Coastal Contracts initiative) can be structured to share IPR,</p>
<p>Coastal contracts (COAST) - Instrument for ensuring greater coordination between different levels of spatial planning and authorities in charge of coastal wetlands management, while limiting conflicts between preservation issues and economic activities. Promotes voluntary agreements between public institutions and private individuals, new forms of institutional cooperation, new ways of integrating the different practices of spatial and sectoral planning</p>	<p>CMCC MEDSEA</p>		

<p>Demand analysis for social services/infrastructures (DSI) - Continuous assessment of climate “deep resilience” of SI, following H2020-EU-CIRCLE project methodology, creating stronger social networks and reducing inequality</p>	<p>MOE</p>	<p>displays, event materials, and publications) can be copyrighted.</p> <p>Data Models and Tools: If any models, methodologies, or assessment tools used in these schemes are developed into digital formats (e.g., software tools, apps, or web-based platforms), the source code can be copyrighted.</p> <p>Trademark:</p> <p>Resilience Index and CIH Branding: The brand name, logo, or slogan for the Resilience Index or the Climate Innovation Hub could be trademarked to create a recognizable identity.</p> <p>Climate Innovation Hub (CIH): Any specific programs or campaigns, such as the climate change exhibition or events like datathons, can be trademarked for consistency and recognition.</p> <p>Coastal Contracts (COAST): If a specific set of tools or methodology for implementation of a unique name or branding.</p> <p>Design Rights:</p> <p>Exhibition Design: The design of the Climate Innovation Hub’s exhibition and public engagement tools (e.g., real-time data displays, posters, and interactive installations) could be protected by design rights.</p> <p>Digital Tools and Interfaces: If any user interfaces (e.g., for the Resilience Index or CIH data visualization platforms) are developed with</p>	<p>ensure joint use, or establish revenue-sharing models.</p> <p>Use of Data and Insights: Data and insights generated from the Climate Innovation Hub or Demand Analysis programs could be licensed for use by other regions or stakeholders working on similar climate adaptation strategies.</p>
<p>Climate Innovation Hub (CIH) - Within the existing Municipal Innovation Hub, promoting green, resilient and climate friendly entrepreneurship towards the creation of a Climate Innovation Hub.</p>	<p>MOE</p>	<p>displays, event materials, and publications) can be copyrighted.</p> <p>Data Models and Tools: If any models, methodologies, or assessment tools used in these schemes are developed into digital formats (e.g., software tools, apps, or web-based platforms), the source code can be copyrighted.</p> <p>Trademark:</p> <p>Resilience Index and CIH Branding: The brand name, logo, or slogan for the Resilience Index or the Climate Innovation Hub could be trademarked to create a recognizable identity.</p> <p>Climate Innovation Hub (CIH): Any specific programs or campaigns, such as the climate change exhibition or events like datathons, can be trademarked for consistency and recognition.</p> <p>Coastal Contracts (COAST): If a specific set of tools or methodology for implementation of a unique name or branding.</p> <p>Design Rights:</p> <p>Exhibition Design: The design of the Climate Innovation Hub’s exhibition and public engagement tools (e.g., real-time data displays, posters, and interactive installations) could be protected by design rights.</p> <p>Digital Tools and Interfaces: If any user interfaces (e.g., for the Resilience Index or CIH data visualization platforms) are developed with</p>	<p>ensure joint use, or establish revenue-sharing models.</p> <p>Use of Data and Insights: Data and insights generated from the Climate Innovation Hub or Demand Analysis programs could be licensed for use by other regions or stakeholders working on similar climate adaptation strategies.</p>

		<p>distinctive visual elements, these designs could be protected under design rights.</p> <p>Data and Database Rights:</p> <p>Climate Data Collection: The large-scale datasets generated from the Resilience Index, Demand Analysis, and Coastal Contracts initiatives can be protected as databases, especially if they are organized in a unique or systematic manner.</p> <p>Environmental and Policy Data: The data collected regarding climate change impacts, governance strategies, and policy outcomes could be protected as databases, especially if they are curated for long-term use by multiple stakeholders.</p>	
<p>Green bonds (GB) - The identification and use of change-agents as a broker between private buyers and private sellers that allow for complex and layered environmental goods and services to be transacted. The role of the change-agent is to pull together all stakeholders and seek agreement on the protocols needed to assess the costs and the benefits either to secure future public funding or the measurement, accounting and verification needed to make goods and services bankable</p>	WRT	<p>Copyright:</p> <p>Green Bonds (GB): Apply to the documents detailing the protocols for identifying change-agents, stakeholder collaboration processes, and the methodologies for measuring, accounting, and verifying environmental goods and services.</p> <p>Adaptation Fund (AF): Reports, project proposals, and financial reports detailing the establishment of the Local Adaptation Fund (FLAG) in Guadeloupe, along with educational materials about the fund's objectives and processes, can be copyrighted.</p> <p>Choice Experiment for Investors (CEI): The survey methodology,</p>	<p>Licensing and Collaboration Agreements:</p> <p>Green Bonds (GB): Green bond methodologies and platforms can be licensed to other organizations or financial institutions interested in issuing green bonds or facilitating environmental transactions.</p> <p>Adaptation Fund (AF): The Local Adaptation Fund (FLAG) model could be licensed to other regions or municipalities wishing to establish similar funds, ensuring that the underlying processes and tools are protected and can be used to replicate the approach elsewhere.</p>
<p>Adaptation fund (AF) - Various financial flows exist, from the French public agencies at local and national</p>	ADEME		

<p>level, but also EU-wide. For investments at local level, in this case the overseas region of Guadeloupe, there is no harmonised vision on financing in climate change adaptation. A need exists for better cohesion to direct existing flows into specific types of adaptation's actions. Mechanisms will be setup, resulting in a fund, on how to bundle and catalyse financial flows in Guadeloupe with the specific aim of climate adaptation</p>		<p>questionnaires, and any publications or reports analysing the results of the choice experiment on stormwater management could be copyrighted.</p> <p>Insurance Mechanism (INSUR): Documents describing the development of damage functions for climate-proofing, as well as related reports, analysis frameworks, and models, could be copyrighted.</p> <p>Data and Database Rights:</p> <p>Green Bonds (GB): The databases used to track green bond investments, environmental goods, services, and stakeholders could be protected under data rights.</p> <p>Adaptation Fund (AF): Data collected regarding the funded projects, including financial data and adaptation results, could be protected under database rights to ensure ongoing use and access.</p> <p>Choice Experiment for Investors (CEI): The dataset of survey responses and the data collected about citizens' willingness to pay for stormwater solutions could be protected as a valuable database.</p> <p>Insurance Mechanism (INSUR): The extensive data on climate risks, damage functions, and insurance claims used to evaluate climate-proofing strategies could be protected as a database.</p>	<p>Choice Experiment for Investors (CEI): The methodology and tools developed for choice experiments can be licensed to other municipalities, research organizations, or financial institutions to implement similar surveys in different regions.</p> <p>Insurance Mechanism (INSUR): The tools, models, or risk analysis systems developed to assess and mitigate climate-related damage could be licensed to insurance companies, governments, or other stakeholders.</p>
<p>Choice experiment for investors (CEI) - Choice experiments for stormwater management system upscaling</p>	<p>UA LUT NTNU LAPP</p>		
<p>Insurance mechanism (INSUR) - Development and validation of damage functions, as part of climate proofing</p>	<p>MOE LAPP CETMAR ADEME WRT CMCC MEDSEA</p>		

D3.2.1. Adaptive Transformation Playbook	Verhaert ACTERRA CMCC E3M PIK UA	Copyright: Protects original works.	Protected by a Creative Commons license BY-NC-ND-EU. No commercial use - no international modification. Reproduction or sharing of this work is permitted for non-commercial purposes only. The application of the TransformAr methodology by an organization or by a service provider (e.g. a consultancy firm) on behalf of an organization, including for remuneration, is only permitted subject to attribution of the TransformAr methodology and tool to the TransformAr consortium.
Data visualisation platform	PIK	Copyright: Protects original works.	Licensing
Mission and Green Deal Success Stories	Under Definition	Copyright: Protects original works.	Dissemination with authorship.
Policy Brief on Transformational Adaptation	Under Definition	Copyright: Protects original works.	Dissemination with authorship.

Dissemination results that have already been produced, along with the corresponding defined IPRs, are included. The remaining dissemination results, not listed in this table, are currently under internal IMB discussion to establish an IP protection plan and evaluate potential exploitation routes in addition to dissemination.

9.5 Exploitation strategy and route

After collecting and analysing all the potential outcomes, it was executed the analysis of the possible exploitation strategies. During the different exploitation and IP management workshops, the 4 categories that can be applied to exploitation strategy were presented, explained and analysed with partners:

1. **New research**, when the results are intended to be used for publications and to be involved in new research projects and activities.
2. **Standard setting**, when the partner intends to propose the adoption of the result as a standard.
3. **Internal adoption**, when the partner plans to use the results internally to improve the knowledge within the organization or improve the internal procedures.
4. **Commercial exploitation**, when the partner intends to use the result according to a market-oriented strategy, based on offering a new service or a new product on the market.

The exploitation strategy flowchart to follow depending on the results nature and partner's interests can be summarised as it is shown in Figure 8.1.

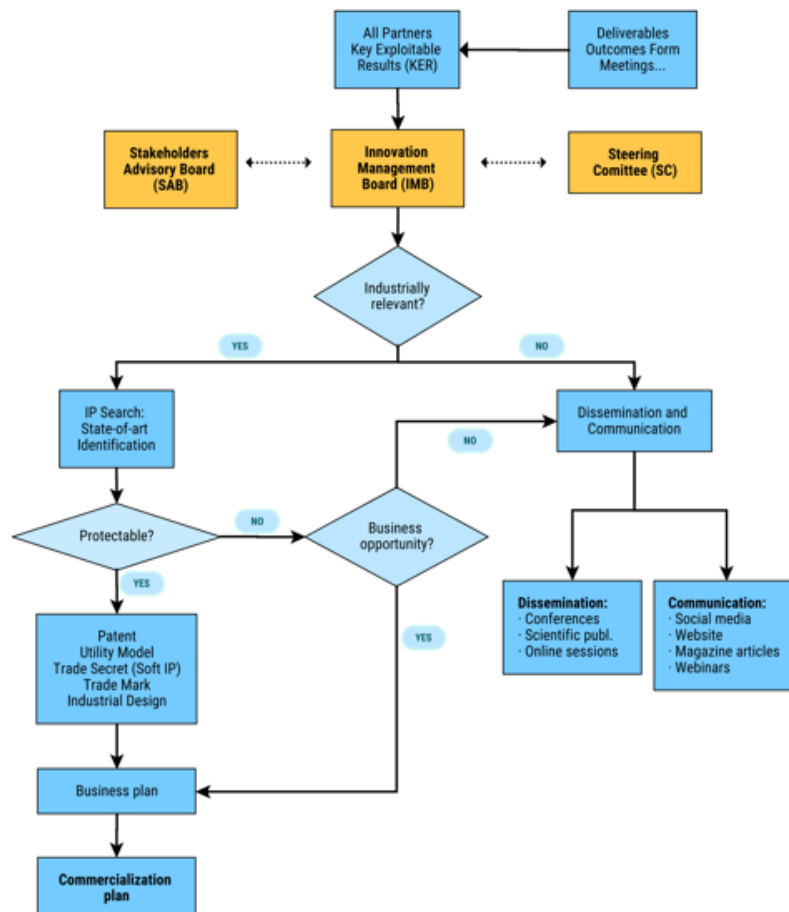


Figure 9.4 Exploitation strategy flow-chart definition.

As a general guiding principle, as soon as partner reports on certain tasks are ready, the consortium first decides whether the results should be protected or not. More specifically, the dissemination will require full agreement of the Steering Committee. Regarding publication, the TransformAr project was based on the writing of joint papers and reports.



The exploitation of the project results requires the development of an appropriate strategy to ensure the project's sustainability. This will involve a stepwise process during that will (i) **identify what project outcomes can be exploited**, (ii) **who will be the end-users of the technology**, (iii) **how the research will be exploited to address the end-user needs**, and (iv) **which partners will be responsible for the exploitation of each technology**.

An exploitation route is proposed for the results included in Table 6.1, TransformAr exploitable assets.

9.5.1. Exploitation Route for Citizen App (CA) - Mobile application for crowd sensing and real time monitoring of extreme flooding events due to CC events by citizens.

The result is composed by two different applications that share definition, characteristics and objectives, both are addressed to citizens, to report anomalies and allow the early warning of this situation. The market data gathered indicates that mobile applications that allow citizen participation for extreme events monitoring are still developing, and the market is expected to increase, for instance the real-time flood monitoring and warning systems and the climate risk digital solutions. This is related with the expected increase of climatic extreme episodes.

The end-users are citizens; however, local and county governments are the ones expected to implement these solutions. Therefore, collaboration with stakeholders that represent this sector is fundamental for the further exploitation of the solution.

The partners involved in developing the solution, City of Lappeenranta, and replicating it, Municipality of Gjøvik, have the property of the IP related with the specific applications, it can be licensed to potential implementation, government, and the developers provide consultancy services for the adaptation of the application.

9.5.2. Exploitation Route for Restoration and creation of wetlands and creation of riparian buffers (RCRB) - Nutrient and soil management measures to demonstrably control farmyard run-off by catching nutrients, sequestering carbon and creating additional water for farmers.

The end users addressed by this result are governments at regional and national level, as well farmers and producers that will receive a positive impact from implementing the solution. This shows multi-benefit since it allows slowing the flow, reducing N and P inputs and improving summer base flow.

There is an increased demand for this solution derived from the implementation of Nature Restoration Regulation (NRR), Carbon Farming Initiatives, Sustainable Agriculture and Funding initiatives and mechanisms with this aim.

The methodology developed and test in the demonstrator for the restoration and creation of wetlands and creation of riparian buffers can be applied for the same target in other regions, promoted by the public administration to manage flow and N a P inputs to water and in collaboration with other stakeholders as environmental agencies and agricultural sector for implementation and society acceptance.

Westcountry Rivers Trust, which oversaw the design and implementation of the proposed solution, can give Consultancy Services for the replication of the solution in other regions, allowing them to define the needs for the execution of a similar solution in regions with similar requirements.



9.5.3. Exploitation Route for Smart Grid for coastal management (SG) - Smart sea-opening system using rapid unhooking grid and gates for emergency opening in case of extreme events.

The proposed solution is addressed to governments, the user is expected to implement this solution due to its characteristics. However, the benefits of this are to citizens and those exploiting the water bodies restored by the implementation of the solution. As summary the potentially involved target market actor are: coastal municipalities and government, port authorities, environmental agencies and private stakeholders.

There is a demand derived from the increasing frequency of extreme weather events, economic impact and regulatory requirements. Specifically, it can be seen a growing demand for automated flood management solutions.

The methodology developed and test in the demonstrator for the smart sea-opening system using rapid unhooking grid and gates for emergency opening in case of extreme events can be applied for the same target in other regions. MEDSEA Foundation, which oversaw the design and implementation of the proposed solution, can give Consultancy Services for the replication of the solution in other regions, allowing them to define the needs for the execution of a similar solution in regions with similar requirements, including specific stakeholders that must be considered for the solution implementation.

9.5.4. Exploitation Route for urban run-off system (URB) – a biofiltration area, that captures and treats runoff and storm water from the surroundings street and sidewalk in the city centre of Lappeenranta.

The proposed solution, a biofiltration area for urban runoff (URB), is addressed to municipal governments and urban planners due to its ability to manage stormwater sustainably in urban centres. The benefits extend to the broader community by improving water quality, reducing pollutant loads, and ensuring groundwater recharge. Target market actors include municipal governments, urban developers, environmental agencies, and construction firms specializing in sustainable infrastructure.

There is an increasing demand for decentralized stormwater management solutions driven by urbanization, stricter environmental regulations, and public interest in sustainable practices. This demand is particularly notable in urban areas facing challenges from impervious surfaces and rising pollution levels.

The methodology tested in Lappeenranta for the biofiltration system demonstrates the feasibility of decentralized nature-based stormwater management. It provides an efficient solution for filtering pollutants, including heavy metals and nutrients, while reducing the load on stormwater sewer systems. The system also acts as a flood buffer, redirecting and managing excess water during heavy rainfall events.

The City of Lappeenranta (LAPP), which implemented this solution, can offer consultancy services for its replication in other regions. This support includes tailoring the system to regional requirements, identifying specific stakeholder needs, and guiding the integration of nature-based solutions in urban planning. The proven benefits of this system make it a scalable and sustainable approach to urban runoff management for regions with similar environmental and infrastructural challenges.



9.5.5. Exploitation Route for digital monitoring (SWMM) - Monitoring system with simple probes to monitor flow rates and water quality through individual modules. The monitoring user interface will be made visual and browser-based, enabling access from any smartphone or laptop.

The proposed solution, the Digital Monitoring System (SWMM), is targeted at municipalities, environmental agencies, industrial facilities, and research institutions due to its capability to provide efficient, real-time monitoring of flow rates and water quality. The benefits extend to inhabitants and industries through enhanced transparency, better flood management, and improved environmental compliance.

The demand for such solutions is driven by increasing urbanization, stringent environmental regulations, and the need for advanced water management technologies. Public awareness and the push for data transparency further reinforce the need for digital monitoring systems like SWMM.

The SWMM system offers applications in stormwater management, wastewater treatment, environmental compliance, and flood forecasting. It integrates simple probes and a browser-based interface accessible from smartphones or laptops, allowing for decentralized, user-friendly monitoring. Selected data, such as the quantity and quality of stormwater, is accessible via CitySen.App, ensuring relevant stakeholders can make informed decisions.

The approach developed and applied by the Municipality of Gjøvik (MOG) and the City of Lappeenranta (LAPP) showcases the viability of using digital solutions for decentralized stormwater management. This pioneering model can be adopted in other areas, with consultancy support from the participating municipalities to tailor the system to meet specific local needs.

Given the rapid growth of the European stormwater management market—projected to reach USD 5.82 billion by 2028 with a CAGR of 7.92%—the SWMM system aligns with market trends. Its design supports data-driven decision-making and addresses the critical need for transparent, efficient water monitoring solutions in urban environments

9.5.6. Exploitation Route for smart climate solutions (SCS) - To acquire a detailed view of the microclimatic conditions, with focus on better understating of the fine scale flows and heat exchanges leading to urban heat island, its diurnal variation and supporting studies apportioning its origins and determination factors.

The Smart Climate Solutions (SCS) initiative aims to enhance the understanding of urban heat islands (UHIs) by collecting real-time microclimatic data through 21 Smart Climate Stations. The data, available via a citizen app, will help inform climate adaptation strategies, monitor heat exposure risks, and support urban planning. The target users are citizens, local authorities, and research institutions.

Market demand for smart climate solutions is growing, driven by urbanization, climate change awareness, and the need for effective urban heat island mitigation. The European smart climate solutions market is expected to grow significantly, with the smart climate control market projected to reach USD 8.33 billion by 2025.

Municipalities and urban planners are the primary users, with local governments expected to implement these solutions. The Municipality of Egaleo (MOE), Greece, owns the IP related to the SCS, and consultancy services can be offered for adaptation and implementation in other regions.

9.5.7. Exploitation Route for mussel raft monitoring (MRM) - Environmental and hydrodynamic sensors based on the implementation of IoT low-cost monitoring solutions powered by solar energy. Digitalization will allow knowing in real-time the state of the platform, alarms in case of risky water conditions, production monitoring and the construction of a comprehensive database.

The Mussel Raft Monitoring (MRM) solution, developed by CETMAR, utilizes solar-powered IoT sensors to monitor mussel farming platforms in real-time. This system allows for constant tracking of environmental conditions, water quality, and production, while providing early warnings in case of hazardous water conditions. The tool was co-designed with mussel farmers to meet their needs, focusing on optimizing mussel production and addressing climate-related challenges.

The target users for this solution include mussel farmers, industry associations, local authorities, policymakers, and research institutions. The increasing demand for sustainable aquaculture practices, coupled with advancements in IoT technology, has led to a growing market for aquaculture monitoring solutions.

With the aquaculture monitoring market valued at USD 37.3 billion in 2023 and projected to reach USD 55 billion by 2030, the demand for real-time, data-driven insights in aquaculture is expanding. This solution aligns with the growing focus on environmental sustainability and regulatory compliance in the aquaculture sector.

CETMAR's expertise and developed platform can be licensed for implementation in other regions, with consultancy services available for adaptation to local mussel farming needs and environmental conditions.

9.5.8. Exploitation Route for intertidal monitoring (INTERM) - To improve the knowledge of environment behaviour and numerical modelling to predict banks response under changing environmental conditions.

The Intertidal Monitoring (INTERM) system, developed by UVIGO, focuses on enhancing the understanding of coastal sediment dynamics and predicting the response of intertidal zones to changing environmental conditions. By integrating advanced morpho dynamic modelling and sedimentological data, this solution helps improve coastal management, particularly for the shell fishing sector, in adapting to climate-induced changes.

The target audience includes environmental agencies, coastal zone managers, research institutions, and policymakers. Key applications include assessing coastal erosion, conserving intertidal habitats, studying climate change impacts, and guiding marine spatial planning.

The demand for intertidal monitoring is growing due to the increasing awareness of climate change effects, regulatory pressures, and the availability of advanced modelling and monitoring technologies. While specific market data on intertidal monitoring is limited, the broader environmental monitoring sector is expected to grow from USD 17.9 billion in 2020 to USD 26.2 billion by 2027, reflecting a CAGR of 5.6%.

This solution, tailored to the shell fishing sector, provides valuable insights into coastal management and ecosystem preservation. UVIGO's expertise and the system's adaptability position it for expansion, with opportunities for consultancy and replication in other regions facing similar needs.

9.5.9. Exploitation Route for behavioural change and awareness-raising solutions

This integrated package aims to address sustainability and climate resilience by combining three innovative approaches: Nudging (NUDG), Awareness-Raising Modules (AWAR), and the Resilience Index

(RI). These complementary solutions target multiple stakeholders, fostering proactive engagement in sustainable practices and climate adaptation.

1. **End-Users:**

- **Tourists, Hotels, and Accommodation Providers (NUDG)**
- **Local Communities, Students, Teachers, and Schools (AWAR)**
- **Mussel Farmers, Industry Associations, Local Authorities (RI)**

2. **Exploitation to Address End-User Needs:**

- **Nudging (NUDG):** This approach will be used in the tourism sector, encouraging sustainable behaviours like water and energy conservation among tourists and hotel staff. The use of low-cost, scalable interventions (e.g., stickers, flyers, and sensors) makes this solution applicable in various regions.
- **Awareness-Raising Modules (AWAR):** Educational materials and modules will be implemented in schools and local communities to raise awareness about climate change, its impacts, and mitigation strategies. This initiative empowers future generations to adopt climate-friendly behaviours and actively participate in local sustainability efforts.
- **Resilience Index (RI):** The RI will serve the mussel farming industry, local authorities, and policymakers to assess the resilience of aquaculture sectors to climate change. This tool provides valuable insights to improve resource management, optimize decision-making, and ensure long-term sustainability in coastal and marine environments.

3. **Partners Responsible for Exploitation:**

- **Tourism Stakeholders and Environmental NGOs** for implementing Nudging (NUDG) in the tourism industry.
- **Schools, Local Authorities, and Climate Education Networks** for deploying Awareness-Raising Modules (AWAR).
- **Mussel Farmers, Industry Associations, and Research Institutions** for leveraging the Resilience Index (RI) in the aquaculture sector.

This combined package ensures a comprehensive, multi-stakeholder approach to behavioural change, climate adaptation, and environmental sustainability.

By presenting these solutions as one cohesive package, they can be marketed to a broader audience, creating synergies across different sectors such as tourism, education, and aquaculture, all while aligning with EU sustainability and climate adaptation goals.

9.5.10. Exploitation Route for governance schemes

This integrated package combines three powerful tools for addressing climate change impacts and fostering resilience: **Coastal Contracts (COAST)**, **Demand Analysis for Social Services/Infrastructure (DSI)**, and **Climate Innovation Hub (CIH)**. Together, these initiatives offer a comprehensive solution for promoting sustainable practices, enhancing social infrastructure, and driving climate-friendly innovation across different sectors.

End-Users:

- **Coastal Contracts (COAST):** Local Governments, Environmental Agencies, Private Sector (Fishing, Agriculture, Tourism)

- **Demand Analysis for Social Services/Infrastructure (DSI):** Municipalities, Social Service Providers, Vulnerable Communities
- **Climate Innovation Hub (CIH):** Local Entrepreneurs, Startups, Public Sector, and Citizens

Exploitation to Address End-User Needs:

- **Coastal Contracts (COAST):** This tool facilitates better coordination between authorities and private stakeholders managing coastal and wetland areas. It promotes voluntary agreements to reduce environmental impacts, enhance water quality, and increase climate resilience. By implementing COAST, local governments and economic sectors like tourism and fishing can collaborate to protect coastal ecosystems while pursuing sustainable economic activities.
- **Demand Analysis for Social Services/Infrastructure (DSI):** This tool helps municipalities assess the climate resilience of social services and infrastructure. Through continuous climate resilience assessments, the **DSI** initiative helps local governments, particularly in vulnerable regions, prepare for shifts in demand for services such as healthcare and social care, ensuring uninterrupted service provision to citizens, especially the most vulnerable.
- **Climate Innovation Hub (CIH):** The **CIH** will promote green entrepreneurship and innovation by transforming a municipal facility into a hub for climate-related solutions. It will showcase real-time climate data, host innovation events, and encourage collaboration between public and private sectors. This initiative will drive the development of climate adaptation solutions and encourage the creation of sustainable businesses focused on local climate challenges.

Partners Responsible for Exploitation:

- **Local Governments and Environmental Agencies:** Will be the primary implementers of **COAST**, ensuring the integration of cross-sectoral coordination in coastal and wetland management.
- **Municipalities and Social Service Providers:** For **DSI**, they will assess and address the impacts of climate change on social services, ensuring the needs of vulnerable populations are met.
- **Innovation Ecosystem Players (Startups, Entrepreneurs, Investors):** Will drive the success of **CIH**, leveraging the hub to develop and scale innovative climate solutions.

Combined Approach:

By integrating **COAST**, **DSI**, and **CIH**, this package provides a holistic solution that strengthens local governance, enhances resilience, and drives climate innovation. Each tool complements the others, addressing the interconnections between environmental protection, social infrastructure, and climate innovation. This combined package offers a scalable, multi-sector approach that can be applied to municipalities, coastal communities, and urban areas, aligning with EU climate goals and sustainability targets.

9.5.11. Exploitation Route for insurance, financial and economic schemes

This market analysis focuses on the growing demand for climate adaptation and resilience financial solutions, identifying key sectors, target markets, and applications for the four financial mechanisms—Green Bonds (GB), Adaptation Fund (AF), Choice Experiment for Investors (CEI), and Insurance Mechanism (INSUR). The following outlines the expected exploitation strategies based on current and emerging market trends:

1. Green Bonds (GB)

Applications:



- Financing green infrastructure projects (e.g., renewable energy, sustainable transportation systems, and climate-resilient urban developments).
- Funding for environmental conservation programs, such as reforestation and conservation projects.
- Supporting climate adaptation projects like flood control systems and implementing low-carbon technologies.

Exploitation Strategy:

- **Key Players:** Financial institutions, governments, investors, and private developers. Green bonds will be marketed primarily to large-scale urban developers, municipalities, and sectors prioritizing ESG (Environmental, Social, and Governance) investment strategies.
- **Exploitation Pathways:** Collaborations with local and national governments for financing adaptation and mitigation projects. Promotion of green bonds to institutional investors focusing on sustainable finance. Incorporation of Green Bond issuance into municipal climate adaptation plans.

2. Adaptation Fund (AF)

Applications:

- Funding for climate adaptation projects, including agricultural resilience, water management, flood protection, and coastal resilience initiatives.
- Supporting local economic activities through climate-resilient development plans and promoting public-private partnerships.

Exploitation Strategy:

- **Key Players:** Local governments, NGOs, private sector partners, and public institutions.
- **Exploitation Pathways:** Encourage public-private sector cooperation, especially in areas with high vulnerability to climate risks (e.g., coastal flooding). Foster collaboration with international climate funds and bilateral investors. Utilize the **Local Adaptation Fund (FLAG)** in Guadeloupe as a model for similar projects in other regions.

3. Choice Experiment for Investors (CEI)

Applications:

- Survey-based assessments to understand citizens' willingness to pay for stormwater management solutions on their properties.
- Data-driven insights for informing local governments and private sector investment in stormwater management and flood mitigation.
- Upscaling stormwater management systems in cities based on citizen preferences and willingness to invest in local solutions.

Exploitation Strategy:

- **Key Players:** Local governments, municipalities, developers, and insurance firms.
- **Exploitation Pathways:** Conduct choice experiments with residents to understand their willingness to invest in stormwater solutions. Translate survey data into policy and urban planning strategies that incorporate citizen engagement. Collaborate with insurance firms to offer tailored flood protection solutions to property owners.

4. Insurance Mechanism (INSUR)

Applications:

- Developing damage functions to assess and quantify risks posed by extreme weather events (floods, storms, droughts).
- Offering insurance products tailored to climate-induced risks for businesses and communities.
- Climate-proofing efforts in sectors like agriculture, energy, and real estate through customized insurance schemes.

Exploitation Strategy:

- **Key Players:** Insurance companies, municipalities, local authorities, and risk assessors.
- **Exploitation Pathways:** Work with insurers to incorporate climate risk models into their offerings and ensure climate resilience. Collaborate with local governments to develop risk-based insurance models that protect against rising flood risks and other climate-related disasters.

Overall Exploitation Pathways for the Package:

Given the complementary nature of these financial mechanisms, the exploitation strategy should involve creating integrated, multi-sector solutions that engage both public and private stakeholders. The Green Bonds, Adaptation Fund, Choice Experiment for Investors, and Insurance Mechanism can be packaged together as a comprehensive solution for climate adaptation financing. Key exploitation pathways would include:

- **Public-Private Partnerships:** Collaborating across sectors to ensure the effective reallocation of funds towards climate adaptation strategies and offering tailored financing solutions for municipalities and businesses facing climate risks.
- **Urban and Rural Resilience Projects:** Using **CEI** and **INSUR** to inform and finance large-scale stormwater and infrastructure projects, while using **Green Bonds** and **AF** to secure long-term investment in climate adaptation.
- **Scaling and Replicating Models:** Expanding the reach of successful initiatives, such as the **Local Adaptation Fund (FLAG)**, to other regions facing similar climate risks and creating opportunities for investment in green infrastructure and climate-resilient projects.

This integrated package of financial mechanisms provides a holistic approach to addressing the urgent need for climate adaptation across urban, rural, and coastal areas. By leveraging public and private sector resources, these solutions can drive sustainable development, enhance climate resilience, and mitigate the impact of extreme weather events.

9.6 Commercialization strategy

In order to draft a potential commercialization strategy for the results obtained within the TransformAr project a Business Model Canvas framework was developed and detailed on Figure 9.5. The commercialization strategy to follow based on this preliminary draft of the Business Model Canvas is described below. This model is proposed for the whole project, it will be detailed and segmented as part of deliverable 6.8 Business report.

Figure 9.5 TransformAr Preliminary Business Model Canvas.

TransformAr Preliminary Business Model Canvas

Key Partners ✓ Public Authorities ✓ Citizens ✓ Producers ✓ Associations ✓ Local authorities ✓ Private institutions	Key Activities ✓ Decision support ✓ Climate awareness ✓ Risk alert ✓ Extreme events anticipation ✓ Consultancy services	Value Propositions 7.1 Citizens extreme climate events risk awareness. 7.2 Management of nutrient loading from farms. 7.3 Autonomous adjust in case of hydraulic risk in coastal system. 7.4 Urban runoff management system. 7.5 Flooding risk minimize system. 7.6. Public administration decision support. 7.7 Anticipation to mussels' low production risks. 7.8 Anticipation to clam low production risks. 7.9 Promoting citizen well behavior facing climate change. 7.10 Decision support systems for local authorities in sector affected by CC 7.11 Maximizing outputs of fund raised.	Customer Relationships ✓ Dissemination of results ✓ Presentation of solutions	Customer Segments ✓ Public Authorities ✓ Local authorities ✓ Private institutions
	Key Resources ✓ Technology development ✓ New knowledge ✓ Background experience		Channels ✓ Policy briefs ✓ Best practices ✓ Event attendance	
Cost Structure ✓ Human resources ✓ Technology implementation		Revenue Streams ✓ Monetize knowledge throw consultancy services ✓ Agreement for fundraising for solutions replication and implementation		

10.0 FUTURE TASKS

Future task and exploitation recommendations can be divided depending on the potential exploitation strategy discussed with consortium partners grounded on their interests:

- Non-commercial exploitation: further research activities, developing product or process, service or in standardisation activities.
- Commercial exploitation

Case in point, as is stated in section “Description of action” of Grant Agreement number: 101036683 — TransformAr — H2020-LC-GD-2020 / H2020-LC-GD-2020-2, Transformational Adaptative Blocks (TABs) will be disseminated as open source to feed CSA platform and potentially exploited following a non-commercial path by escalating the findings to the relevant EU policy making bodies.

All the decisions and conclusions detailed throughout this document should be taken as recommendations resulting from the work carried out in Task 6.4 Exploitation, IPR strategy, business model and planning of identified solutions (WP6) lead by FEUGA with the contribution of all partners and whose final deliverable is this document.

Other outputs from the project are being tracked, i.e. dissemination results, included here as Key Exploitable Results but not analysed its exploitation potential, are relevant Outputs track within the Innovation Management Board (IMB).

As part Task 6.4, in other to advance it to the expected period to be executed detailed in Grant Agreement, between month 42 and month 46, a selection of the most promising results in terms of market up-scaling is proposed focused on commercial exploitation:

- Citizen App (CA)
- Restoration and creation of wetlands and creation of riparian buffers - Integrated constructed wetlands (RCWRB)



- Smart Grid for coastal management (**SG**)
- Digital monitoring (**SWMM**)
- Mussel raft monitoring (**MRM**)
- Intertidal monitoring (**INTERM**)

During the coming months, Round of Meetings with relevant stakeholders (industry players, potential technology adopters, investors) will be organized to explore and validate real market perspectives, up-scale strategies and/or commercialization channels of this specific results.

The remaining results, which were not selected as the most promising for market up-scaling, will also be analysed internally to assess their commercialization potential. They will then be broadly validated from a market perspective by specific expected actions to be executed.

The present report aims to develop the exploitation and IPR strategy as part of Task 6.4: Exploitation, IPR Strategy, Business Model, and Planning of Identified Solutions. As part of this task, Deliverable 6.8: Business Report is scheduled for delivery in Month 46. This document, based on the exploitation plan, will outline a business model for the project solutions, considering market perspectives. Further activities within IMB will be carried out to finalize the alignment between dissemination, communication, and exploitation. Additionally, other project tasks are being monitored, and their final outputs will be incorporated into the exploitation activities planned for execution over the next six months.

These recommendations should be considered for the final implementation of the exploitation plan for the project's results. That will determine the exploitation of the TransformAr's outcomes/results once the project, as a project financed by the H2020 programme, is completed.

ANNEX A: DISCLAIMER

Diligence


The execution of the project has been carried out with the maximum diligence, according to the published information and the state of the art at all times. The execution of the project does not require the incorporation or identification of all the documentation which could potentially exist related to an investigation, but only the one that can be accessed at any time. Considering that generally the part of the investigation is carried out following certain patent classifications to obtain a reproducible result, this circumstance constitutes an essential restriction which determines that relevant documents are not identified, since the patent offices have been able to use other classifications. Another relevant restriction is that the patent applications are not published in most countries until 18 months after the application has been filed in the patent office, so that only after that can they be identified. This implies that highly relevant documents may not have been found in a precise moment. Therefore, the execution of the project does not require assuring the legal terms of the investigation or the specific legal scope of the protection, obligations and rights which are included in the regulation of intellectual property, which, furthermore, do not constitute the purpose of this project.

Integrity

In the execution of projects, FEUGA is not responsible for the integrity, precision and update of the information contained in the databases used that are owned by third parties, as well as the various sources of information used that are owned by third parties and which are related with the intellectual property, patent standards and scientific literature.

Responsibility

FEUGA is not responsible of any infringement, damage or prejudice related to the technological project or the legal situation of the identified intellectual property. The responsibility of FEUGA related to the results of the investigation is limited to possible failures of its strict obligations in the framework of the execution of the service and is limited to the maximum cost incurred to the development of the service.



Climate change impacts are here and now. The impacts on people, prosperity and planet are already pervasive but unevenly distributed, as stated in the new EU Blueprint strategy (European Commission-EC, 2019). To reduce climate-related risks, the EC and the IPCC agree that transformational adaptation is essential. The TransformAr project aims to develop and demonstrate products and services to launch and accelerate large-scale and disruptive adaptive process for transformational adaptation in vulnerable regions and communities across Europe.

The 6 TransformAr lighthouse demonstrators face a common challenge: water-related risks and impacts of climate change. Based on existing successful initiatives, the project will develop, test and demonstrate solutions and pathways, integrated in Innovation Packages, in 6 territories.

Transformational pathways, including an integrated risk assessment approach are co-developed by means of 9 Transformational Adaptive Blocks. A set of 22 tested actionable adaptive solutions are tested and demonstrated, ranging from nature-based solutions, innovative technologies, financing, insurance and governance models, awareness and behavioural change solutions.



TransformAr



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