



SWAMP

SMART WATER MANAGEMENT PLATFORM

Project n°: 777112

WP6
D6.5 Exploitation Activity
Report

Editor: Carlos Kamienski (ABC)

Authors: All partners

Status – Version: 1.0

Date: 9 November 2020

Distribution – Confidentiality: Confidential

Code: 777112-SWAMP – D6.5 Exploitation Activity Report



Disclaimer

This document contains material, which is the copyright of certain SWAMP contractors, and may not be reproduced or copied without permission. All SWAMP consortium partners have agreed to the full publication of this document. The commercial use of any information contained in this document may require a license from the proprietor of that information. The SWAMP Consortium consists of the following institutions.

Participant no.	Participant organisation name	Part. short name	Country
1 (European Coord.)	Teknologian tutkimuskeskus VTT	VTT	FI
2	Intercrop	ICRO	ES
3	University of Bologna	UBO	IT
4	Consorzio di Bonifica dell'Emilia Centrale	CBEC	IT
5	Quaternium	QUAT	ES
6 (Brazilian Coord.)	Federal University of ABC	ABC	BR
7	Centro Universitário da FEI	FEI	BR
8	Federal University of Pernambuco	UFPE	BR
9	LeverTech Tecnologia Sustentável	LEV	BR
10	Brazilian Agricultural Research Corporation	EMBR	BR

The information in this document is provided "as is" and no guarantee or warranty is given that the information is fit for any particular purpose. The user thereof uses the information at its sole risk and liability.

Document revision history

Date	Issue	Author/Editor/Contributor	Summary of main changes
26/10/2020	0.1	Carlos Kamienski (UFABC)	Initial draft
27/10/2020	0.9	Carlos Kamienski (UFABC)	First version, still missing some inputs from partners
03/11/2020	0.95	Carlos Kamienski (UFABC)	First complete version
09/11/2020	1.0	Carlos Kamienski (UFABC)	Final version

Internal review history

Date	Reviewer	Summary of comments
5/11/2020	Juha-Pekka Soininen (VTT)	Accepted with minor edits and comments.
09/11/2020	Marcos Visoli (Embrapa)	Accepted with minor edits and comments.

Table of contents

Abbreviations.....	4
Executive Summary.....	5
1. Introduction	6
1.1. Purpose and Context of this Deliverable.....	6
1.2. Scope of this Deliverable.....	6
1.3. Deliverable Structure	6
2. SWAMP Final Exploitation Workshop	7
3. Exploitation Activities and Plans from SWAMP Partners.....	7
4. SWAMP Interest Group	16
5. Final Remarks	20
References	21

Abbreviations

ABDI	Brazilian Agency for Industrial Development
ICT	Information and Communication Technologies
IoT	Internet of Things
RTK GPS	Real Time Kinematic Global Positioning System
SIG	Special Interest Group
SWAMP	Smart Water Management Platform
VRI	Variable Rate Irrigation
VWC	Volumetric Water Content

Executive Summary

SWAMP (Smart Water Management Platform) is a Europe-Brazil cooperation project aiming at developing Internet of Things (IoT) based methods and approaches for smart water management in the precision irrigation domain and to pilot the approaches in four places, two pilots in Europe (Italy and Spain) and two pilots in Brazil. SWAMP aims at improving precision irrigation by increasing the awareness of the condition of the crop, by monitoring the field based on crop status (size, growing phase) and environment (e.g., weather forecast) and to adjust the irrigation prescription map accordingly. The same underlying SWAMP platform can be customized to different pilots considering different countries, climate, soil, and crops.

This document reports the final views of SWAMP partners on the exploitation of project results, as well as exploitation activities that have already been carried out so far. Two years have elapsed since the SWAMP Exploitation Plan (D6.6) was written and during this period the view on how to exploit the project results evolved significantly and different activities have been conducted by the partners in this regard. The exploitation of SWAMP results from SWAMP partners so far involve the creation of a startup in Italy and the submission of project proposals for new collaborations in research, development, and innovation. This document closes the ring opened in 2018 with the SWAMP Internal Workshop on Innovation and Exploitation that resulted in the Exploitation Plan, contrasting current and initial perspectives. A final workshop occurred on October 2020 and revealed that the views on exploiting SWAMP outcomes evolved significantly and some of them have been already materialized, as the creation of a startup in Italy and a variety of project proposals for extending the project achievements. SWAMP partners strongly believe that SWAMP has already left a significant legacy in terms of exploiting findings, understanding, insights, approaches, algorithms, and mostly lessons learned.

The idea of launching a SWAMP Interest Group (SIG) was officially introduced with the Exploitation Plan and after some unsuccessful attempts to aggregate interested parties by invitation, an open call was issued that resulted in the current 34 members. A first newsletter has been already issued targeted to the general public, but specially to the SIG members and a new one is expected before of the end of this year.

1. Introduction

1.1. Purpose and Context of this Deliverable

The primary objective of the SWAMP (Smart Water Management Platform) project is to develop IoT (Internet of Things) based methods and approaches for smart water management in the precision irrigation domain and to pilot the approaches in four places, two pilots in Europe (Italy and Spain) and two pilots in Brazil. SWAMP aims at improving precision irrigation by increasing the awareness of the condition of the crop, by monitoring the field based on crop status (size, growing phase) and environment (e.g., weather forecast) and to adjust the irrigation prescription map accordingly. The smart water management pilots aim at guaranteeing that technological components are flexible enough to adapt to different contexts and to be replicable in different locations and settings. The same underlying SWAMP platform can be customized to different pilots considering different countries, climate, soil, and crops.

The present document is an output of Task T6.3 (Exploitation) within Work package 6 (Impact Creation Measures), whose main goal is to support the exploitation possibilities by ensuring that the results are as exploitable as possible, by highlighting the business possibilities and opportunities that will emerge from the project, and encouraging and supporting the creation and management of new knowledge and innovations.

1.2. Scope of this Deliverable

The present document contains the final views of the SWAMP partners on the exploitation of the project results, influenced by the 2018 internal workshop on innovation and exploitation and in the experiences, achievements, market perspectives, and outcomes of the project from November 2017 to October 2020.

1.3. Deliverable Structure

The remainder of this document is organized in six chapters.

- Section 2 (SWAMP Final Exploitation Workshop) provides clarifications about the organization and agenda of the workshop.
- Section 3 (Exploitation Activities and Plans from SWAMP Partners) reports the exploitation activities and plans of SWAMP Partners as of October 2020, comparing with their views two years before.
- Section 4 (SWAMP Interest Group) reports the experience and the outcome of an initiative for attracting prospective parties interested in exploiting SWAMP results.
- Section 5 (Final Remarks) presents final thoughts about exploitations activities and plans.

2. SWAMP Final Exploitation Workshop

On October 14th 2020, the SWAMP project partners met in the Final Exploitation Workshop for reporting exploitation activities that have already been conducted during the term of the project and the new plans for the future exploitation. This internal workshop was based on the 2018 Internal Workshop on Innovation and Exploitation reported on Deliverable D6.7 [3] and the current activities and plans have are now compared to the initial plans reported on Deliverable D6.6 Exploitation Plan [2].

Exploitation aims at guaranteeing that significant project results survive after the end of the project. According to the European Commission, partners must take concrete measures to exploit project results in three different ways¹:

1. Using project results in further research activities, which are not covered by the project itself;
2. Developing and providing a product, process or service, which have a clear focus on the market;
3. Using project results in standardization activities and policy-making or advocacy actions.

Given the profile of SWAMP consortium members, both exploitation way number 1 (research, by academic partners) and number 2 (market, by business partners) have been and will be explicitly pursued. There are a variety of other end-users and stakeholders in general that are considered an important target audience of the project. In the SWAMP consortium, we count on various farmers (Intercrop, CBEC pilot farms, Guaspari Winery, Rio de Pedras Farm (MATOPIBA), a water distributor (CBEC), a drone manufacturer (Quaternium), a system integrator (LeverTech), two technology transfer institutions (VTT and EMBRAPA), and four universities as scientific partners (UBO, UFABC, UFPE, FEI).

3. Exploitation Activities and Plans from SWAMP Partners

Almost four years have elapsed since the SWAMP proposal was written and two years elapsed since the SWAMP Exploitation Plan (D6.6) was written. Since then, the view on how to exploit the results of the SWAMP Project evolved significantly and different activities have been conducted by the partners in this regard. TABLE 1 shows an evolution of partner's perspectives on SWAMP exploitation, which was more generic in the initial exploitation plan and now is more specific and focused. The exploitation of SWAMP results from SWAMP partners so far involve the creation of a startup in Italy and the submission of project proposals for new collaborations in research, development, and innovation. However, the potential for future exploitation is still very high, since the most significant results of the project were only available this year and thus the perspective for future uses of SWAMP technologies and concepts tends to increase.

TABLE 1: SWAMP EXPLOITATION BY PARTNERS: ACTIVITIES AND PLANS


Partner	Exploitation Plan (October 2018 - D6.6)	Exploitation Activities and Plans (October 2020)
VTT	<p>Main results and innovations from VTT perspective: a) automated decision-making based on situation-awareness and artificial intelligence in a very complex system; b) automated data collection from large area (with the help of autonomous systems and gateway mobility); c) SWAMP platform (and platform development principles)</p> <p>The main type of exploitation is to develop the SWAMP technology further (from current TRL 5 or 6 to TRL 8 and 9) with industrial partners. The development can</p>	<p>Current exploitation activities are related to on-going and starting research projects. SWAMP platform ideas are extended towards farm management and agriculture dataspace development. The drone and automated mission execution results are extended and applied in multi-robot collaboration pilots starting early next year.</p> <p>VTT is using FIWARE in several research projects and exploits SWAMP experiences in those. In these projects, the focus is in using FIWARE</p>

	<p>be done either with help of public funding or as contract research project with customer. A second alternative is to set up a start-up to commercialize the technology. VTT will definitely use competences and results of SWAMP in its future projects. SWAMP fits in perfectly to VTT business plan.</p>	<p>together with IDS (International Data Spaces) data sharing solutions.</p> <p>VTT is also setting up FIWARE competences to support the use of FIWARE and its Linked Data version. VTT hosts a couple of Digital Innovation Hubs and these results are promoted through them.</p> <p>IoT and communication solutions developed are also exploited in customer projects, where data collection is needed in harsh environments. SWAMP sensor nodes and gateway solutions create technology bases for these.</p> <p>In our future plans we see the need for integrating SWAMP results into the implementation of EU data strategy very important. EU has decided to invest in trusted cloud/edge infrastructures and data spaces with AI driven services. GAIA-X initiative has been proposed as a way to implement this infrastructure together with IDSA. VTT is already the Finnish IDSA Hub and day one member of GAIA-X AISBL that has been established in autumn 2020. The trusted path from data collection (i.e FIWARE) to edge and cloud, and data sharing (GAIA-X/IDSA) in value co-creation based business networks so that data sovereignty is preserved are the target. We aim to use SWAMP results and experiences in defining and implementing these goals.</p>
<p>ICRO</p>	<p>If SWAMP shows good results that reduce their costs, the ICRO board may be willing to invest in implementing it. Intercrop is a SME so that investments are not easy made. Despite of that, they try adopt as much as possible new technologies in salad crops. The Intercrop board must see that there is a balance between pros and cons to make a decision: cost, yield, water saving, quality.</p> <p>With high probability ICRO will use SWAMP results depending on how they can fit into their irrigation needs. Saving water has a big impact in their business because they are situated in a very dry area, so saving water is a must. Average rainfall is 200-300ml in this area, which requires irrigation.</p>	<p>Intercrop produces specialties that add value to the business. To achieve that, we have to work on details in all aspects of operation within which cost control and saving are very important. Also, Intercrop has been an important user of the latest technology of the market.</p> <p>SWAMP can provide us with information on precision irrigation method, water and energy saving, also good cost control on irrigation labour. In addition to those, we undoubtedly improve our crop yield and quality.</p> <p>Intercrop is and will use the results of SWAMP on daily basis and also irrigation planning. We will consider hiring the system if it converts to a commercial product.</p> <p>Intercrop will need to carry on with SWAMP results in the future projects to achieve automation in irrigation management.</p>

<p>UBO</p>	<p>Working with a multidisciplinary team (computer science, agronomy, hydrology) has been extremely profitable in terms of opportunities for further exploitation, for example, cooperation in publications. Each department has the possibilities to expand its range of actions and they are already taking part in new proposals.</p> <p>UBO is experiencing a very fruitful cooperation with CBEC and that can lead to exploitation in the education field, such as internships and PhD. Also, cooperation with EMBR in the sensor manufacturing.</p> <p>UBO can create a new company, a spin-off, and CBEC might do that for optimization of irrigation scheduling.</p>	<p>VAIMEE SRL start-up has been founded by a member of the SWAMP team. The start-up aims to provide B2B services in several domains, including the farming one. VAIMEE will exploit the results of the project mostly in terms of data sharing capabilities provided by the SEPA component of the SWAMP platform.</p> <p>UBO developed in SWAMP Ultra Low Power wireless sensor hubs deemed to interface partners and third parties soil sensors in LoRaWAN networks. Some of these are going to be exploited and further developed in other research activities (including the ECSEL project AI4DI, in cooperation with STMicroelectronics and Meter Group).</p> <p>UBO collected and turned into linked open data quite a lot of information about soil, canals water levels, weather, irrigations (both measured and predicted data), originating from: i) CBEC, ii) the Regional Environmental Protection Agency (ARPA), iii) the pilot farms and iii) the models adopted and developed in SWAMP (e.g., the water distribution optimizer developed within UBO and Criteria, provided by ARPA and integrated in the SWAMP platform within SWAMP). As for today (Oct 21, 2020) we have > 16.9M data on the SWAMP platform, collected in the last 16 months, that are just waiting to be exploited in further research. UBO plan is to continue to collect data after the end of the project, to increase the open data asset and to exploit them in the coming irrigation seasons. Funding strategy is currently being discussed.</p>
<p>CBEC</p>	<p>Ensuring environmental and territorial safety and water supply for irrigation takes constant soil defence and maintenance, as well as water regulation, so as to avoid worsening the instability and environmental degradation and reduce the land vulnerability</p> <p>Immediate outcomes include the functioning of water management evaluating present management modes and highlighting bottlenecks, as well as verifying whether the introduction of new technologies could contribute to solve the identified bottlenecks and whether it could also lead to the identification of new management rules.</p> <p>The management of water resources is one</p>	<p>CBEC core business includes activities aimed at the improvement of water resources management. In this respect, CBEC is already exploiting SWAMP results, with the daily use of the automatic gate and its control system installed at the front end of the pilot area (where the San Michele canal originates from Canale dei Ronchi).</p> <p>The results achieved are so relevant that CBEC is now defining a plan to review the operating modes of canal management based on the same approach taken in SWAMP.</p> <p>Three automatic gates have been installed (already in 2019) on the large Calvetto Canal (East to the pilot area), and a plan for additional installations in the Brescello Area, on the</p>

	<p>of CBEC fundamental functions, and therefore all activities aimed at the improvement of water resources management, their shrewd use, their protection and enhancement are part of our core business.</p>	<p>northern side of the territory controlled by CBEC, near the PO and the Enza rivers, is under development. Long term exploitation of this approach is envisioned.</p> <p>An additional trigger for SWAMP results exploitation are the wireless level sensors installed along the canals of the pilot area, to support the water distribution process.</p> <p>The plan is to exploit the knowledge achieved in the management and use of these low-cost low power LoRa sensors and reuse such a knowledge with an extensive deployment of several types of sensors to be turned into Lora sensors, possibly exploiting the results achieved by UBO within SWAMP (see UBO exploitation plan). This includes pluviometers, level sensors, flow meters that could be deployed across CBEC entire territory, to monitor water delivery, water consumption, water losses, with an increased level of transparency in their interaction with the farmers.</p> <p>This approach to highly valuable SWAMP results exploitation is made sustainable by the interest shown for SWAMP by Lepida (the Emilia Romagna company providing broadband network services to Local Administrations, see UBO section above) to extend their regional LoRaWAN network to the farming territory covered by CBEC. During SWAMP times Lepida has already extended their LoraWan network, to cover the SWAMP pilot area with three gateways located in the municipalities of the so-called Terra di Mezzo, just west to the SWAMP pilot area (namely Bagnolo in Piano, Cadelbosco di Sopra and Castelnovo di Sotto). With these three gateways the Lepida LoraWan coverage of CBEC territory is extended a lot to the west of SWAMP pilot area, probably reaching the extreme CBEC western border (i.e., the Enza river).</p> <p>CBEC is encouraging additional joined exploitation activities, to be carried out with SWAMP partners, aiming at applying SWAMP results, models, sensors and services to the incoming irrigation seasons, in order to extend the impact of and further assess the project results. How far this strategy will materialize, is of course dependent on the ability of the partners to intercept appropriate funding resources.</p>
--	--	---

<p>QUAT</p>	<p>Quaternium current cannot be precise regarding exploitation of SWAMP results. It is early to assess how much value this adds to drone business. Quaternium is a drone startup that currently is exploring different possibilities and markets to exploit its technology.</p> <p>Precision farming is expected to be the main market in the drone industry, therefore, according to our business plan, Quaternium is highly interested in studying this potential market. However, an open and affordable drone might complicate commercialization.</p> <p>Everything must be integrated, i.e., there is no business with just the drone. Quaternium is a hardware company, which makes it more difficult to exploit the results than services. Rather than cost, they must think about added value; once you get closer to the market, things get more expensive. Quaternium is partnering with intermediaries that can take more risks and have access to big companies</p> <p>In terms of the drone functionality, it is very likely that Quaternium adopts SWAMP results.</p>	<p>The main exploitation field for SWAMPdrone (the main project result delivered by Quaternium) is precision farming, especially the application of photogrammetry.</p> <ul style="list-style-type: none"> • Photogrammetry: adding a compact camera to our drone we are able to generate terrain models in 3D. These models, thanks to their precision, will replace in a short period of time all the satellital models currently used. • Multispectral photogrammetry: adding a multispectral compact camera to our drone as payload, we can obtain orthophotos of the terrain with different indicators, to help the farmers to know which areas of the field need more irrigation or lack nutrients. <p>During the action, our team has tested and piloted this configuration with local farmers to validate the solution. But Quaternium is also researching other markets to exploit this versatile and affordable drone</p> <p>There are many other applications that a drone like this can manage. During this time, we have carried out two integration projects with SWAMPdrone as the flying platform, in order to analyse other market opportunities:</p> <ul style="list-style-type: none"> • In collaboration with Optia Robotics, Quaternium developed a camera calibration system for a wind park: Adding a RTK GPS to the SWAMPdrone and integrating a 150W led remotely controlled, we made a system to calibrate two cameras covering the field of view of a whole wind turbine park, making possible the early detection of birds flying in the proximities of the wind turbines and stopping them to avoid accidents. • In collaboration with the Local Police of Benidorm, our team integrated a camera and a loudspeaker for crowd management at the beach during COVID-19. It was used to detect and inform people of the social distance they should maintain at the beach during the COVID-19.
-------------	---	---

		 <p>SWAMPdrone is especially valuable for R&D and innovation activities thanks to its modular design and high load / flight-time ratio. Therefore, we see exploitation opportunities in very different fields, enabling fast results in a very accessible way.</p>
<p>ABC</p>	<p>Being a university, it is more likely that UFABC will use SWAMP results in further research activities. The SWAMP Platform based on FIWARE may be used in a variety of different projects. UFABC FIWARE Lab Node: project proposal submitted to the Brazilian FINEP funding agency</p> <p>Smart Farming, Precision Agriculture and working with agriculture and farming in general: being an urban university focused on engineering, it is more natural for UFABC to focus on industry since the ABC is the most industrialized area in Brazil. Research in agriculture is rare, but SWAMP opens up the possibility of new project in this important area for Brazil and for the whole world</p> <p>Collaboration: new EU-BR projects or bilateral collaboration with SWAMP partners</p>	<p>UFABC sees exploitation opportunities mainly in new research activities. Some of them have already started, some proposals have been submitted to funding agencies, and new activities in the future may be highly influenced by the results of SWAMP.</p> <p><u>Brazilian Capes PrInt Program</u>: PrInt² is the Internationalization program of the Brazil funding agency Capes. Within the institutional UFABC Capes PrInt project, there is a subproject called IoT-based applications for Smart Cities and Smart Farming³, started in 2018 and expected to end in 2022. SWAMP made it possible for UFABC to have this subproject, with the objective of investigating the use of IoT and related technologies in the development of innovative applications for smart cities and smart farming having UBO and VTT as partners. Some activities have been already conducted:</p> <ul style="list-style-type: none"> • Jeferson Cotrim (UFABC – PhD student): 6 months in UBO (2019) • Carlos Kamienski (UFABC): visit of one week to UBO (2019) <p><u>MIMOSA Project</u>: Managing the Internet of Movables for Smart Agriculture (MIMOSA) was submitted to funding agencies in Brazil and Italy⁴</p>

2 <https://propg.ufabc.edu.br/capesprint>

3 <https://propg.ufabc.edu.br/information4>

4 <https://fapesp.br/index.php/13780/italy-brazil-joint-science-and-technology-call-for-joint-project-proposals>

		<p>in January 2020 (under review) involving UFABC, UBO and Embrapa. The MIMOSA project aims at developing management approaches for distributed mobile and stationary things for smart agriculture, as well as intelligent data analysis techniques for fully realizing the system's purpose</p> <p><u>Finalizing the MATOPIBA Pilot:</u> This project proposal has been submitted for the Agro 4.0 of the Brazilian Agency for Industrial Development (ABDI)⁵ in October 2020 and is currently under review. UFABC is partnering with Embrapa and the Rio de Pedras Farm (the MATOPIBA Pilot) to implement, evaluate and disseminate the adoption of the SWAMP Platform for Variable Rate Irrigation (VRI).</p>
FEI	<p>FEI will focus of exploitation in water management. Right now there is a PhD student at FEI working with "açai" (a Brazilian fruit). Previously açai was obtained by extractivism, but since two years ago, there are açai farms in Brazil and they have different business models using IoT and they are willing to understand how such platform could be used in setting. A new project is being negotiated with an employee of SABESP (urban distribution state-owned company) to use the IoT Robot in a scenario beyond Industry 4.0 is a new avenue for exploitation of SWAMP IoT-based results in a different area</p>	<p>Researchers at FEI are working on the use of Artificial Intelligence and data mining to estimate irrigation parameters needed for precision agriculture, such as evapotranspiration. Neural Networks and Support vector machines were used in this researches and will continue to be improved. We also developed a Fuzzy Logic Control System for irrigation control, which will be used in a possible cooperation with farmers of the estate of São Paulo.</p> <p>Another important step is to validate, in a small pilot in the campus, the data collection, communication protocols and cloud technology, by deploying a small instance of the SWAMP platform.</p> <p>The development of software simulation using systems like Plant Simulation, integrated with the IoT platform is also ongoing research, in order to develop a digital twin for smart farming that can irrigate fields autonomously.</p> <p>FEI learned how to develop and deploy IoT related technologies, that will be used on other IoT projects under development.</p>
UPFE	<p>Key exploitation type for UFPE is creating more research projects, new avenues for research, theses, dissertations. Once the SWAMP platform is running we can create</p>	<p>The key exploitation path for UFPE is the creation of more research projects, new avenues for research, theses, and dissertations, not only at UFPE but also in partnership with other</p>

	<p>more applications. Interested in performance analysis that can generate a lot of research and publications; besides that they have more opportunities with data that is available in the platform to exploit more models (analytics).</p> <p>There is also the interest for the region where UFPE is located. The Northeast of Brazil is a semiarid area with a chronic problem of water scarcity. Must go after public agencies to promote the adoption of the platform. Since water scarcity is a long lasting problem, policy and advocating must be undertaken. Recife is a tech hub where they might find companies to exploit the results.</p>	<p>institutions in the Recife area, such as Federal Institute of Pernambuco (IFPE) and Federal Rural University of Pernambuco (UFRPE). Once the SWAMP platform is ready, more applications can be created, and the performance analysis of the platform can generate more research and publications.</p> <p>There is also the interest for the region where UFPE is located. The Northeast of Brazil is a semiarid area with a chronic problem of water scarcity. Public agencies are going to be sought to promote the adoption of the platform. Recife is also a regional tech hub; local tech companies can exploit the results of the project, with the guidance of UFPE.</p>
<p>LEV</p>	<p>Exploitation objective for LeverTech is to take the SWAMP solution to the market. The path is by the existing distribution channels, i.e., companies that sell irrigation products and services</p> <p>LeverTech is now exploiting the results of a research project started 12 years ago with a Swedish partner company called Tannak that commercializes LoRa Gateways.</p> <p>The focus must be on sales: "No sales, no product; just a project". The most important information: is this product part of the acquisition list of customers (farmers)? If it is in the acquisition list of buyers it means that the product is desired by the market. A success for the market is one can sell their products.</p> <p>Exploitation of SWAMP results: most farmers around Brasilia (where LeverTech is located) have two problems: cost and scarcity. Irrigation amounts for up to 20% of the total production cost. Also, Brasilia is a dry area and most farmers are already using the total permitted water they can obtain from rivers</p>	<p>Levertech understands the exploitation opportunities of SWAMP technology are clearly associated with the institutions and regions where there's an intensive use of irrigation. This is the case of some Government companies like CODEVASF (Development Company of the São Francisco and Parnaíba River's Valley), that explores the irrigation along the São Francisco River, and DNOCS (National Department Against Water Drought), the institution responsible to build and maintain a big number of dams, the majority with irrigation perimeters, distributed in the very dry area of the Brazilian Northeastern region.</p> <p>The Project of the Transposition of the waters from the São Francisco river, in its very advanced state of execution, is also an important candidate to use SWAMP's technology, as they use a lot of pumping of the water through the various canals. In order to be able to use this water for production purposes, there must be a water optimizations system in place, otherwise this transposition system will not be effective.</p> <p>Levertech is today associated with many Cooperatives related to the Agriculture production, and expects to be able to adopt SWAMP Project's technology in order to help the optimization of the resources.</p> <p>There is a big number of farmers around the Center-West region of the country that adopts</p>

		<p>irrigation, especially using center pivots. This is also a great opportunity for the adoption of the technology, that Levertech expects to be part in the exploitation.</p> <p>Brazilian ABDI 4.0 Project: Utilizing IoT technology in order to implement the traceability of the Fishing Chain, currently under review. The objective of this project is to implement, evaluate and disseminate the adoption of the Tracking and Tracing of the fishes from the time they are caught in the ocean, to the final consumer.</p>
<p>EMBR</p>	<p>EMBRAPA works with research & development mostly for technology transfer. EMBRAPA has collaborative projects with about 80% of universities in Brazil. Collaborations are also established with companies, such as with the Fockink company that manufactures the center pivot for the MATOPIBA farm; EMBRAPA is establishing a cooperation agreement with Fockink for developing a VRI solution, an agreement that is about to be signed, which is one way EMBRAPA considers the results of SWAMP to be exploited.</p> <p>A mind map of SWAMP exploitation is used for visually organizing information, the EMBRAPA mind map shows SWAMP results supported by high tech start-ups and agritech companies. It does not consider SWAMP as a unique solution, but rather as a solution suite. In each layer of the architecture, solutions might have a particular TRL to be exploited by different companies and start-ups. Fockink is an example of a high tech company that may explore SWAMP results.</p> <p>Embrapa is also interested in reusing technologies and concepts explored in SWAMP in other farming challenges involving different crops, planting systems, areas and even fish farming. The reuse of IoT technologies can accelerate the development of the sector.</p> <p>Partnerships with startups in this sense can also be explored.</p>	<p>Embrapa sees high potential to use the results of SWAMP in internal and external activities</p> <p><u>Internal exploitation</u>: exploit the results of SWAMP inside Embrapa. a) Keep improving the soil moisture probe (VWC + Water Tension); b) Develop a field experiments automation system based on IoT; c) Using the FIWARE and the SWAMP Platforms.</p> <p><u>External exploitation</u> have been spanned multiple activities and opportunities.</p> <p><u>RADCOM</u> is an SME making Irrigation Automation products based on wireless communications. Embrapa partners with RADCOM for the PIPE Project funded by FAPESP (The São Paulo Research Foundation) in a project that is starting by the end of 2020. The objective is migrating RADCOM products to LoRaWAN and use of Embrapa soil probes (comparison of Embrapa and commercially available probes)</p> <p><u>Fockink</u> is a Brazilian Center Pivot maker (Big company). Embrapa and Fockink will soon sign and agreement for use of Embrapa soil probes and SWAMP platform as part of their future VRI solution (VRI Center pivot + control system). Fockink also won the public bidding process for producing the MATOPIBA pilot 100 probes and installation/maintenance activities.</p> <p>Agrienge is a startup in the business of Electronics and Automation Engineering and has been hired by Embrapa for the MATOPIBA pilot maintenance</p> <p>ABDI proposal to keep going on MATOPIBA pilot energy savings evaluation for 3 crop cycles:</p>

		<p>Agrienge + Embrapa + UFABC + Fockink + Agropecuaria Santa Carmem (Rio de Pedras farm owner).</p> <p><u>3V3 Irrigation Automation</u> make products based on wireless communication devoted to drip irrigation (Small company from Fortaleza, CE). This company is a potential supplier for MATOPIBA pilot parts/sensors (water supply level, power consumption, etc). Also, a potentially important SWAMP platform contributor with a huge field experience to share and a potential partner to promote the SWAMP platform for Center Pivot as new line of products.</p>
--	--	---

4. SWAMP Interest Group

The idea of creating a SWAMP Interest Group was conceived during the first year of the project, when partners noticed that SWAMP has been attracting the attention of different stakeholders of the irrigation business and end-users. Based on that, in 2019 the SWAMP partners started to invite potential companies willing to be informed of the SWAMP activities more closely. By the end of 2019 we realized that the initial interest did not reflect in a real agreement of being part of the SWAMP Interest group. So, this initiative was changed in 2020 for an open call for any interested individual or institution using the SWAMP Website⁶, spread via email, Twitter, LinkedIn, and as a piece of news in the SWAMP website as depicted by Figure 1.

6

<http://swamp-project.org/call-for-members>

SWAMP Interest Group – Call for Members

27 DE MARCH DE 2020 [ADMIN](#) [LEAVE A COMMENT](#)

This is an open invitation to companies, individuals, and any type of organization to join the SWAMP Interest Group (SIG). The SIG membership is free, non-binding, and participation in activities is optional, at the member's discretion. If you (or your organization) are interested in being a member of the SIG, please register at <http://swamp-project.org/sig>.

SWAMP[1] is a collaborative research project involving 10 partners in Europe and Brazil that develops and assesses an IoT-based smart water management platform for precision irrigation in agriculture with a hands-on approach based on four pilots in Brazil, Italy and Spain (<http://swamp-project.org>). The SWAMP Platform can be configured in different ways to deal with the requirements and constraints of different settings, countries, climate, soils, and crops, which requires a good deal of flexibility to adapt to a range of deployment configurations involving a varied mix of technologies.

The SWAMP Interest Group (SIG) brings together stakeholders with special interests in the approaches, technologies, experiences, findings, results, and exploitation opportunities of the SWAMP project firsthand. SWAMP has been attracting the attention of different stakeholders of the irrigation business, farmers, and water distributors. Considering that it is not feasible to add new project partners and new pilots to the project, the SIG is a

Figure 1: Open Call for the SWAMP Interest Group

Prospective members were instructed to register via a form available on the SWAMP Website⁷, depicted by Figure 2. This open call resulted in the registration of 34 members from 14 different countries for the SWAMP Interest Group, from which, 19 companies, 10 individuals, 2 research institutions, 2 educational institutions, and 1 government agency. The planned activities for the members would be newsletters and webinars. Unfortunately, the COVID-19 pandemic slowed down the activities of the SIG, and so far one activity has been conducted. The first activity was to produce the SWAMP Newsletter #1⁸ that comprised a collection of 12 News and an opening message from the coordinators, released on June 26th, 2020. As promised, the SWAMP Interest Group members received the newsletter firsthand, even before the SWAMP partners, via an email message partially depicted in Figure 3. A second edition of the newsletter is expected before the end of 2020.

7 <http://swamp-project.org/sig/>

8 <http://swamp-project.org/swamp-newsletter-1>

Figure 2: SWAMP Interest Group – Registration Form (partial screenshot)

The list of news belonging the SWAMP Newsletter #1 is:

- Message from the Coordinators⁹: We have the pleasure to release the first SWAMP Newsletter, to spread the word about the concepts, efforts, practical experiences, and lessons learned during the development of the project.
- News from the Reggio Emilia Pilot at COVID-19 Time¹⁰: During the Covid emergency SWAMP activity on the Reggio Emilia pilot progressed mostly on line.
- Experiences on the SWAMP Cartagena pilot during spring 2020¹¹: The SWAMP Cartagena pilot is a baby-leaf spinach field farmed by Intercrop Iberica. The pilot plan for the spring crops was to continue data collection of soil moisture, the data collection of weather data using local Libelium weather station.
- News from the MATOPIBA Pilot¹²: The MATOPIBA pilot is a Center Pivot of 100ha out of seven installed in Rio de Pedras farm, located about 40 Km from Luis Eduardo Magalhães municipality, state of Bahia in Brazil. The city is known as the capital of Brazilian agribusiness.
- Communication Activities¹³: Due to the very nature of the project, which allies key ICT technologies with critical societal challenges in agriculture, the SWAMP project has been causing a positive repercussion within the different stakeholders interested in the project.

9 <http://swamp-project.org/message-from-the-coordinators>

10 <http://swamp-project.org/activities-done-at-covid-19-time-in-the-reggio-emilia-pilot/>

11 <http://swamp-project.org/experiences-on-the-swamp-cartagena-pilot-during-spring-2020>

12 <http://swamp-project.org/matopiba-pilot>

13 <http://swamp-project.org/communication-activities>

- Dissemination Activities¹⁴: Due to the very nature of the project, which allies key ICT technologies with critical societal challenges in agriculture, the SWAMP project has been causing a positive repercussion within the different stakeholders interested in the project.
- Exploitation Activities¹⁵: Exploitation efforts aim to guarantee that significant project results survive after the project, taking concrete measures to exploit project results in different ways.
- SWAMP Paper¹⁶: Architecting and Deploying IoT Smart Applications: A Performance-Oriented Approach: The SWAMP project recently published a paper in the Sensors Journal summarizing theory and practice with designing IoT Architectures, developing IoT Platforms, and deploying IoT Smart Applications.
- SWAMP Paper¹⁷: Advancing IoT-Based Smart Irrigation: Advancing IoT-Based Smart Irrigation is the first SWAMP paper to specifically address the combination of IoT and artificial intelligence.
- SWAMP Paper¹⁸: End-to-End Security in the IoT Computing Continuum: Perspectives in the SWAMP Project: The SWAMP project recently published a short paper in the 9th Latin-American Symposium on Dependable Computing (LADC 2019) presenting a secure end-to-end data flow for an inherently distributed IoT smart application.
- SWAMP Paper¹⁹: Foundations of Data Quality Assurance for IoT-based Smart Applications: The SWAMP project recently published a paper in the IEEE Latin-American Conference on Communications (LATINCOM 2019), reporting an early experience with data quality assurance for IoT-based smart applications.
- SWAMP Paper²⁰: A Digital Twin for Smart Farming: The SWAMP project recently published a paper in the IEEE Global Humanitarian Technology Conference (GHTC 2019), reporting an early attempt to build a digital twin for smart agriculture.
- SWAMP Paper²¹: Designing an Open IoT Ecosystem: The SWAMP project published a paper in the Workshop of Cloud Networks (WCN 2019) promoting openness as a critical factor for providing interoperability and facilitating the interaction of new and existing pieces of an end-to-end IoT smart application.

14 <http://swamp-project.org/dissemination-activities>

15 <http://swamp-project.org/exploitation-activities>

16 <http://swamp-project.org/swamp-paper-architecting-and-deploying-iot-smart-applications-a-performance-oriented-approach>

17 <http://swamp-project.org/swamp-paper-advancing-iot-based-smart-irrigation>

18 <http://swamp-project.org/swamp-paper-end-to-end-security-in-the-iot-computing-continuum-perspectives-in-the-swamp-project>

19 <http://swamp-project.org/swamp-paper-foundations-of-data-quality-assurance-for-iot-based-smart-applications>

20 <http://swamp-project.org/swamp-paper-a-digital-twin-for-smart-farming>

21 <http://swamp-project.org/swamp-paper-designing-an-open-iot-ecosystem>

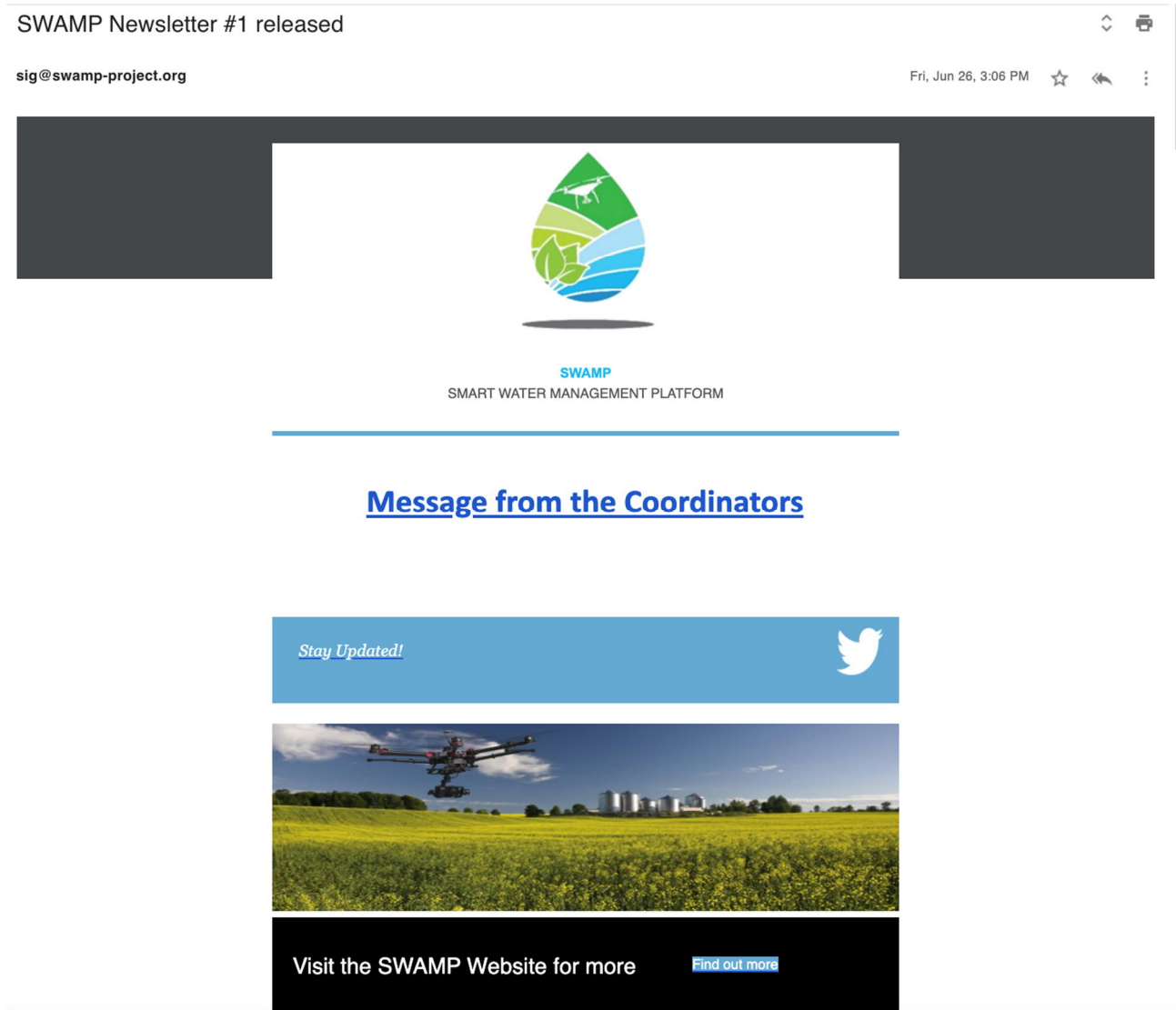


Figure 3: SWAMP Newsletter #1 from June, 26th 2020 (partial screenshot)

5. Final Remarks

The SWAMP Exploitation Plan (D6.6) was based on the SWAMP Internal Workshop on Innovation and Exploitation (D6.7) held virtually in three meetings during September and October of 2018. The final remarks section of D6.6. says “Another important outcome of the workshop was that in the end partners agreed that a final workshop on innovation and exploitation will be conducted, so that we can exchange our more informed views with each other and document it accordingly.” The final workshop occurred on October, 14th 2020 and revealed that the views on exploiting SWAMP outcomes evolved significantly and some of them have been already materialized, as the creation of a startup in Italy and a variety of project proposals for extending the project achievements.

Even though this document officially seals the exploitation activities of the project as of October 2020, we strongly believe that SWAMP has already left a significant legacy in terms of exploiting findings, understanding, insights, approaches, algorithms, and mostly lessons learned. Since the SWAMP partners engaged in many different dissemination activities, the knowledge generated within the project will survive the project official end and survive in the future.

References

- [1] European Commission, "Dissemination and Exploitation in Horizon 2020", H2020 Coordinators' Day, March 2017, http://ec.europa.eu/research/participants/data/ref/h2020/other/events/2017-03-01/8_result-dissemination-exploitation.pdf.
- [2] Kamienski, C., Gaudêncio, H., "Exploitation Plan", SWAMP Deliverable D6.6, October 2018.
- [3] Kamienski, C., "Internal Workshop on Innovation and Exploitation", SWAMP Deliverable D6.7, October 2018.