Deliverable 1.3: Industry solutions SETA material

Accelerating Innovative practices for Spraying Equipment, Training and Advising in European agriculture.

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Abstract

INNOSETA project aims to set-up a self-sustainable Thematic Network on Spraying Equipment, Training and Advising designed for the effective exchange between researchers, industry, extension services and farming community.

The final goal of WP1 of the project is to generate the INNOSETA repository, a free database available for farmers, contractors and suppliers regarding new technologies and techniques for PPP application. For the realization of this database information about latest technologies, called SETAs (Spraying, Equipment, Training and Advising), have been collected in the form of:

- Articles
- Projects
- Training Material
- Industry Solutions

The aim of this document is to illustrate the process adopted for collecting Industry Solutions, in the wake of the selection guide provided in Deliverable 1.1.

This report is articulated in four chapters: first three chapters are referred to phases of the process and then the final chapter illustrates the results achieved for the launch of the repository.

Chapter 1 (Phase 1) illustrates the identification and research of Industry Solutions, Chapter 2 (Phase 2) describes the data gathering process and Chapter 3 (Phase 3) details the screening criteria and categorization steps. Finally, the last chapter summarizes the results achieved at the end of these 3 phases: out of 289 industry solutions collected, 188 were validated as SETAs, where the majority are innovative sprayers and their components. The end-goal was to have a solid and complete data collection in order to launch the first phase of the repository, serving as a guideline for further entry submissions by project partners and manufacturers, whom interest should be raised.

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Introduction

Context

In the modern agriculture scenario, European farmers have to face major challenges: given the effects of climate change and the production rates that are needed, crop systems need to be efficient in terms of productivity and environmental sustainability, also in order to comply with recent European regulations that foresee the drastic reduction in use of PPPs (**Plant protection products**). To achieve this goal, the trend is to adopt **Precision Agriculture (PA), a modern farming management concept** which avails itself of technologies and practices that allow to reduce the use of PPPs and shifts the farming system towards more sustainable production. In particular, for reduction and optimization of application of PPPs, PA technologies and practices aim at:

- Protecting air and human health by exposure through the reduction of spraying drift during application and operations for preparation of the mix and filling of the tank
- Protecting water bodies and soil by preventing Point Source Pollution through proper cleaning of sprayers and remnants disposal

The widespread adoption of PA strongly depends on the knowledge held by stakeholders: farmers, advisors, contractors; this is withheld by the **gap** existing between the results of research (in terms of technology advancement and best practices, both achieved by public institutions and private companies) and their efficient **communication and adoption** on behalf of stakeholders.

The creation of the **INNOSETA repository** aims to close this knowledge gap and enhance the sustainability of European farming: it is a collection **of information about the latest technologies** available for application in spraying of PPPs. By making it available for end users, there is a dramatically increased chance that such advertised technologies and practices can be adopted in European small-medium farming systems.

Materials and Methods

Information to be gathered and transmitted to stakeholders, in order to provide them with the latest technologies and best practices to **reduce and optimize the application of PPPs in selected cultural systems,** has been pin-pointed as SETA: Spraying, Equipment, Training and Advising. This comprehends:

- Papers (peer reviewed and technical articles)
- Projects (from European databases and other reliable sources)
- Industry Solutions (spraying machinery and relative components developed by local and international companies)

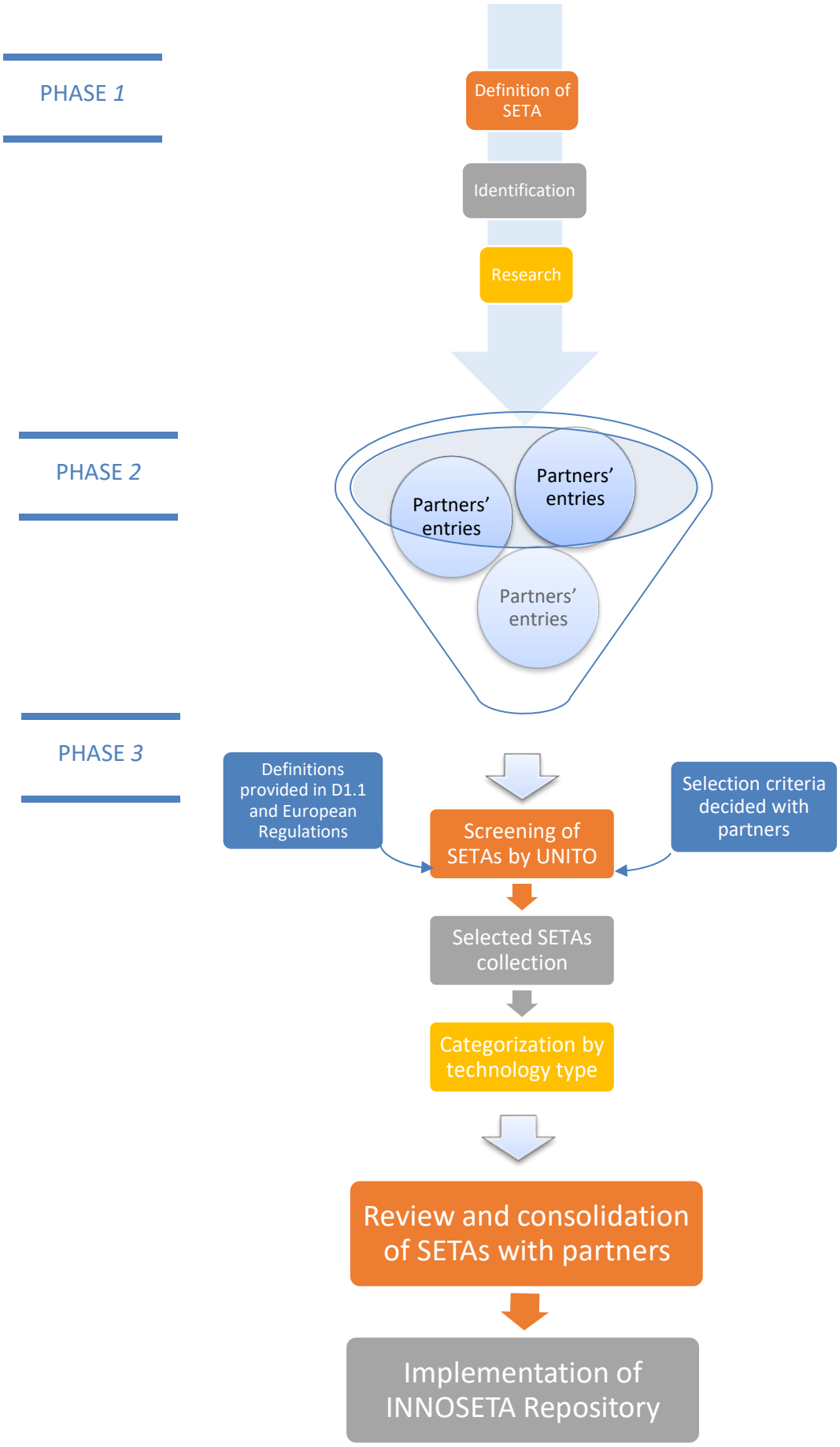


Figure 1 Phases for gathering of SETAs

In Deliverable 1.1., the methodology for searching and gathering of said SETAs was defined and divided in 3 Phases:

- Phase 1: Initial identification
- Phase 2: Survey
- Phase 3: Data Aggregation

In this deliverable it is detailed how these three phases have been carried out for **industry solutions** and the results therefore obtained.

1 Phase 1: Initial Identification

1.1 Step 1: Research of SETAs

The first step consisted in the identification of SETAs, where project partners were asked to look for **industry solutions** developed by local and international companies, which allow an optimized application of PPPs and that are preferably of innovative nature. The following were considered as industry solutions:

- **Spraying machinery and their components**
- **Software and hardware applied in sprayers and spraying application techniques**

As a guideline for this research, a series of **keywords** was provided as illustrated in *Figure 1*.

This set of keywords was set as non-restrictive and any appropriate keyword relative to reduction of use of PPPs was allowed to be used during the research. Furthermore, as planned in D1.1. a list of manufacturers for every country partner involved in the project was provided by CEMA (partner). (See Annex 2)

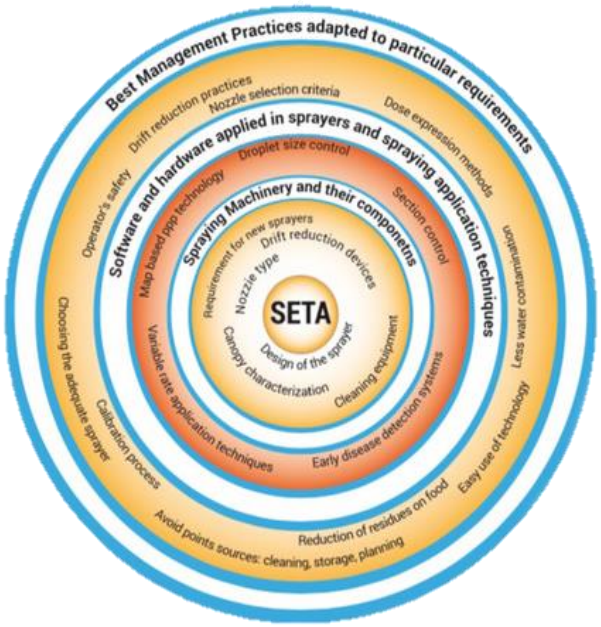


Figure 2. Keywords used as reference to look for SETAs.

Sources used for the research were:

- **manufacturers' websites** from CEMA list and each project partner's personal knowledge
- magazines and official websites concerning **national and international faires on agricultural machinery** awards and mentions, (some examples are illustrated in *Table 1.*)

Table 1 Some examples of national (Italian) and International faires for agricultural machinery and relative websites that have been used as reference to look for innovations in industry products (new spraying machinery and relative components).

EIMA	https://www.eima.it/
SIMA	https://en.simaonline.com/
AGRILEVANTE	https://www.agrilevante.eu/
MACFRUIT,	https://www.macfrut.com/
AGRITECHNICA Hannover	https://www.agritechnica.com/en/
ENOVITIS	http://www.enovitisincampo.it/
INTERPOMA	http://www.fierabolzano.it/interpoma/
FIMA	https://www.feriazaragoza.es/fima-agricola-2020

Information about previous editions of said faires were considered up to 2010 wherever available.

2 Phase 2: Survey

2.1 Method

In order to have a comprehensive, uniform and efficient collection of SETAs, G-forms were adopted as information gathering system. G-forms are a survey form that has let the different project partners involved in WP1 register the SETA of choice (whether it was an industry product or another type of SETA) through a series of options; these make possible to specify fundamental information and details about the SETA of choice. An example of the form is illustrated in Figure 3.

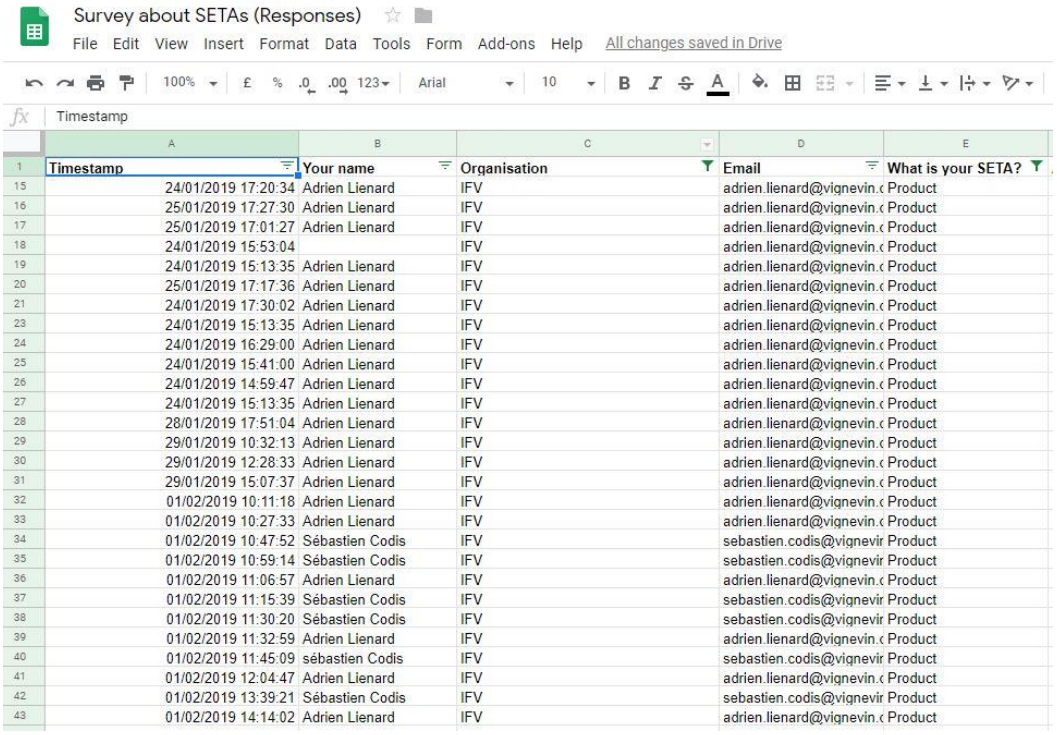
All partners logged in with the same google account "**innoseta.proj@gmail.com** ", so that all entries could be retrievable in a final excel file in the Google Drive section of the account.

In these forms fundamental information such as Title or Acronym of the product were required, a link to a reference web page, specifications about the type of technology examined, the TRL (Technology Readiness Level) of the product, etc.

2.2 Issues and troubleshooting

During the first steps of information gathering, some issues were raised among partners about the **kind of technology** eligible as valid industry solutions to be looking for. Therefore, this definition was further discussed in order to facilitate data gathering, and as a common decision a valid industrial solution was further defined as:

- **Any item that could be directly applied to spraying machinery:**
  - **E.g. closed transfer systems, cameras for spectral imaging, UV sensors, movement sensors, nozzles, nozzle accessories**
- **Any item useful for its functioning :**
  - **E.g. Boom height controllers, computers for filling control of the tank, automations**
- **Any item useful for the improvement to the precision of spraying :**
  - **E.g. prescription map obtaining, apps for monitoring of activities, automations for precise applications, unmanned vehicles**



Survey about SETAs (Responses)

File Edit View Insert Format Data Tools Form Add-ons Help All changes saved in Drive

Timestamp

	A	B	C	D	E
1	Timestamp	Your name	Organisation	Email	What is your SETA?
15	24/01/2019 17:20:34	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
16	25/01/2019 17:27:30	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
17	25/01/2019 17:01:27	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
18	24/01/2019 15:53:04		IFV	adrien.lienard@vignevin.(	Product
19	24/01/2019 15:13:35	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
20	25/01/2019 17:17:36	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
21	24/01/2019 17:30:02	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
23	24/01/2019 15:13:35	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
24	24/01/2019 16:29:00	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
25	24/01/2019 15:41:00	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
26	24/01/2019 14:59:47	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
27	24/01/2019 15:13:35	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
28	28/01/2019 17:51:04	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
29	29/01/2019 10:32:13	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
30	29/01/2019 12:28:33	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
31	29/01/2019 15:07:37	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
32	01/02/2019 10:11:18	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
33	01/02/2019 10:27:33	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
34	01/02/2019 10:47:52	Sébastien Codis	IFV	sebastien.codis@vignevir	Product
35	01/02/2019 10:59:14	Sébastien Codis	IFV	sebastien.codis@vignevir	Product
36	01/02/2019 11:06:57	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
37	01/02/2019 11:15:39	Sébastien Codis	IFV	sebastien.codis@vignevir	Product
38	01/02/2019 11:30:20	Sébastien Codis	IFV	sebastien.codis@vignevir	Product
39	01/02/2019 11:32:59	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
40	01/02/2019 11:45:09	sébastien Codis	IFV	sebastien.codis@vignevir	Product
41	01/02/2019 12:04:47	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product
42	01/02/2019 13:39:21	Sébastien Codis	IFV	sebastien.codis@vignevir	Product
43	01/02/2019 14:14:02	Adrien Lienard	IFV	adrien.lienard@vignevin.(	Product

Figure 3 First five columns that appear in the final excel that collects all the information gathered via g-forms

The other issue encountered was that innovations **may not be advertised** on websites and manufacturers could show recalcitrance to provide information about their latest products upon direct inquiry, to avoid industrial competition and copying. It was further stressed that in order to be as direct as possible to the end users, the **link to the industry product was preferably addressed to the original manufacturer** of the product and not to any eventual reseller and/or dealer.

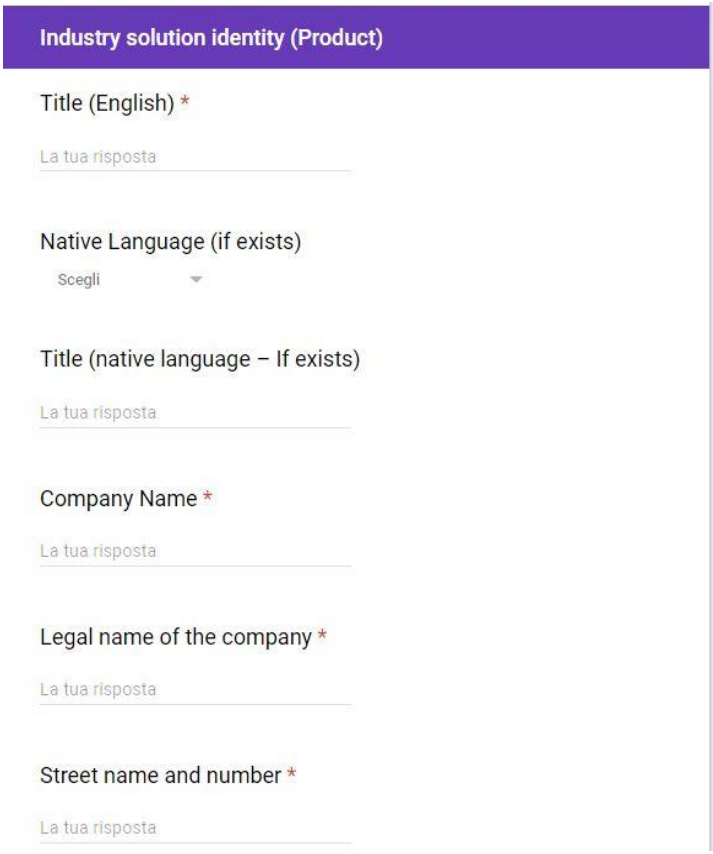


Figure 4 Snapshot of the first page of G-Form for Industry solutions registration. Detailed information about fields available in g-forms are described in Deliverable 1.1.

3 Phase 3: Screening

3.1 Step 1: First aggregation of data

Screening of Industry Solutions was conducted by UNITO team. All partners' entries were collected from the common Google account (shown in *Figure 2*).

A first rough aggregation and screening was conducted: entries were first aggregated using the information provided in the "Type of Technology" option. Then, every website filled in the forms was visited to verify its correctness and to determine the validity of the technology along the lines of the definition given in phase 2, excluding a first group of non-pertinent entries to the INNOSETA project aim. In this phase the exclusion concerned those industry products out of the spraying field such as, for example, hoeing machinery, mechanical/thermic weeding machinery.

3.2 Step 2: Determination of criteria

After this first data aggregation, the screening process proceeded with the definition of screening criteria, decided in common agreement among partners. The criteria served as "filter" to determine what type of industry solutions could be selected as valid SETAs; they are detailed respectively in Table 2.

Table 2 Detailed description of criteria used for selecting valid SETAs

Criterion	Description
1. The technology must be **directly applicable or relative t**o the spraying machine	Any component, sensor or integrated system (sensor + actuator), tracking systems, monitoring systems and control units.
2.The technology or technique of application of PPPs should be preferably **innovative**	Completely new technologies are quite rare, declinations and small innovations that provide an advantage in terms of sustainability and efficacy of PPP application were considered valid
3.Technologies should be **environmental sustainability-oriented**	The aim of the technology must explicitly be an improvement of the application of PPP in order to make the agricultural operation more sustainable that in previous/conventional ways. These type of technologies were considered more relevant as the main goal is improving the sustainability
4.New technologies even though not particularly innovative	Some technologies have been developed over the course of the last decade. As aforementioned, this is not directly linked to a proper information and adoption by farmers. The **diffusion** of information about said technologies amongst farmers was hence deemed necessary. This complies with the goal of closing the gap between research and farmers.
5.Prototypes and new technology designs	Some companies advertise their technology advancements in the form of prototypes or designs. These type of entries were kept whether the innovation was quite recent (material published up to 5 years ago). Otherwise it is probable that the prototype/design was not carried out to commercialization.

Therefore, screening criteria were applied, leading to the exclusion of a certain number of industry products that were not considerable as SETAs. Their description and motivation of exclusion is justified in *Table 3.*

These products were excluded considering the point of view of INNOSETA repository's end users' needs and the goal that it has to fulfill: innovations must be specific, or the risk was to generate a database which lies outside of the specific field of **application of PPPs,** becoming way too generic. A omni -comprehensive repository would be too vast, losing in user-friendliness, specificity and coherence.

In compliance to what was described for Phase 3 in D1.1, **duplicates, malicious and incomplete SETAs were removed**. "Incomplete" and "malicious" SETAs are considered those which lack an exhaustive description in the form of text, video or explicative brochure and most of all those with a lack of specific or broken link. Partners were solicited to review and eventually complete said entries in order to avoid underrepresentation of potential SETAs. Moreover, the completeness of screened products was ensured by integrating images where missing and providing a short, clear description of the technology. This was provided by partners as descriptions on manufacturers websites can be too technical or too general and publicity-oriented, while the goal is to make sure that the end user can understand the functioning and usefulness of the technology at first glance.

Table 3 This table explains in detail type of industry solutions that have been excluded and why they were not considered valid.

Type of industry products excluded	Motivation
Guidance systems and mapping systems	can be used for a wide variety of field operations and are not exclusive for PPP application. For example, generic ISOBUS systems and field mapping for vigor and disease detection via satellite and/or drone.
Drones for application of PPP	in compliance with the ban implemented in article 9 of Directive 2009/128/EC of the European Parliament that **restricts** any type of aerial application of PPPs.
Operative technologies	e.g. machine movement facilitation, headland manoeuvres
Prototypes and new technology designs	Part of projects concluded five or more years ago Ideas proposed five or more years ago No results/follow-up/final product retrievable online

3.3 Step 2: Data categorization

The effort made was to divide SETAs in a **harmonized system of categories**, **groups and subgroups**,(later illustrated in Table 5 and in Figure 8) that could be useful to facilitate the organization of workshops part of WP3. During the workshops SETAs will be presented for four crop systems**: Field Crops, Vineyards, Orchards and Greenhouse & Horticolture**. For each crop system the workshop will be organized in four thematic groups (described in *Table 4).* The categorization system emerged from the screening process itself and from the keywords illustrated in *Figure 1* that were used as reference. Indeed, this categorization ensues the technical nature of the industry product considered.

Table 4. This table describes the four thematic groups that will be used in workshops in the frame of WP3. Each title, description and reference example have been deliberated between partners and used as reference to organize SETAs that will be presented in that context.

Thematic group	Description	Example
1: Optimization of PPP distribution	This first thematic group includes all SETAs than can be used for a better precision of spraying according to the "needs". It includes the choice and the application of the right dose at the right place at the right time	SETA for precise spray application on the target as for example Variable Rate Application systems, control units reading prescription maps, control units enabling to differentiate the spray application along the boom or even nozzle by nozzle according to target needs, air-assisted sprayers equipped with distribution elements adaptable to target shape and density, sensors for mapping the crop
2: Prevention of PPP spray drift	This second thematic group includes all the SETA than can be used for drift reduction	air induction nozzles, boom stabilization systems, tunnel sprayers in vineyard and orchard, air assistance sprayers in field crops, GPS based automated switching on/off of boom sections to avoid spray overlap in the field and spraying out off the field boundaries, deflectors for air flow direction adjustment in orchards.
3: Correct filling and cleaning of sprayers - prevention of contamination	This third thematic group includes all SETAs than can be used during the filling of the sprayer (both for mitigation of environmental risks or to be more precise on the dose and volume that are prepared). It also includes SETA that aims to facilitate the cleaning of the	close transfer systems, filling and cleaning device and personal protective equipment for operators' safety

	sprayer in the field (inner part and outer parts), and to collect the remnants. Note that the systems used to treat the remnants at farmyard level are not included in the project. The terms "prevention of contamination" deals with all the risks except drift (point sources contamination, operator exposure risks	
4: New technologies	This fourth thematic group includes all the new technologies that are developed to help growers for application	All the SETA dealing with direct injection systems, robot sprayers and UAV, and all devices enabling to monitor and record the spraying parameters and sprayer location in the field.

Categories determined were the following: **Components, Sensors, Integrated Systems, Support Systems and Innovative Sprayers.** What has been included in these macrocategories and what groups and subgroups they include is described in *Table 5.*

Table 5. This table displays the system of categorization adopted as guideline to aggregate similar SETAs that have been screened and approved. Each description corresponds to the closer category, group or subgroup on corresponding row.

CATEGORY	GROUP	SUBGROUP	DESCRIPTION
Components			Generally any mechanical/electronic component of the spraying machine.
	Nozzles		Anti-drift nozzles, caps and accessories that facilitate and /or optimize the PPP application
	Nozzles Accessories		
	Valves		With sensor guided or automatic shut-off
	Fans		New types of distribution fans
	Sprayer Booms		Booms with innovative design
	Cleaning Systems		Cleaning nozzles and innovative systems to clean the tank or the exterior of the sprayer
	Filling Systems :		
		Closed transfer systems	Components that allow to pour the PPP in the mixing tank without dispersing the product, protecting the operator and the environment from contamination
		Direct Injection	Direct injection of PPP in the mixing tank
		Filling level monitoring	Allows to easily check the filling level of the tank and avoid spillage/overfilling

		Pre mixers	Mixer tanks directly applicable to sprayers that allow to prepare the mix directly onto the machine, without transporting it from a prep bench. This reduces the risk of spillage and exposure of operators and contamination of the environment.
Sensors			Sensors able to detect relevant information to optimize PPP application
	Canopy Sensing		Sensors that are capable to scan and perceive the dimension of the canopy and its density. This is essential for the dose/volume expression of PPPs and avoid over/under treatment.
	Target detection :		--
		Weed detection	Ultrasound or LIDAR imaging systems that accurately detect weeds and or signs and symptoms of diseases in order to determine a precise target to be treated
		Disease detection	
Integrated Systems			Systems that integrate a sensor component that guides a mechanical actuator.
	Boom height control		Adjusts the position of the boom following the characteristics of the ground detected by a sensor. This allows a more uniform application.
	Control Units		These include automation devices for automated spraying, computers that allow adjustments of the machine
	Nozzle Control :		
		Variable rate/PWM	Recent technology (2016) that employs the duty cycle of a pulsing solenoid instead of spray pressure to control nozzle output. It ensures constant droplet size, ability to change pressure with instant response and doesn't drip.
		On/Off section or single nozzle	Control of single nozzles allows to more precisely apply PPPs where needed. For example, this technology can be combined with Weed detection systems to treat only unwanted weeds.
		GPS based nozzle control	A GPS system detects where the PPP has to be applied, following prescription maps or operation data to avoid overlaps with already treated areas. It controls the nozzle activity

Support systems			Systems that support the farmer in the application process, to reduce stress of decision making and operations.
	Guidance :		
		Automated guidance	Guidance of machinery automated following prescription map / pre-determined path
		Assisted Steering	Steering is made easier thanks to an automated system which reduces the stress for the operator
	DSS		Decision support System, might be a online page, software or an app for smartphones and/or tablets which help the farmer decide when/how much PPP to apply.
	Monitoring		Monitoring operations is important to avoid overlapping of treatments
		Single/Multiple operation monitoring	One or more operations are monitored and registered.
		Sprayer position via GPS	GPS system that allows to know where the machinery is located / has applied PPP
		Nozzle activity monitoring	Sensors that detect the activity and adjustment of the sprayer and its parts (e.g. nozzle pressure, eventual clogging, speed)
	Mapping/recording		
		Field operations (automated data collection)	Softwares and apps for smartphones and/or tablets that keep track of treatments (area, date and time, product used), products in stock.
		Field mapping (Drones/Satellite)	Prescription maps obtained by Satellite or Drone imaging systems
Personal Protective Equipment			Any item designed to protect operators from contamination of PPPs
Innovative sprayers			Spraying machinery with innovative elements
	Sprayers for field crops		In these subgroups were included sprayers that carry an innovative element (component or sensor) but were presented as a whole new innovative machine by the manufacturer. They were divided by crop type of use.
	Sprayers for arboreal crops		
	Sprayers for greenhouses		

3.4 Issues and troubleshooting

A certain number of issues emerged from the screening process:

- **Mentioning companies and conflict of interest**. As mentioned in §1.2., original manufacturer's reference and websites were privileged. Though this information is not always available, so in some cases it has been necessary to display the website/name of a reseller of the industrial solution.
- **Declinations of the same product**: innovations are quite hard to find. A common case is that an innovation has been addressed by different companies with a slightly different approach. So the scenario presents a series of declinations of the same technology, which we have decided to include as much as possible.
- **Lack of thorough description, specifications and clarifications on the functioning of the industrial solution**. Even on manufacturers' sites, industry products' webpages are often incomplete: an explanation about their functioning and/or technical specifications can be lacking. Or, sometimes we encountered "Additional information" such as explanatory videos and/or brochures but not an official webpage. Moreover, technical specifications and an English description are absolutely necessary.
- **"Deciphering" the technology**. In some cases, as specified above, the lack of information made difficult to categorize properly the SETA of interest. In some other, despite the sufficient information, categorizing the industry solution was difficult to assess because of the ambiguity of its nature, that fell in more than one category.

3.5 Results

A total of 188 Industry Solutions was selected: in Figure 5 it is illustrated the country of origin of the industry solutions before and after the screening process, where we can observe that about **65%** of the entries originally registered. In Figure 6 it is shown a general assessment of the quantity of SETAs retained after screening, where projects are the SETA saw the most excluded entries (see Deliverable 1.2.). Figure 8 shows in detail how many SETAs have been collected for type of technology without country distinction: it shows that Sprayers (69 SETAs) and Components (60 SETAs) might be, by far, the technologies most available on the market that present innovative elements.

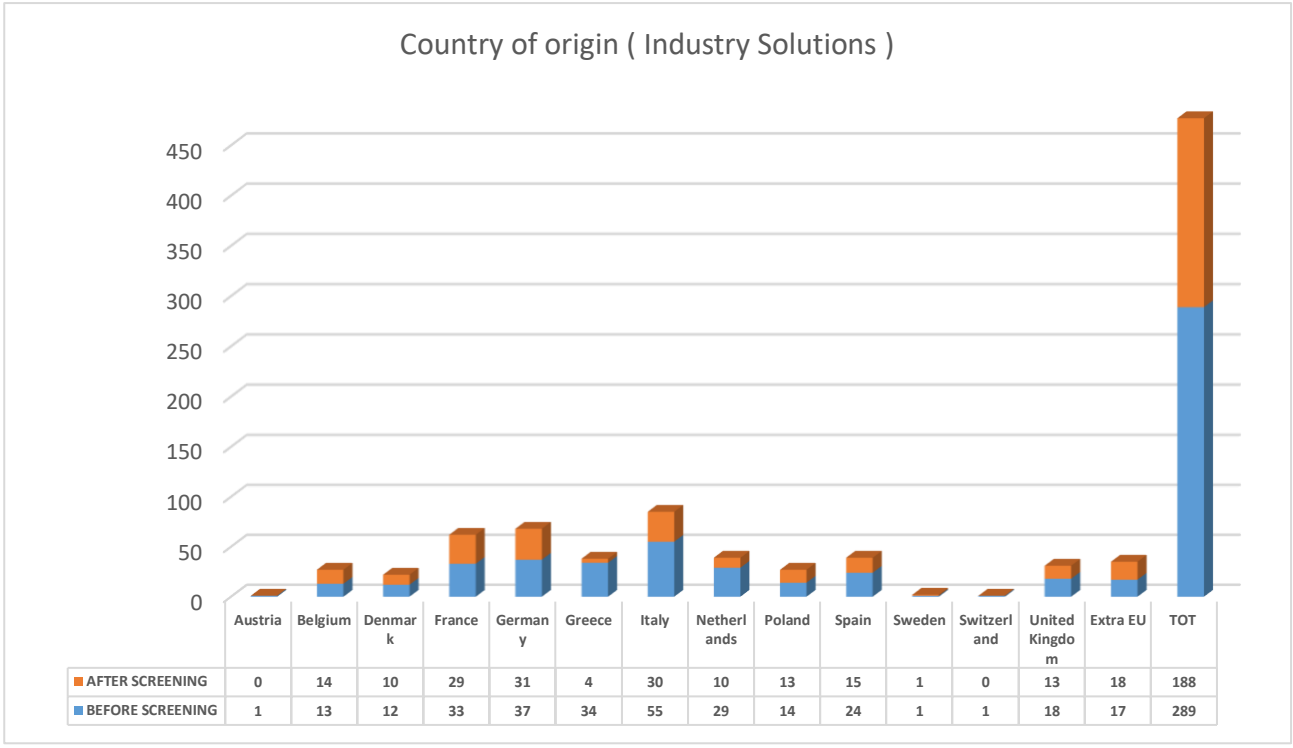
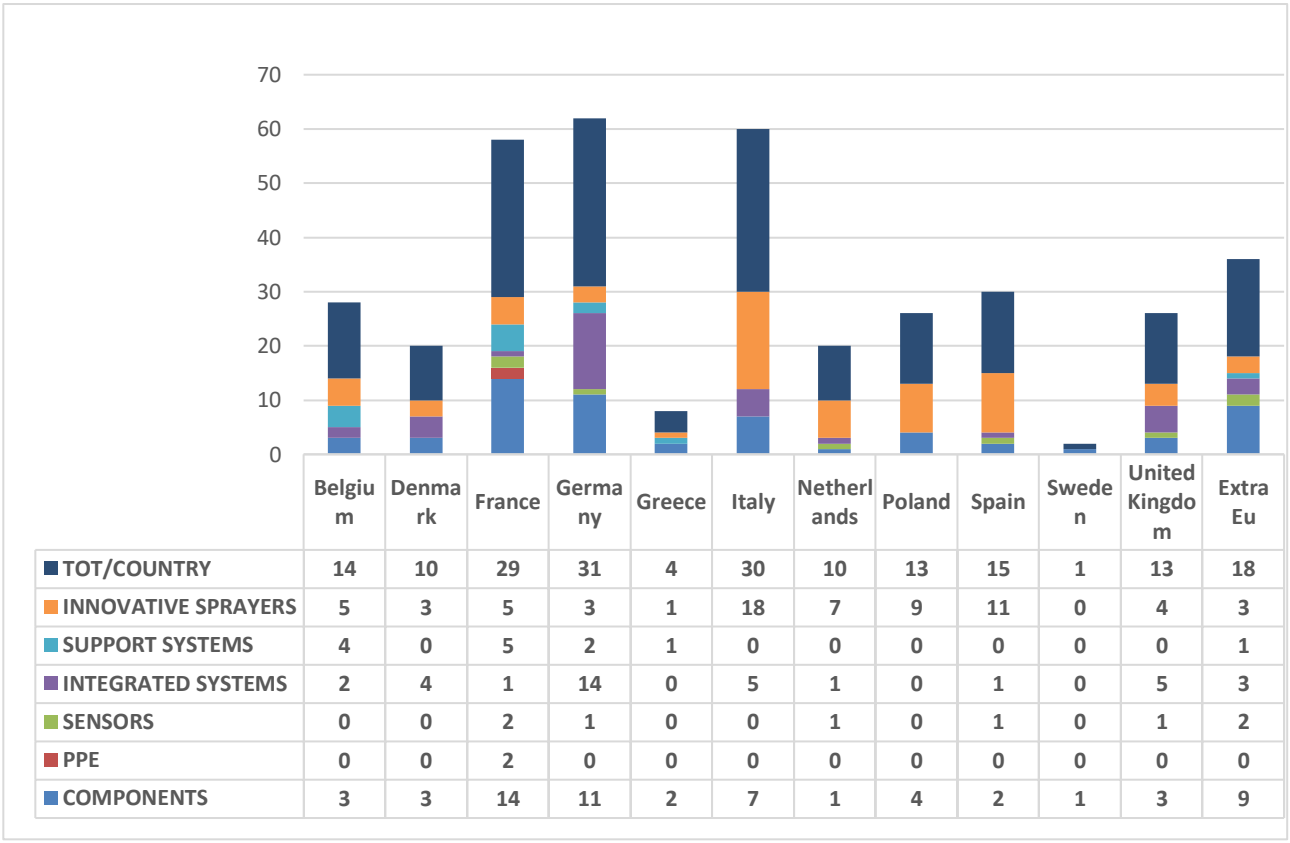


*Figure 5 Country of origin of industry solutions, meaning the location of its manufacturer. Entries are shown before screening process in **blue** and after the screening process in **orange**.*



	Belgium	Denmark	France	Germany	Greece	Italy	Netherlands	Poland	Spain	Sweden	United Kingdom	Extra Eu
TOT/COUNTRY	14	10	29	31	4	30	10	13	15	1	13	18
INNOVATIVE SPRAYERS	5	3	5	3	1	18	7	9	11	0	4	3
SUPPORT SYSTEMS	4	0	5	2	1	0	0	0	0	0	0	1
INTEGRATED SYSTEMS	2	4	1	14	0	5	1	0	1	0	5	3
SENSORS	0	0	2	1	0	0	1	0	1	0	1	2
PPE	0	0	2	0	0	0	0	0	0	0	0	0
COMPONENTS	3	3	14	11	2	7	1	4	2	1	3	9

*Figure 6 bar graph showing **quantities of collected SETAs** according to the **type** of technology and manufacturer' **country** of origin*

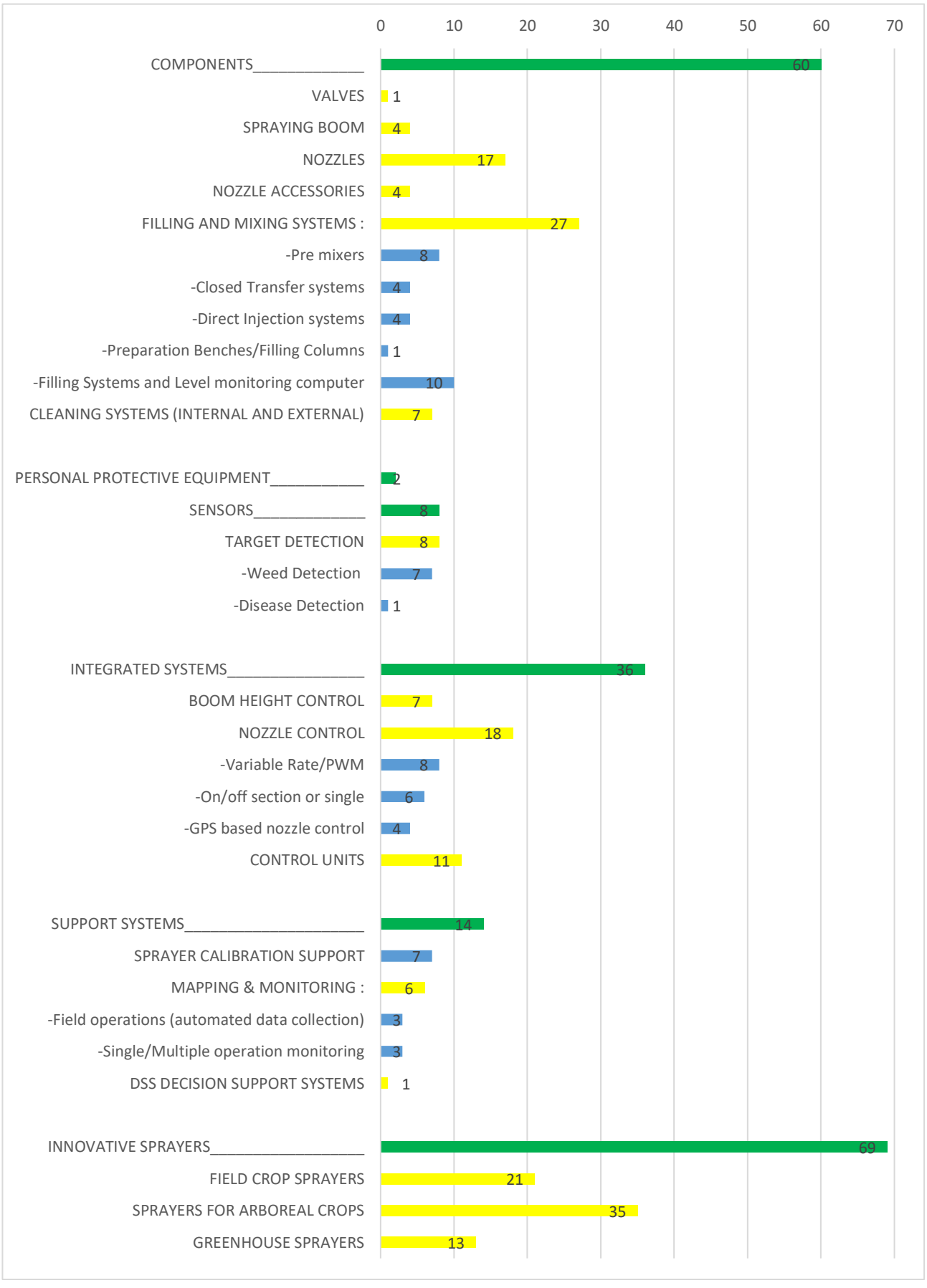


Figure 7 Bar graph showing number of SETAs retrieved for type of Technology. Categories are highlighted in green, groups in yellow and subgroups in blue – ref. Table 5

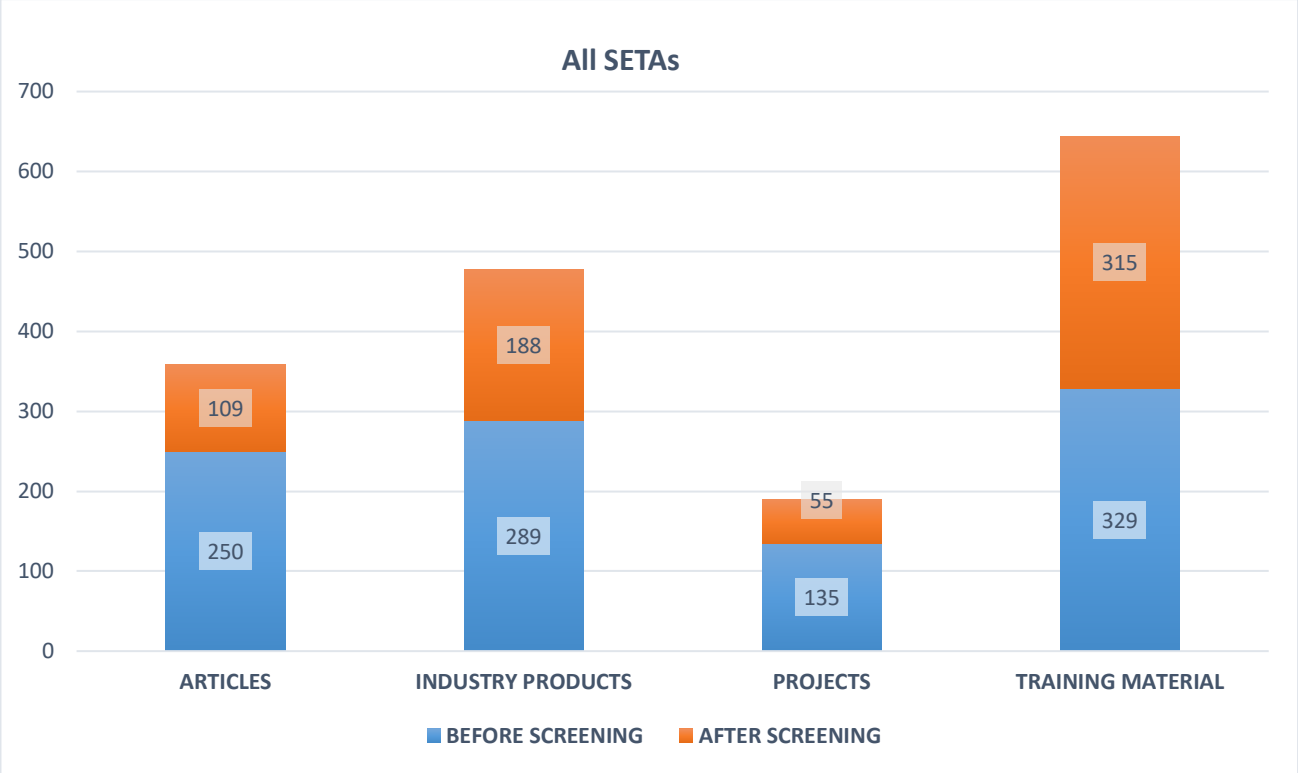


Figure 8 Amount of collected SETAs before and after the screening process.

3.6 Conclusions and perspectives

The aggregated and screened data has been further analysed to meet **two end goals**: consolidating a first database for the INNOSETA repository and organizing it for the planning of workshops in WP3.

In detail:

A) INNOSETA Repository

Having a solid database for the launch of the INNOSETA Repository meant not only gathering innovations and tools, but ensuring that their communication could be as effective as possible.

As described in D1.1., a number of specifications were made in the Google forms; it was then assessed the mock-up for the actual look of the platform (Figure 8) and it was deliberated between partners which information was actually available and useful for the purpose. A **resizing of the google forms** could be proposed in order to make the filling of the g-forms as effective and quick as possible.

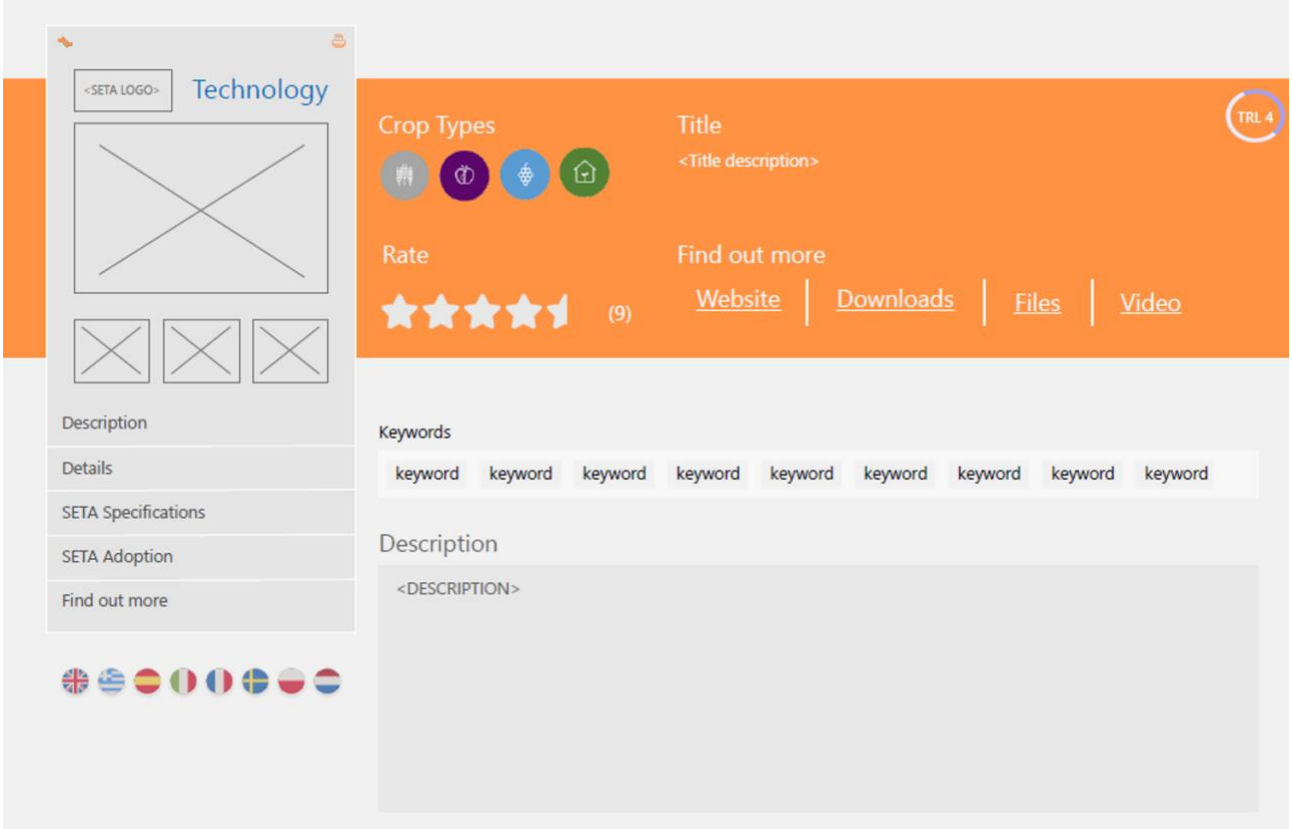


Figure 9 Mock-up of the INNOSETA Repository webpage for an industry product.

The effort was to include latest innovations and relative declinations.

The INNOSETA repository is called “self-sustainable” as we have confidence that, by raising awareness about its existence among relevant stakeholders, more input will be provided.

Having set this first solid base and implemented the method to gather valid innovative and useful industry solutions, we are confident that the implementation of the platform will be effective for its end goal and its further expansion will be easier as precise instructions and requirements can be followed.

Partners’ further input is planned.

B) WP3 WORKSHOPS

For this second purpose, a system of categories was suggested as illustrated in Figure 7. Then for organizing training workshops, intended for updating stakeholders about latest technologies and practices, each project partner will choose among the collected and categorized SETAs and refer them to the proper Thematic Group (illustrated in Table 4.) The difference lies in the cultivation system that will be the most interesting for the partner’s country and relative stakeholder needs.

Annex

CEMA LIST OF RELEVANT COMPANIES

COUNTRY	COMPANY
BRAZIL	HEXAGON AGRICULTURE
BELGIUM	AAMS - Salvarani
BELGIUM	RDS electronics
BELGIUM	Octionion
BELGIUM	BAB Bamps
BELGIUM	JMB Pump solutions
BELGIUM	Baekelandt
BELGIUM	Boone Hydro Elektro
BELGIUM	Demtec
BELGIUM	Van Dessel Automatisatie NV
BELGIUM	Beyne
BELGIUM	Delvano
BELGIUM	Lemken Belgium
BELGIUM	Mais Automatisering NV
BELGIUM	Gp electronics
BELGIUM	Perdum
CZECH REPUBLIC	Agrio
DENMARK	Danfoil
DENMARK	Datalogisk
DENMARK	HARDI
DENMARK	Skovhave
FRANCE	ALBUZ SOLCERA
FRANCE	ARLAND PULVERISATION
FRANCE	AXE-ENVIRONNEMENT
FRANCE	BEDOUELLEDISTRIBUTION
FRANCE	BERTHOUD
FRANCE	BOBARD
FRANCE	BUISARD DISTRIBUTION
FRANCE	CALVET
FRANCE	CHABAS
FRANCE	CHAMBAGRI GARD
FRANCE	CLEMENS
FRANCE	CNH
FRANCE	DAGNAUD
FRANCE	DHUGUES
FRANCE	EXEL
FRANCE	GREGOIRE GROUP
FRANCE	HARDI EVRARD
FRANCE	John Deere (engine)

FRANCE	JCM-TECHNOLOGIE
FRANCE	KREMER
FRANCE	KUHN
FRANCE	LANDREAU-SOLUTIONS
FRANCE	LECHLER
FRANCE	MAGNETTO
FRANCE	NICOLAS THOMAS
FRANCE	Naio Technologies
FRANCE	PELLENC
FRANCE	PULVERISATION S21
FRANCE	SATPLAN
FRANCE	SULKY
FRANCE	TECHPRODIS
FRANCE	VANTAGE-AM
FRANCE	TECNOMA
FRANCE	VERMANDE
GERMANY	AgroTop
GERMANY	altek GmbH
GERMANY	Amazone
GERMANY	Dammann
GERMANY	GLORIA Haus- und Gartengeräte GmbH
GERMANY	HORSCH
GERMANY	LECHLER
GERMANY	LEICA-GEOSYSTEMS
GERMANY	Lemken
GERMANY	LIPCO
GERMANY	Lochman
GERMANY	Maschinenfabrik SCHMOTZER GmbH
GERMANY	MESTO Spritzenfabrik Ernst Stockburger GmbH
GERMANY	MULLER ELECTRONIC
GERMANY	WANNER
GERMANY	WEBER
GERMANY	AGCO/Fendt
ITALY	A.M.A.S. Snc di Cecconi Marco & Meri
ITALY	ABBA' snc
ITALY	AGRI PERRONE Sas
ITALY	AGRICOLMECCANICA
ITALY	Agrieffe di Orlando Filippo
ITALY	AGRIMASTER - DEMETRA SpA
ITALY	ANDREOLI ENGINEERING Srl
ITALY	ANNOVI REVERBERI SpA
ITALY	ARAG
ITALY	ASJ srl
ITALY	Berra di Massimo Berra

ITALY	BERTONI
ITALY	Bgroup SpA (Barga, Projet)
ITALY	Braglia srl
ITALY	CAFFINI
ITALY	CICLONE srl
ITALY	CIFARELLLI spa
ITALY	CIMA spa
ITALY	COMET spa
ITALY	Dal DEGAn srl
ITALY	DIEFFE snc di Dutto Felice e Davide
ITALY	DRAGONE srl
ITALY	DSM ITALIA Srl
ITALY	ELIVENT srl
ITALY	EUROPIAVE snc
ITALY	FIENI GIOVANNI srl
ITALY	FLORIDA di MANTOVANI GIUSEPPE & ANTONIO Srl
ITALY	G.R. GAMBERINI Srl
ITALY	GENESINI MACCHINE AGRICOLE snc
ITALY	Geoline by Tecomec
ITALY	GRIM srl
ITALY	I.M.M. di Moccia Srl
ITALY	IDEAL
ITALY	IDROMECCANICA BERTOLINI spa
ITALY	IMOVILLI POMPE Srl
ITALY	LOCHMANN PLANTATEC
ITALY	M.M. srl
ITALY	MAGGIO srl
ITALY	MAR sas
ITALY	MARCHETTI MACCHINE AGRICOLE
ITALY	MARTIGNANI srl
ITALY	MASCHIO GASPARDO SPA
ITALY	MATERMACC
ITALY	MAZZOTTI srl
ITALY	MITTERER E. Sas COSTRUZIONI MECCANICHE
ITALY	NOBILI spa
ITALY	O.C.L.L. Srl
ITALY	OSELLA & C srl
ITALY	PANARI GIANCARLO & C. Snc
ITALY	POLMAC srl
ITALY	RELCOM snc
ITALY	RICOSMA Snc
ITALY	RODANO snc
ITALY	ROSATELLO srl
ITALY	SAE sas
ITALY	SALF MACCHINE AGRICOLE Srl
ITALY	SPILA srl

ITALY	SPRAY TEAM srl
ITALY	STEINER SPRAYERS
ITALY	TANKMASTERS MURATORI Srl
ITALY	TECNOFRUIT
ITALY	TECOMEC srl
ITALY	TIFONE
ITALY	TIFONE srl
ITALY	TOSELLI srl
ITALY	UDOR spa
ITALY	V.M.A. srl
ITALY	VALVOLMECCANICA srl
ITALY	VERZELLESI srl
ITALY	VETRORESINA PADANA srl
ITALY	VULCANO srl
SPAIN	AGROSAN
SPAIN	AGUIRRE
SPAIN	AMATE
SPAIN	AMP SPRAYERS
SPAIN	ATASA
SPAIN	BALVEN
SPAIN	CAMPOSUR
SPAIN	CORBINS
SPAIN	DELGADO
SPAIN	FEDE
SPAIN	FITOLIVA
SPAIN	FITOSA
SPAIN	GAMA
SPAIN	GARMELET
SPAIN	GAYSA
SPAIN	GENERAL
SPAIN	GIL
SPAIN	GOIZPER
SPAIN	GOMEZ REDONDO
SPAIN	GYM
SPAIN	HERPA
SPAIN	ILEMO-HARDI
SPAIN	INDUSTRIAS SANZ
SPAIN	MAKATO
SPAIN	MAÑEZ Y LOZANO
SPAIN	MARISAN
SPAIN	MAURICIO
SPAIN	MOVICAM
SPAIN	MULTEYME
SPAIN	NIUBO

SPAIN	OSUNA SEVILLANO
SPAIN	PEREZ SANCHEZ
SPAIN	PULVIPLASS
SPAIN	SAHER
SPAIN	SOLANO HORIZONTE
SPAIN	TALLERES CORBINS
SPAIN	TECNOMA
SPAIN	TEYME
SWEDEN	Dataväxt
SWEDEN	Viby-Teknik
SWEDEN	V-Teknik
PORTUGAL	ROCHA
PORTUGAL	STAGRIC
PORTUGAL	TOMIX
THE NETHERLANDS	Agrifac Machinery
THE NETHERLANDS	Berg Hortimotive
THE NETHERLANDS	CHD Eefting Landbouwspuitmachines
THE NETHERLANDS	Coenders Lottum
THE NETHERLANDS	Damcon
THE NETHERLANDS	De Vette
THE NETHERLANDS	Dubex Europe
THE NETHERLANDS	Empas
THE NETHERLANDS	Gerritsma
THE NETHERLANDS	H. Hol en Zn
THE NETHERLANDS	HSS
THE NETHERLANDS	John Deere Horst
THE NETHERLANDS	Kverneland Group Benelux
THE NETHERLANDS	KWH Holland
THE NETHERLANDS	Machinefabriek Steketee
THE NETHERLANDS	Micothon
THE NETHERLANDS	Munckhof
THE NETHERLANDS	Robur
THE NETHERLANDS	Wingssprayer
THE NETHERLANDS	Widontec
THE NETHERLANDS	Wout Hogervorst
UK	Household Sprayers Ltd
UK	Knight
UK	Lite-Trac Ltd
UK	Sands Agricultural Machinery Ltd
UK	Micron Sprayers Ltd.
USA	DOSATRON

USA	Norac
USA/FR	TEEJET
USA	Topcon
USA	Trimble

LIST OF INDUSTRY PRODUCTS COLLECTED AND APPROVED

Organisation	Title (English)	What is the subtype of this SETA?	Country
UNITO	COM00	Sprayer Component-Actuator	Italy
VISAVI	CropSurfer	Crop sprayer	Sweden
ILVO	Wingssprayer	Sprayer Component-Actuator	Netherlands
UNITO	ARBOS Blaster	Crop sprayer	Italy
UPC	Pre-pneumatic nebulizer with AWASULF treatment system	Crop sprayer	Spain
UNITO	SoftDrop	Sprayer Component-Actuator	Germany
VISAVI	Symetrical Twin fan injector nozzle IDKT	Crop sprayer	Germany
VISAVI	Drift reducing nozzles	Crop sprayer	Germany
VISAVI	Asymmetrical twin flat spray air-injector nozzles IDTA	Sprayer Component-Actuator	Germany
VISAVI	TurboDrop HiSpeed, assymetric double fan venturi nozzle	Sprayer Component-Actuator	Germany
VISAVI	AI3070 Air Induction Dual Pattern Flat Spray Tips	Sprayer Component-Actuator	United States
Visavi	Dropleg UL	Crop sprayer	Germany
IFV	IDK 90 air induction nozzle	Crop sprayer	Germany
IFV	TVI 80 air induction nozzle	Crop sprayer	France
IFV	AVI 80 air induction nozzle	Crop sprayer	France
IFV	CVI 80 air induction nozzle	Crop sprayer	France
UNITO	ExactApply Primer	Sprayer Component-Actuator	United States
UNITO	3D Nozzle	Sprayer Component-Actuator	United States
ZODR	Antisorresponding AZ	Sprayer Component-Sensor	Poland

ZODR	Ejector compact EŻK	Sprayer Component-Sensor	Mauritius, Poland, Vatican City
ZODR	EG Eżektorowe	Crop sprayer	Poland
ILVO	Micron Controlled Droplet Application	Sprayer Component-Actuator	United Kingdom
ILVO	Led Sprayer Boom Lighting	Sprayer Component-Actuator	Belgium
VISAVI	Angeled caps	Angeled nozzle cap	United Kingdom
CERTH-iBO	AGROCARE Electrostatic Spraying System	Sprayer Component - Electrostatic spraying	Greece
ZODR	Conical filters	Crop sprayer, Sprayer Component-Sensor	Poland
CERTH-iBO	POLMAC Promixer	Extra tank for plant protection products (PPPs) mixing	Greece
UNITO	NIAGARA	Sprayer Component-Actuator	Italy
IFV	FORMABAC	Mixer for PPP preparation	France
IFV	Phytomix	Mixer for PPP preparation	France
IFV	Top Incorpo	Mixer for PPP preparation	France
IFV	Tech'bac	Mixer for PPP preparation	France
UNITO	ECO3	Sprayer Component-Actuator	Italy
UNITO	ECOTANK 120	Sprayer Component-Actuator	Italy
UNITO	GoatThroat GT300-C/STANDOFF Pump With Viton Seal	Sprayer Component-Actuator	United States
UNITO	ezi-connect™	Sprayer Component-Actuator	Germany
IFV	easyFlow	close transfer system	France
UNITO	Banjo Closed Mix Fitting system	Sprayer Component-Actuator	Italy
UNITO	Piix	Sprayer Component-Actuator	France
UNITO	RTM101 - REAL TIME MIXER	Sprayer Component-Actuator	Italy
VISAVI	Knight Highspeed Injection	Crop sprayer, Sprayer Component-Actuator	Denmark
UNITO	Direct Injection	Sprayer Component-Actuator	United States
IFV	Eco Filing	Personal Protective Equipment	France

ILVO	Knight Fluid control pro	App/IoT/automation, Sprayer Component-Actuator	United Kingdom
IFV	TOP- COMPTEUR	Equipement	France
VISAVI	Auto Fill	Crop sprayer, Sprayer Component-Sensor	Denmark
IFV	Individual flow meter - EXCELA	equipement	France
UNITO	TANK- Control	Sprayer Component-Actuator, Sprayer Component-Sensor	Germany
UNITO	TANK-Control III	App/IoT/automation, Sprayer Component-Actuator, Sprayer Component-Sensor	Germany
IFV	PRO-FLOW 9 VOLT	Sprayer Component-Actuator, Sprayer Component-Sensor	France
UNITO	Load Command	Sprayer Component-Actuator, Sprayer Component-Sensor	United States
UNITO	Tank Fill Calculator	Sprayer Component-Sensor	United States
UNITO	PowrSpray	Sprayer Component-Actuator	United States
IFV	Lavotop	Sprayer cleaning equipment	France
UPC	Spray nozzles and cleaning devices in Series Cleaner1 sprayers	Cleaning device	Spain
ILVO	Delvano auto-eco-clean automatic cleaning program	Sprayer Component-Actuator	Belgium
ILVO	Beyne automatic cleaning program	Sprayer Component-Actuator	Belgium
VISAVI	AutoWash	Crop sprayer	Denmark
UNITO	Air Rinse	Sprayer Component-Actuator	United States
UNITO	XtremeClean intensive cleaner	Sprayer Component-Actuator	Hasbergen
IFV	S protec apron	Personal Protective Equipment	France
IFV	Aegis overall	Personal Protective Equipment	France
UNITO	AiCPlus camera system	App/IoT/automation, Sprayer Component-Sensor	Netherlands

UNITO	See & Spray	Crop sprayer, Sprayer Component-Sensor	United States
	UX AmaSpot trailed sprayer	Crop sprayer, Sprayer Component-Actuator, Sprayer Component-Sensor	Germany
UPC	Select Sprayer Weeds	Sprayer Component-Sensor	Spain
Visavi	Robocrop Spot Sprayer	Crop sprayer	United Kingdom
IFV	I-SPRAY	Crop Sprayer	France
UNITO	WeedSeeker Spot Spray	Sprayer Component-Sensor	United States
IFV	Carbon Bee Technologies	App/IoT/automation, disease sensor	France
ILVO	Delvano Deveric 2600 boom height control system	Sprayer Component-Actuator, Sprayer Component-Sensor	Belgium
ILVO	Househam Boom height control	Sprayer Component-Actuator, Sprayer Component-Sensor	United Kingdom
VISAVI	Boom management systems	Crop sprayer, Sprayer Component-Sensor	Denmark
UNITO	DISTANCE-Control I and II	Sprayer Component-Actuator, Sprayer Component-Sensor	Germany
UNITO	BLC kit -Boom Leveling Control	Sprayer Component-Actuator, Sprayer Component-Sensor	Italy
UPC	AutoSlant, AutoHeight and AutoTerrain	Crop sprayer	Denmark
ILVO	Knight Auto boom levelling	Sprayer Component-Actuator, Sprayer Component-Sensor	United Kingdom
VISAVI	MULTI-Rate	Sprayer Component-Actuator, Sprayer Component-Sensor	Germany
UNITO	SwingStop pro	Crop sprayer, Sprayer Component-Actuator	Germany
Visavi	Auto Select	Crop sprayer	Denmark
VISAVI	DynamicDosePlus	Crop sprayer, Sprayer Component-Actuator	Netherlands
ILVO	Bateman Blended pulse nozzle control	Sprayer Component-Actuator	United Kingdom
ILVO	Delvano Dynamic pulse spraying	Sprayer Component-Actuator	Belgium
ILVO	Househam Auto nozzle select	Sprayer Component-Actuator	United Kingdom

IFV	DynaJet® Flex 7120	Sprayer Component-Actuator	France
Visavi	SECTION-Control TOP	Sprayer Component-Actuator, Sprayer Component-Sensor	Germany
VISAVI	Auto section control	Crop sprayer, Sprayer Component-Actuator, Sprayer Component-Sensor	Denmark
UNITO	Electrical Stop Valve (ESV)	Sprayer Component-Actuator	Germany
UNITO	SELETRON	Sprayer Component-Actuator, Sprayer Component-Sensor	Italy
UNITO	VARIO-Select	Sprayer Component-Actuator	Germany
UNITO	Section Control	App/IoT/automation	United States
ZLTO	GPS-Switch + AmaSelect	Crop sprayer	Germany
ILVO	Knight GPS nozzle control	Sprayer Component-Actuator	United Kingdom
	CURVE-Control	Sprayer Component-Actuator, Sprayer Component-Sensor	Germany
UNITO	ISOBUS SPRAYER-Controller	Sprayer Component-Sensor	Germany
UPC	Waatic: Smart sprayer	App/IoT/automation, Sprayer Component-Actuator	Spain
UNITO	Bravo 180s	App/IoT/automation	Italy
UNITO	Bravo 400s	App/IoT/automation	Italy
UNITO	ISOBUS TRAIL-Control	Sprayer Component-Sensor	Germany
UNITO	MULTI-Control	Sprayer Component-Actuator, Sprayer Component-Sensor	Germany
UNITO	ME-Confi gurator for ISOBUS SPRAYER-Controller	App/IoT/automation, Sprayer Component-Actuator	Germany
UNITO	SPRAYDOS	App/IoT/automation, Sprayer Component-Actuator	Germany
UNITO	SECTION-Control BOX	App/IoT/automation, Sprayer Component-Actuator	Germany
IFV	TRIMBLE FMX	App/IoT/automation	United States
IFV	Aeros 9040	App/IoT/automation	United States
IFV	Bravo 300S		ITALY

IFV	Quali'Drop spraying calibartion tools	Sprayer calibration device	France
IFV	EVIDENCE spraying calibartion tools	Sprayer calibration device	France
IFV	Vertical test bench	Sprayer calibration device	Belgium
IFV	PULVE DYNAMIC spraying calibration tool	Sprayer calibration device	France
IFV	Single nozzle testing stand ED 16-2K	Sprayer calibration device	Germany
IFV	FLOW RATE MEASUREMENT test bench	Sprayer calibration device	Belgium
IFV	VERTICAL PATTERNATOR WITH LAMELLAE	Sprayer calibration device	Belgium
ILVO	Spray pressure registration sytem	Sprayer Component-Actuator	Belgium
UNITO	FieldPilot® with Matrix®Pro	App/IoT/automation, Sprayer Component-Sensor	United States
IFV	Karnott	App/IoT/automation	France
IFV	Monitoring of sprayers application parameters (P, Right section flowrate, Left section flowrate)…This device can be fitted on in-use sprayers	Sprayer Component-Sensor	France
CERTH-iBO	ARCADIA TERRA - ARAG VISIO	Sprayer Component-Sensor	Greece
UNITO	PICORE	App/IoT/automation, Sprayer Component-Sensor	Germany
UNITO	PAM - Pesticide Application Manager	App/IoT/automation	
VISAVI	StrictSprayPlus	Crop sprayer, Sprayer Component-Actuator	Netherlands
UNITO	Smart Spraying	Sprayer Component-Actuator, Sprayer Component-Sensor	Germany
Visavi	Multispray	Crop sprayer	Netherlands
	Varidome	Crop sprayer, Band sprayer for row crops	United Kingdom
Visavi	Band sprayer	Crop sprayer	Netherlands
VISAVI	Row shields bandspraying	Crop sprayer, Row crop sprayer	Denmark
Visavi	Band and Hooded sprayers	Crop sprayer	United Kingdom

VISAVI	Hardi Twin Stream, Twin Force	Crop sprayer	Denmark
ILVO	Delvano Bi-air air support	Sprayer Component-Actuator	Belgium
ILVO	Landquip Fieldmaster GPS mapping system	App/IoT/automation, Sprayer Component-Actuator	United Kingdom
CERTH-iBO	AgroHalc Electrostatic Generator	Sprayer Component-Electrostatic Generator	Greece
IFV	MULTISPRAY	Crop Sprayer	France
IFV	AUTOSPRAY	Crop Sprayer	France
ZLTO	Kverneland iXTrack series	Crop sprayer, Sprayer Component-Actuator, Sprayer Component-Sensor, Personal Protective Equipment	Netherlands
ZLTO	Wave	Crop sprayer, Sprayer Component-Actuator	Netherlands
ZLTO	Widontec Winner	Crop sprayer	Netherlands
ILVO	BAB Duoturb Orchard sprayer	Crop sprayer	Belgium
UPC	Smartomizer: smart and connected atomizer	App/IoT/automation, Sprayer Component-Actuator	Spain
UPC	Duplex tornado	Crop sprayer, Sprayer Component-Actuator	Spain
UPC	Atomizer with double turbine with opposite rotation	Crop sprayer	Spain
UNITO	GUSS	App/IoT/automation	United States
UPC	Trailed atomizerTwister FR Backrest	Crop sprayer, Sprayer Component-Actuator	Spain
UNITO	TAV2006	Crop sprayer	Italy
UNITO	Cima Variable Rate Pneumatic Atomizer	Crop sprayer	Italy
UNITO	Synthesis P	Crop sprayer	Italy
UNITO	A.C.T. System (Adjustable Crop Treatment System)	Sprayer Component-Actuator	Italy
UNITO	ELI S33	Sprayer Component-Actuator	Italy
UNITO	OKTOPUS P/T	Crop sprayer	Italy
UNITO	Adaptive2 - Canopy Reading System	Crop sprayer, App/IoT/automation, Sprayer Component-Actuator, Sprayer Component-Sensor	Italy

UNITO	DOSA - DROPLET SIZE ADJUSTMENT	Sprayer Component-Actuator	Italy
UNITO	Electrostatic Pneumatic Nebulizer M612 Compact with Diffuser "Gib-Dor"	Crop sprayer	Italy
UNITO	Drop save	Crop sprayer	Italy
UNITO	WHIRLWIND M612 DUO-WING-JET (BIFILARE	Crop sprayer	Italy
UNITO	DRIFT RECOVERY 1000 - 1500 LT	Crop sprayer	Italy
UNITO	The Rainbow	Sprayer Component-Actuator	Italy
UNITO	Drift Stopper EVO	Crop sprayer	Italy
UNITO	Drift Recovery Mignon	Crop sprayer	Italy
VISAVI	Tunnelsprayer, driftreducing and chemical saving	Crop sprayer	Germany
IFV	KOLEOS Tunnel sprayer for vineyard	Crop sprayer	France
IFV	ECOPROTECT S2/L2 ZNT	Crop sprayer	Italy
IFV	Multi Row & Recycling	Crop sprayer	Germany
UNITO	Bakus	Crop sprayer, App/IoT/automation	France
UPC	Self-propelled atomizer - Caterpillar	Crop sprayer	Spain
UPC	SELF-PROPELLED TRAILED SPRAYER	Crop sprayer	Spain
UPC	SELF-PROPELLED SPRAYER WITH FOLDED ARM	Crop sprayer	Spain
UPC	Radiant x4 Towed Nebulizers	Crop sprayer	Spain
UPC	Multi-row sprayer for horticultural crops	Crop sprayer	Spain
IFV	TURBIPANO		France
ILVO	Greenhouse plot sprayer	Crop sprayer	Belgium
UNITO	JACTO - PJB	Crop sprayer	Brazil
UNITO	GBT1	Sprayer Component-Actuator	Italy
UPC	Fumimatic vertical with turbine	Crop sprayer	Spain
IFV	SprayVeg	Crop sprayer	Italy
UNITO	ESS Electrostatic Greenhouse Sprayers	Crop sprayer	South Africa

Visavi	Flexidome	Crop sprayer, Band spraying	United Kingdom
UNITO	S55 spray robot	Crop sprayer, App/IoT/automation	Netherlands
UNITO	Qii-Jet	Crop sprayer	Belgium
UNITO	Qii-Jet HAV	Crop sprayer, App/IoT/automation	Belgium
UNITO	Meto	Crop sprayer, App/IoT/automation	Denmark
UPC	Tizona 35	Crop sprayer	Spain
UNITO	GOTRACK	App/IoT/automation	Poland