DELIVERABLE 11.2
Final Plan for the Use and Dissemination of the Foreground

Project Acronym	**ENTOMATIC**
Project Reference:	**605073**
Project Title:	**Novel automatic and stand-alone integrated pest management tool for remote count and bioacoustic identification of the Olive Fly (Batrocera oleae) in the field**

Deliverable 11.2 – Final Plan for the Use and Dissemination of the Foreground

Revision: **V 3.1**

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Dissemination Level		
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C	**Confidential, only for members of the consortium and the Commission Services**	

Revision History

Revision	Date	Author	Organization	Description
1	08/12/2017	Toni Adame, Albert Bel	UPF	General structure
2	17/12/2017	Eda Biricik	AEGEAN	Amendments, comments and validation
		Johannes Charlier	AVIA-GIS	
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Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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EXECUTIVE SUMMARY

The work presented in this deliverable is related to **task 11.2 "Exploitation Potential and PUDF"** within **work package 11 "Preparing for Exploitation"**. In this document, we present the consortium future plans for the exploitation of the techniques and technologies emerging from the project beyond the time-horizon of the project, comprising: the final project results, an outline of the IPR licensing strategies, and the initial exploitation plans.

The document is divided in three main parts: a brief explanation of the results obtained by the project, i.e., the foreground achieved that will be able to commercialize; the dissemination performed by the consortium and the exploitable foreground and their possible protection after the end of the project; and, the commercial plan and the estimation of the benefits that the commercialization of the foreground will have.

1 INTRODUCTION

The successful deployment of the ENTOMATIC solution is expected to benefit the olive production sector. The results obtained by the consortium offer an innovative solution to the growers' sector.

The ENTOMATIC solution is offering a new Integrated Pest Management (IPM) tool, not only based on an automatic trap. The major innovations performed along these three years are summarized in three main parts:

- a new bioacustic sensor that is able to recognize and automatically count the olive fruit fly entering at the trap.
- a new communicated trap designed that, thanks to a set of novel communication protocols, is able to distribute the information along a mesh network to aggregate the information in a gateway node.
- an IPM tool based on a Spatial Decision Support System algorithm that with the information collected by the traps estimates the propagation of the plague and offers the recommendations that a grower should follow to diminish its effects on the orchards.

The SME-AGs and SMEs participant in ENTOMATIC consortium have the opportunity of taking advantage of being the first association offering a novel solution to the market. The expected benefits are not only related to economic growth, as there will also contribute to employment, expansion of markets and incursion in new markets.

The ENTOMATIC project has worked to offer the best solution to the market requirements and has accomplished the major objectives established at the beginning of the project with the ENTOMATIC system developed.

2 USE AND DISSEMINATION OF THE FOREGROUND

The ENTOMATIC consortium set out the following dissemination objectives at the outset of the project:

- To disseminate the findings of the research as widely as possible - through conferences, workshops, exhibitions, tutorials and web dissemination.
- To ensure the efficient flow and exchange of information of the project.

The ENTOMATIC consortium has disseminated information about the progress and results of the project in a number of ways, including: shared publications in leading scientific journals, shared presentations in relevant scientific conferences and workshops, maintenance of the project web site with a "public" site for the project promotion, dissemination of promotion documentation like flyers, project brochures, participation in fairs etc. Moreover, there is also a training section where it is published the training material used by the SME-AGs.

We will now present the project publications up-to-date, the dissemination events that took place during the last three years, and finally the project foreground and initial exploitation ideas.

Section A (public)

List of scientific publications accepted during the life of the project and ordered by publication date. During the lifetime of the project a total number of 7 peer reviewed journals has been published.

A1: List of Scientific (peer reviewed) publications									
No.	**Title**	**Main Author**	**Series**	**Number**	**Publisher**	**Year**	**Pages**	**Permanent identifiers**	**Is/will open access provided?**
1	HARE: Supporting efficient uplink multi-hop communications in self-organizing LPWANs[1]	T. Adame, S. Barrachina, B. Bellalta, A. Bel	Sensors		MDPI	2017			yes
2	Automated remote insect surveillance at a global scale and the Internet of Things	I. Potamitis, P. Eliopoulos, I. Rigakis	Agriculture Robotics	6(3)	MDPI	2017		http://www.mdpi.com/2218-6581/6/3/19	yes

[1] This publication is pending of publication.

3	The Impact of dual prediction schemes on the reduction of the number of transmissions in sensor networks	G.M. Dias, B. Bellalta, S. Oechsner	Computer Communications	112	Elsevier	2017	58-72	http://www.sciencedirect.com/science/article/pii/S0140366417308435	yes
4	Multi-hop Communications in the Uplink for LPWANs	S. Barrachina, B. Bellalta, T. Adame, A. Bel	Computer Networks	123	Elsevier	2017	153-168	http://www.sciencedirect.com/science/article/pii/S1389128617302207	Yes
5	A Survey about Predictions-based Data Reduction in Wireless Sensor Networks	G.M. Dias, B. Bellalta, S. Oechsner	Computing Surveys	49 (3)	ACM	2016		https://dl.acm.org/citation.cfm?id=2996356	yes
6	Insect Biometrics: Optoacoustic Signal Processing and its Applications to Remote Monitoring of McPhail Type Traps	I. Potamitis, I. Rigakis, K. Fysarakis	PLOS One	10(12)	PLOS	2015		http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0140474	yes
7	Novel Noise-Robust Optoacustic Sensors to Identify Insects through Wingbeats	I. Potamitis, I. Rigakis	Sensors Journal	15 (8)	IEEE	2015	4621-4631	http://ieeexplore.ieee.org/document/7091854/?tp=&arnumber=7091854&searchWithin%3Dp_First_Names:ilyas%26searchWithin%3Dp_Last_Names:potamitis%26matchBoolean%3Dtrue%26queryText%3D(p_Authors:potamitis,%20ilyas)	no
8	The Electronic McPhail Trap	I. Potamitis, I. Rigakis, K. Fysarakis	Sensors	14(12)	MDPI	2014	22285-22299	http://www.mdpi.com/1424-8220/14/12/22285	yes

The ENTOMATIC project has been presented at: 8 scientific conferences and workshops, 2 olive oil sector workshops, 5 olive oil fairs, 11 olive oil sector magazines, and more than 6 publications at general media. All these actions are summarized at the following table.

A2: List of dissemination activities								
No.	**Type of activity**	**Main Leader**	**Title**	**Date/period**	**Place**	**Type of audience**	**Size of audience**	**Countries addressed**
1	Conference	TEIC	International Conference on Information and Communication Technologies in Agriculture	September 2017	Chania, Greece	Scientific Community	--	International
2	Conference	UPF	IEEE World Forum on Internet of Things	December 2016	Reston, USA	Scientific Community	--	International
3	Conference	UPF	IEEE Future Technologies Conference	December 2016	San Francisco, USA	Scientific Community	--	International
4	Workshop	UPF	International workshop on Multiple Access Communications	September 2015	Helsinki, Finland	Scientific Community	--	International
5	Conference	TEIC	International Congress on Sound and Vibration	July 2015	Florence, Itlay	Scientific Community	--	International
6	Conference	TEIC	Meeting of the IOBC/wprs WG Integrated Protection of Olive Crops	May 2015	Kalamata, Greece	Scientific Community	--	International
7	Workshop	TEIC	EARSeL SIG Imaging Spectroscopy	April 2015	Luxembourg, Luxembourg.	Scientific Community	--	International
8	Conference	TEIC	Ecology and acoustics	June 2014	Paris, France	Scientific Community	--	International
9	Meeting	UPF	Catalan Scientific Association Meeting	June 2016	Barcelona, Spain	Scientific Community	--	Regional
10	Workshop	INOLEO/ NUTESCA	Trafoon Project	June 2016	Córdoba, Spain	Industry	--	National
11	Fair	PHYTOPHYL	Olive and Olive Oil Festival	April 2017	Athens, Greece	Industry	--	National
12	Fair	AJAP	Ovibeja Agricultural fair	April 2017	Alentejo, Portugal	Industry	--	National

13	Fair	NUTESCA	EXPOLIVA	May 2017	Jaén, Spain	Industry	--	International
14	Workshop	CITOLIVA, NUTESCA, UPF	Espacio INNOVA (Expoliva)	May 2017	Jaén, Spain	Industry	--	International
15	Fair	IMMS	MEDICA	November 2017	Düsseldorf, Germany	Industry	--	International
16	Fair	BIOSYSTÈMES	International Conference on Pests Agriculture	October 2017	Montpellier, France	Industry	--	International
17	Magazine	AJAP	Revista Jovens Agricultores #112	December 2017	Portugal	Industry	--	National
18	Magazine	INOLEO , NUTESCA	Interempresas	December 2017	Spain	Industry	--	National
19	Magazine	INOLEO , NUTESCA	Info Agro	December 2017	Spain	Industry	--	National
20	Magazine	INOLEO , NUTESCA	OLEO	December 2017	Spain	Industry	--	National
21	Magazine	INOLEO , NUTESCA	Agro Información	November 2017	Spain	Industry	--	National
22	Magazine	INOLEO , NUTESCA	Innovagri	November 2017	Spain	Industry	--	National
23	Magazine	INOLEO , NUTESCA	Universidad Agricola	November 2017	Spain	Industry	--	National
24	Magazine	AJAP	Revista Jovens Agricultores #111	December 2017	Portugal	Industry	--	National
25	Magazine	AJAP	Revista Jovens Agricultores #108	November 2016	Portugal	Industry	--	National
26	Bulletin	TEIC	Hellenic Entomological Society	September 2016	Greece	Scientific Community	--	National
27	Magazine	AJAP	Revista Jovens Agricultores #106	May 2016	Portugal	Industry	--	National
28	News	UPF	National Television (TV3)	April 2016	Catalonia	General Audience	--	Regional
29	Magazine	AJAP	Revista Jovens Agricultores #105	January 2016	Portugal	Industry	--	National
30	Magazine	CITOLIVA	Revista Mercacei	August 2015	Spain	Industry	--	National

31	Magazine	TEIC	Farming	April 2015	Greece	Industry	--	National
32	Magazine	CITOLIVA	Revista Olimerca	October 2014	Spain	Industry	--	National
33	Magazine	UPF	Revista Olimerca	October 2014	Spain	Industry	--	National
34	Magazine	CITOLIVA, UPF	Infaoliva	October 2014	Spain	Industry	--	National
35	News	UPF	SINC agency	October 2014	Spain	General Audience	--	National
36	News	UPF	RURALCAT (Catalan Government)	October 2014	Catalonia	Industry	--	Regional
37	News	UPF	RAC1 Radio station	October 2014	Catalonia	General Audience	--	Regional
38	News	UPF	La Vanguardia Newspaper	October 2014	Spain	General Audience	--	National
39	News	--	Teatro Naturale	December 2014	Italy	General Audience	--	National
40	News	AEGEAN	Various newspapers	October 2014	Turkey	General Audience	--	National

Section B (Confidential[2] or public: confidential information to be marked clearly)

Part B1

The applications for patents, trademarks, registered designs, etc. shall be listed according to the template B1 provided hereafter.

Not Applicable. The project has not generated any patents, trademarks or registered designs.

Template B1: List of applications for patents, trademarks, registered designs, etc.					
Type of IP Rights[3]	Confidential (Yes/No)	Foreseen embargo date dd/mm/yyyy	Application reference(s)	Subject or title of application	Applicant (s) (as on the application)

[2] Not to be confused with the "EU CONFIDENTIAL" classification for some security research projects.
[3] A drop down list allows choosing the type of IP rights: Patents, Trademarks, Registered designs, Utility models, Others.

Part B2

The exploitation of the foreground obtained by the project is the entire ENTOMATIC system. For the sake of simplicity, we have divided the system in individual components that have been integrated in the final system. All of them are summarized at the following table. A brief description of all components is provided below.

Type of Exploitable Foreground[4]	Description of exploitable foreground	Confidential YES/NO	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application[5]	Timetable, commercial or any other use	Patents or other IPR exploitation (licenses)	Owner & other beneficiary(s) involved
Commercial exploitation of R&D results	ENTOMATIC trap unit and gateway	Yes	N/A	Communication software and modifications designed	Agriculture Growing of oleaginous fruits	Mid 2019	NO	SME-AGs and SMEs of the consortium[6]
Commercial exploitation of R&D results	Bioacustic identification system for olive fruit flies	Yes	N/A	Detection sensor and recognition software	Agriculture Growing of oleaginous fruits	Mid 2019	NO	SME-AGs and SMEs of the consortium[5]
Commercial exploitation of R&D results	Olive fruit fly Spatial Decision Support system (SDSS)	Yes	N/A	Software designed for SDSS of olive fruit fly	Agriculture Growing of oleaginous fruits	Mid 2019	NO	SME-AGs and SMEs of the consortium[5]
Commercial exploitation of R&D results	Monitoring and management central cloud service	Yes	N/A	Data based and visualization system developed	Agriculture Growing of oleaginous fruits	Mid 2019	NO	SME-AGs and SMEs of the consortium[5]

Table 2-1. Access rights per partner

Partner	Access Rights for the Use of the Foreground
SMEAGs: INOLEO, AJAP AEGEAN	Owners of the Foreground
SMEs: PHYTO, BIOSYS, MTSYS	Licensees of Foreground
SMEs: NUT, KASIM	Users of Foreground

[4] A drop down list allows choosing the type of foreground: General advancement of knowledge, Commercial exploitation of R&D results, Exploitation of R&D results via standards, exploitation of results through EU policies, exploitation of results through (social) innovation.

[5] A drop down list allows choosing the type sector (NACE nomenclature) : http://ec.europa.eu/competition/mergers/cases/index/nace_all.html

[6] See the table Access Rights below

ENTOMATIC trap and gateway:

The focus of the activities in this work package is the development of concepts for the ENTOMATIC trap for the investigations and tests during the project and a final concept for the utilization at the end of the project. two new housings / cases were developed: The first electronic case, installed on top of the trap, contains all the control and pro- cessing electronics of the opto-electronic sensor system, the Zolertia Remote gateway and the batteries. This case is made of white Plexiglas® XT to protect the electronic components against direct sunlight. The second housing, mounted lateral at the first electronic case, contains the environmental sensors for the WSN. There are temperature, humidity and luminance sensors on the small PCB. The sensor housing has been manufactured by using 3D-printing technology with Dura- form ProX material. It is designed as a separate housing in order to be able to detect the measured data independently of the trap and allowing a better acquisition of these environmental magnitudes. Moreover, these traps are equipped with a radio module and the communication protocols and communication modules at the traps and the Gateway of the ENTOMATIC network are also part of the exploitable foreground. The proposed solution for each one of the communication layers existing in the WSN; namely, physical, medium access control (MAC), network, transport, and application, are art of the design achieved and also, the protocol proposed to establish GPRS communication between the gateway and the data receiver server could be protected. The ENTOMATIC network is composed by: **An acquisition network**, based on wireless sensors and used for the communication between the traps and the gateway. While the gateway is placed in a central position, a series of rings formed by scattered communication devices are deployed over the monitored area. **A cellular network** responsible of transmitting the gathered information from the gateway to the ENTOMATIC data receiver server. In this case, the single requirement for the gateway is being provided with cellular coverage

Bioacustic Identification system for olive fruit flies:

The device is designed so as to introduce the minimal disturbance into the internal space of a McPhail type trap. We build on traps that have been proven in time to be compatible with the life cycle of insects as we did not want a new design to jeopardize the effectiveness of the trap in attracting insects. Therefore, all electronics are gathered in a slim 2.75 cm thick add-on component attached from the outside on the top of the trap. Regarding the optical sensor, we use a lightguide as a receiver and an array of infrared LEDs with an attached diffuser as an emitter. A 1D linear array as well a 2D array of photodiodes proved insufficient for flying insects such as fruit flies, as their fast movement and relatively low wingbeat frequency did not leave enough traces for their efficient identification. Note that the photodiodes we use have 3.5 mm width and the gaps between them effected a variation in the intensity of received light as the fruit fly crossed the diode in less than 30 ms. The embedded microprocessor runs a constantly-looping program which processes the data captured by the optical sensor. The board is programmed in optimized C/C++. The MCU executes two basic procedures: The first one is interrupt-driven and stores the ADC data in a cyclic buffer of 16K samples, that is, the line-level output from the optoelectronic sensor is copied to a circular buffer. After triggering, the subsequent performed tasks are: a) Fast Fourier Transform (FFT) of the data chunk captured, b) decision on the identity of the insect based on analysing its wingbeat and c) storing the wingbeat snippet in the SD card and queuing information to be transmitted on a pre-scheduled basis to a server. If during the FFT process we have a new event this will be stored in the main 16K buffer and will be served when the MCU completes the previous event.

Olive fruit fly Spatial Decision Support System:

The SDSS can be considered in three parts: (i) The *B. oleae* spring onset model (ii) The control decision tree and (iii) Additional analysis on the ENTOMATIC Web app. The *B. oleae* spring onset model will serve as an early spring. It will run from the 1st January and constantly record the change in daily temperature in each of the orchards. orchards. When a critical, threshold temperature (TT) is reached the model calculates the growing degree days (GDD) for the orchard and gives an estimate of when the first peak of *B. oleae* could be expected What the model basically does is: it uses the link between spring flowering of the olive trees and the onset of the first generation of *B. oleae* [1] to provide early warning to the farmers. Air temperature was used as the main factor for estimating the change in olive phenology. This response of spring-flowering of the olive trees to temperature has been widely demonstrated [2-5]. A thermal growing degree day model was applied. Once the traps are on and the *B. oleae* population increases, the control decision tree (CDT) model will be run in parallel with the wireless sensor network (WSN) of traps that will provide data on air temperature (T), relative humidity (RH) and olive fruit fly count. Decision trees can help make rapid administrative decisions and make complex assessment more manageable. A decision tree provides objective guidelines without resolving the inherent uncertainty of the system. Each branch of a decision tree represents a particular pest management strategy whilst the nodes of each branch indicate the decision points. The leaf node is then the final decision to be taken by the orchard manager. In this case the leaf nodes represent recommendations for spraying of *B. oleae.*

Monitoring and Management central cloud service:

A software layer has been developed for receiving data from the traps in the field, and database architecture has been defined for the storage of data gathered. This module is able to read data received from the field and store it, after pre-processing it, in the system database. This module also incorporates the ability for the software to perform system checks, detect failures in nodes and sensors, troubleshooting guide, auto-calibration and to incorporate “plug and play” devices. A user friendly graphical interface has been developed for the user to interact with all the above described modules. The developed modules act as the model layer according to the Model-Controller-View standard architecture. In this task, the controller and the view layer of the cloud application have been developed.

3 EXPLOITATION OF PROJECT RESULTS

SME-AGs will form a strategic alliance and grant exploitation rights for PHYTO, BIOSYS and MTSYS to manufacture, integrate and commercialise the ENTOMATIC system. These companies will be in charge of the post-project development of ENTOMATIC and to secure the capital investment of €250,000 necessary for the time-to-market phase. To assist this process, specific government programmes and sources of finance to assist commercialisation of research results have been identified by the SME-AGs and SMEs: SME Instrument Programme, TTA- Technology Transfer Accelerator (TTA) from the EIF-European Investment Fund, JEREMIE- Joint European Resources for Micro to Medium Enterprises, RSFF-Risk Sharing Finance Facility, and PRAXE- Programme for the Exploitation of Research Results.

The company PHYTOPHYL is a factory of insect traps, and will be responsible for the manufacture of the ENTOMATIC trap as well as the continuous updates of the hardware and firmware. The company MTSYSTEMS is an expert in communications and sensors for agriculture, and they will be responsible for implementing the communication modules and gateways in the traps as well as implementing the weather sensors in the gateway. They will also be responsible for continuous developments of the Wireless Sensor Network. The company BIOSYSTEMES is an experienced distributor of IPM solutions in the Olive sector and will be the responsible for drawing and implementing the marketing plan and the commercial routes that will support the sales of ENTOMATIC. Furthermore, the three SMEs will be assisted by the SME-AG members KASIM and NUTESCA in distribution and the market push efforts. KASIM and NUTESCA will receive free ENTOMATIC systems to cover the olive orchards they manage.

The SME-AGs will perform an important role in exploitation, as they will assist the ENTOMATIC strategic alliance in market pull actions in Europe, benefiting from 10% objective oriented royalties on all sales. Apart from the financial benefit, in form of royalties, they will also benefit from an improved image among their members and possibly gain new associates.
PHYTO, BIOSYS and MTSYS have agreed to act jointly within the strategic alliance to boost their commercialization actions, so as to avoid mutual competition and obtain a better geographical coverage. BIOSYS and MTSYS, supported by INOLEO and NUT, will promote the commercialization in Western Europe and Northern Africa, and PHYTO, supported by AJAP, AEGEAN and KASIM, in Eastern Europe and Middle-East.

3.1 MARKET PLAN

The market volume for the ENTOMATIC system is given by the total area of EU Olive orchards: 4,3 million hectares. The plan is to sell complete systems with a commercial price of €1.400, consisting of 8 traps (€150) plus 1 gateway (€160), ideal for 2 hectares, which corresponds to the average holding in the EU.

Manufacturing costs are expected to drop with higher volume productions and the decrease of off-the-shelf component costs. The customer may also have to pay for a GPRS subscription, but this value has been accounted in the cost. It can be estimated that that the total market volume for the complete system is 2.1 million systems (21 million traps and 2.1 million gateways). A 0.01% penetration of the total market after the first year of operation is expected, reaching 0.50% after the end of the fifth year.

The following table summarises the expected benefits of the ENTOMATIC strategic alliance, based on conservative estimates.

Table 3-1. Expected benefits

Year	0	1	2	3	4	5
Total market potential- Olive Orchard area (x 1000 ha)		4.376	4.354	4.332	4.311	4.289
Ratio of effective market potential		97%	97%	97%	97%	97%
Effective market potential Olive Orchard area (x 1000 ha)		4.245	4.224	4.202	4.181	4.161
Total market for 2 ha start-up system (x 1000)		2.111	2.112	2.102	2.091	2.080
Ratio of market penetration		0,01%	0,05%	0,15%	0,30%	0,50%
Projected number of new customer orchards		**424**	**1.687**	**4.192**	**6.241**	**8.258**
Sales of ENTOMATIC system in the EU(k€)		580	2.360	5870	8.737	11.561
Maintenance contracts (k€)		34	169	538	1.240	2.642
Income from sales out of EU (k€)		34	216	805	1.498	2.643
TOTAL sales (k€)		**747**	**3.085**	**8.050**	**12.723**	**18.498**
Capital financing (k€)	**250**					
Capital costs- interests (k€)		10	8	6	4	2
Amortization of Initial Investment (k€)		50	50	50	50	50
Personnel costs (k€)		240	450	650	1.050	1.500
Production, distribution and R&D (k€)		252	999	2.484	3.698	4.894
Marketing (k€)		50	100	150	200	300
Overheads (k€)		103	426	1.111	1.756	2.553
Total Costs (k€)		**705**	**2.034**	**4.451**	**6.758**	**9.298**
Annual net profit before taxes (k€)		**-57**	**711**	**2.762**	**4.717**	**7.548**
EBITDA (k€)		**3**	**769**	**2.818**	**4.771**	**7.600**
NPV (k€)	**-250**	**-247**	**365**	**2.371**	**5.403**	**9.686**
Return On Investment (ROI)		**-0,35**	**0,18**	**0,53**	**0,80**	**1,04**

3.2 ECONOMIC IMPACT[7]

As the SME-AGs will be the responsible of the distribution of the ENTOMATIC a first approach on an individual projection is presented below. This projection is done in a 5 year time-frame.

Taking into account the area of orchards covered by the different SME-AGs the economic impact of the ENTOMATIC system, in terms of "Net increase of annual income" (NIAI), "Earnings Before Interest, Taxes, Depreciation, and Amortization" (EBITDA), "Net Profit Value" (NPV), and Return on Investment (ROI). As an example, the estimated 5-year economic impact on an SME-AG, below is presented the conservative benefits that the SME-AG INOLEO will obtain. The assumptions considered are the following:

1. The SME members of INOLEO will cover a total number of 1100 hectares of their orchards with the ENTOMATIC system. The capital investment at cost price, will be of 616 thousand Euros with a 4% cost of capital. Maintenance, calibration and upgrade contracts are free of cost during the first two years.
2. As field practices continuously improve with the use of ENTOMATIC, the annual income increases with a steady growth, until it reaches the expected 505€/ha. For the calculation of annual income, the savings gained through ENTOMATIC in trapping implementation costs (trap inspections and materials) were not accounted for as a major part of these correspond to savings in time for producers.

Table 3-2. 5-year economic impact of ENTOMATIC in the olive orchars under the SME-AG INOLEO

Year		1	2	3	4	5
Olive orchards implementing ENTOMATIC (area-ha)	**1100**					
Capital Investment (k€) in ENTOMATIC	**527,0**					
Cost Of Capital (%)	**4,00**					
INCREASE IN ANNUAL INCOME (k€)		**333,3**	**388,9**	**444,4**	**500,0**	**555,5**
COSTS (k€)						
Maintenance/Calibration/Upgrades contract (free during first two years)		0,0	0,0	55,0	55,0	55,0
Amortization of Capital Investment		105,4	105,4	105,4	105,4	105,4
Capital Costs (interests)		24,6	19,7	14,8	9,9	4,9
Total Costs		**130**	**125,1**	**175,2**	**170,3**	**165,3**
Net increase of annual income (k€)		203,3	263,8	269,2	329,7	390,2
EBITDA[8] (k€)		333,3	388,9	389,4	445	500,5
NPV[9] (k€)	**-527**	**-193,7**	**195,2**	**584,6**	**1029,6**	**1530,1**
ROI[10]		**-0,47**	**0,12**	**0,75**	**1,3**	**2,06**

Applying the same assumptions and calculation for the case of INOLEO, the following table shows the

[7] This estimation is based on the information extracted from [6-12]
[8] Earnings Before Interest, Taxes, Depreciation and Amortization
[9] Net Present Value
[10] Return On Investment

summary of the entire SME-AGs of the consortium.

Table 3-3. NIAI, EBITDA and ROI after 5 years implementing the ENTOMATIC system in the SME-AGs

SME-AG	NIAI (k€)	EBITDA (k€)	NPV (k€)	ROI
INOLEO (1100 ha)	390,2	500,5	1530,1	2,06
AJAP (1300 ha)	425,8	601,5	1534,1	2,07
AEGEAN (900 ha)	308,3	399,5	1425,3	1,95

It is shown in the analysis that the commercialization of the ENTOMATIC system is advantageous for all the members. The global Net Profit Value expected is around 4,5M€ after 5 years. But to these benefits we have to take into account the benefits coming from the royalties on sales. Not only the SME-AGs will benefit from those royalties also the SMEs of the consortium will benefit from them. The benefits expected for each beneficiary has been estimated and are shown in the following table.

Table 3-4. Total accumulated benefits (k€) expected for each of the consortium beneficiaries obtained through the use and exploitation foreground.

	INOLEO	AJAP	AEGEAN	KASIM	NUT	PHYTO	BIOSYS	MTSYS
Sales and royalties of ENTOMATIC	364,4	364,4	364,4	109,3	242,9	4.815,5	2.140,2	3.745,2
Extra income for using ENTOMATIC	2.777,5	3.282,5	2.272,5	151,5	25,3	--	--	--
TOTAL	3.141,9	3.646,9	2.636,9	260,8	268,2	4.815,5	2.140,2	3.745,2
ROI for own contribution to project & subcontracting of RTDs	10	12	9	1	1	15	5	8

ROI for EC contribution= 10

3.3 TIME-TO-MARKET

The results obtained in this 3-year project have become a pre-commercial prototype as expected. The necessary time to obtain a fully commercial solution is estimated to be of 18 to 20 months. This period will be necessary to establish the strategic alliance between SME-AGs and SMEs of the consortium, and to establish the manufacturing process for the system. Furthermore, apart from the final technical developments and commercial designs that the alliance will carry at the end of the project, the alliance will invest in defining the corresponding marketing and demonstration activities that will give the final impulse to reach the market.

According to the Technology Readiness Levels (TRL) defined at the Horizon 2020[11], we can consider a TRL7 for the ENTOMATIC system. This level is defined as: "system prototype demonstration in operational environment". The ENTOMATIC system has been tested through different manufactured prototypes in different orchards managed by our partners. The hardware and the software designed has been tested in an operational environment, as the definition said. Moreover, more tests in order to achieve a TRL8 should be performed. For that reason, the alliance considers a necessary maturity of the product, in order to fulfil the requirements for a TRL9, and all these needs will be achieved, as estimated, in 18 months.

[11] https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf

4 CONCLUSIONS

The estimated market at the different countries represented in the consortium is 1.710.000 tones of olive oil that represents, approximately, the 67% of the world production. Moreover, the hectares devoted to the olive production, mainly at the Mediterranean basin, has increased during the last campaigns. This expansion is very important for the sector for two fundamental reasons: **The first** is that it shows that it is an economically dynamic sector, and **the second**, but more important, is that this growth implies an increase in demand, since the consumption of olive oil and table olives is much higher in those producing countries if they are compared with countries that are exclusively consumers.

The ENTOMATIC system is intended to provide rapid benefits to the ENTOMATIC alliance of the SME-AGs and SMEs of the consortium. The increasing market of the olive production will take advantage of this new system. In terms of economic impact, and, with an initial cost of investment of 600 thousand euros and a 4% of cost capital, it is expected a return of the investment at the beginning of the second year of the commercialization of the ENTOMATIC product. Moreover, the royalties on selling the solution will also benefit, not only the SMEs, also the SME-AGs will get a 10% from them.

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