Title: Low cost, low maintenance and effective system to sterilise eggshells using hot air and Excimer UV lamps

# Final Publishable summary RP2

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The research leading to results in this project receives funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement n°605309.

## Executive Summary

The presence of Salmonella bacteria in eggs is one of the main sanitary challenges of the egg producing sector, since eggs are the leading cause of Salmonella outbreaks in Europe. This bacterium resides in the intestinal tracts of infected hosts and is transmitted in the faeces of people and animals. Salmonellosis is one of the most common enteric (intestinal) infections and is the second most common foodborne illness. There are several types of strains, but two of them, Salmonella Enteritidis and Salmonella Typhimurium, are responsible for half of all human infections. Once in the egg, Salmonella is very resistant. A person infected with the Salmonella Enteritidis bacterium begins to show symptoms 12 to 72 hours after consuming contaminated food - with infection lasting 4 to 7 days. While most persons recover with or without antibiotic treatment, diarrhoea can be sufficiently severe to require hospitalisation. The elderly, infants, pregnant women and those with impaired immune systems are more at risk from the infection spreading from the intestines to the blood stream and ultimately threatening the life of the infected individual.

Therefore, a clear European need exists for the secure sterilisation of eggs. To this end, the proposed OVOSHINE technology will provide the egg producing sector with a significant competitive advantage by providing a highly effective, fast, cost-efficient and low maintenance system to sterilise eggs using hot-air and Excimer UV lamps, a safe microbial sterilisation technique. In terms of application to other sectors, this technology could be further developed for sterilisation in food packaging, medical instrumentation and any temperature-sensitive products requiring sterilization.

Starting from lab experiments to assess the efficiency of UV and hot air for sterilization, the technology was upscaled within the project to an industrial scale prototype. It combines both treatments assessed separately so far within the OVOSHINE project (hot air and UV light). It contains excimer lamp technology and hot air applicators which were developed within the project.

Starting with the excimer lamps industrial development, the final design has been developed and manufactured by Fraunhofer. Several designs have been tested by Ateknea in order to obtain the best topology for the power supply, which has been manufactured and tested. Some improvements have been included into the design, in order to optimise its functioning.

In parallel with the excimer lamps development, the industrial hot air applicator has been designed and developed by Ateknea, and the egg conveyor has been selected, purchased and adapted to the prototype. Once integrated, the hot air applicator has been commissioned and tested, and several pathogen tests has been performed with the prototype.

Finally, the power supply and the excimer lamps have been integrated into the UV module that has been then installed onto the prototype. At this point, the OVOSHINE industrial prototype has been fully integrated, commissioned and tested, and final pathogen tests has been conducted in order to validate the final performance of the prototype.

In the last stage of the project, the prototype has been sent to EL CANTO for validation, and several batches of eggs from EL CANTO and IBERTEC have been treated with the prototype and sent to the laboratory to analyse the disinfection performance and hatchability effects of the prototype.

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The RTDs have explained to the SMEs and SME-AGs all technical developments, thus they are completely able to explain these developments to their members in the annual and semi-annual association meetings.

## Project Context and Main Objectives

The presence of Salmonella bacteria in eggs is one of the main sanitary challenges of the egg producing sector, since eggs are the leading cause of Salmonella outbreaks in Europe. This bacterium resides in the intestinal tracts of infected hosts and is transmitted in the faeces of people and animals. Salmonellosis is one of the most common enteric (intestinal) infections and is the second most common foodborne illness. There are several types of strains, but two of them, Salmonella Enteritidis and Salmonella Typhimurium, are responsible for half of all human infections. Once in the egg, Salmonella is very resistant. A person infected with the Salmonella Enteritidis bacterium begins to show symptoms 12 to 72 hours after consuming contaminated food - with infection lasting 4 to 7 days. While most persons recover with or without antibiotic treatment, diarrhoea can be sufficiently severe to require hospitalisation. The elderly, infants, pregnant women and those with impaired immune systems are more at risk from the infection spreading from the intestines to the blood stream and ultimately threatening the life of the infected individual.

Salmonella can be transmitted to eggs either directly from infected hens or during manipulation. In most cases, contamination of the egg initiates on the egg shell. The most usual contamination is due to hens that have the bacteria in their digestive tract, infecting the eggshell but not the interior of the egg. Salmonella infection can be easily transmitted during food processing and cooking since the bacteria contaminates other foods during manipulation, or can pass directly through the shell to the egg content. Salmonella Enteritidis can be inside healthy-looking eggs and does not usually affect the taste, smell or appearance of the food, but if eggs are eaten raw or undercooked, the bacterium can cause illness.

Currently, there are several sterilisation methods to sterilise eggs, including thermal, chemical and radiation methods. However, such treatments are far from sustainable, given that chemical products can be absorbed through the pores of the shell contaminating the contents of the egg. Thermal processes prove unsuitable for the sterilisation of eggs, given that high temperatures (over 100ºC) are required to remove Salmonella, which also affects egg content or leads to shell cracking. Slow pasteurisation, while effective, is far too energy and time consuming for widespread use in the modern egg packing industry. In addition, the chemical washing is not permitted for eggs destined for human consumption and the irradiation of eggs is totally forbidden in the EU. The only method allowed in the EU is UV light. However, commercial mercury vapour UV lamps have high maintenance costs, they are not environment friendly, their sterilisation cycle is too low for industrial application and their useful life should be longer in order to reduce maintenance costs.

A clear European need exists for the secure sterilisation of eggs. To this end, the proposed OVOSHINE technology will provide the egg producing sector with a significant competitive advantage by providing a highly effective, fast, cost-efficient and low maintenance system to sterilise eggs using hot-air and Excimer UV lamps, a safe microbial sterilisation technique. In terms of application to other sectors, this technology could be further developed for sterilisation in food packaging, medical instrumentation and any temperature-sensitive products requiring sterilization.

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The overall OVOSHINE objective lies in the application of Excimer UV lamps and hot air for the effective sterilisation of eggs. Otherwise, to accomplish this objective, several objectives have been fixed. This objectives are divided into scientific and technological.

The scientific objectives are:

1) Sterilisation ratio > 99.9%. Tests will be carried out to measure the effectiveness of the sterilisation process in removing bacteria and results will be evaluated to optimise it. (WP4).
2) Temperature in egg interior < 45 ºC. Ensure that the sterilisation process does not significantly increase the temperature of the egg. This is vital for ensuring that the nutritional quality and sensorial qualities of the egg are in no way jeopardised by the sterilisation treatment. The overall rise in the interior egg temperature will not exceed 45ºC. Exhaustive research will be carried out during the project to analyse egg characteristics following exposure to the process (task 4.6).

The technologic objectives are:

1) Sterilisation cost per egg < 0.001 €. Ensure that the sterilisation process is low cost, amounting to a very small contribution to the total cost of the egg. It is estimated that the total cost of the process will not exceed 0.001€ (0.1 Euro cent) per egg. The study of the sterilisation cost will be performed in task 4.6.
2) Total manufacturing cost of the sterilisation system < 30,000€. Furthermore, the overall initial capital outlay for the OVOSHINE equipment will need to be in the region of 30,000 Euros in order to make it accessible for SMEs (task 4.6).
3) Sterilisation speed must be greater than 10,000 eggs per hour. In order to meet the current production rates of the egg sector, the sterilisation rate must be fast enough to meet the production rates of the egg sector (10,000 eggs per hour in small companies and 80,000 eggs per hour in medium companies). The design of the prototype, which will be carried out in WP4 will be performed to accomplish this requirement.
4) Include all the safety measures to avoid harming OVOSHINE users. Ensure the process is as safe as possible. Given that no chemical products will be used for sterilising the eggs, there will be no harmful residues left on the surface of the shell, nor will there be any risk of contamination through the porous shell to the interior of the egg. Moreover, a special task will be devoted to safety issues to prevent burnings of the operators while using the sterilisation machine. (Task 4.4).
5) Do not crack eggshell. Ensure that the sterilisation process does not harm or damage the delicate eggshells, a vital requirement for industrial packing applications. During the work plan sufficient trials have been envisaged to test eggshell resistance under sterilisation conditions and make any necessary adjustments (Task 4.6).
6) Easy to install. Facilitate easy installation and integration in rapid, modern egg production or packing lines. A continuous hot air and UV generation source will be used in order to make the OVOSHINE system as flexible and as fast as possible. The process will take between five and fifteen seconds. This project contemplates

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exhaustive field trials to modify and fine-tune the technology for optimal online operation. (WP5)

7) Proper dissemination. Assist the egg sector to absorb the knowledge created during the project (task 6.1) and to ensure that the results are explained to the scientific community (task 7.3).

## Main S&T results/foreground

Within the first reporting period, the real needs in terms of sterilisation rate, speed of treatment and cost of the system were defined in WP1.

During the WP2, different types of excimer lamps were assessed, and a State of the Art analysis was conducted in order to assess current solutions available into the market. Moreover, a filling station for the production of the UV lamps was developed and manufactured at the Fraunhofer IGB. Finally, several pathogen tests were conducted by Fraunhofer and NOFIMA, in order to assess the reduction of Salmonella on eggs, using different types of UV lamps.

In WP3, a laboratory scale hot air applicator was developed and manufactured by Ateknea, and the effects of the hot air in the egg, as well as the pathogen reduction, were tested under different hot air treatment scenarios.

Taking into account the conclusions obtained from the first reporting period, an industrial scale prototype that combines both treatments assessed separately so far within the OVOSHINE project (hot air and UV light) has been developed, manufactured and tested (WP4).

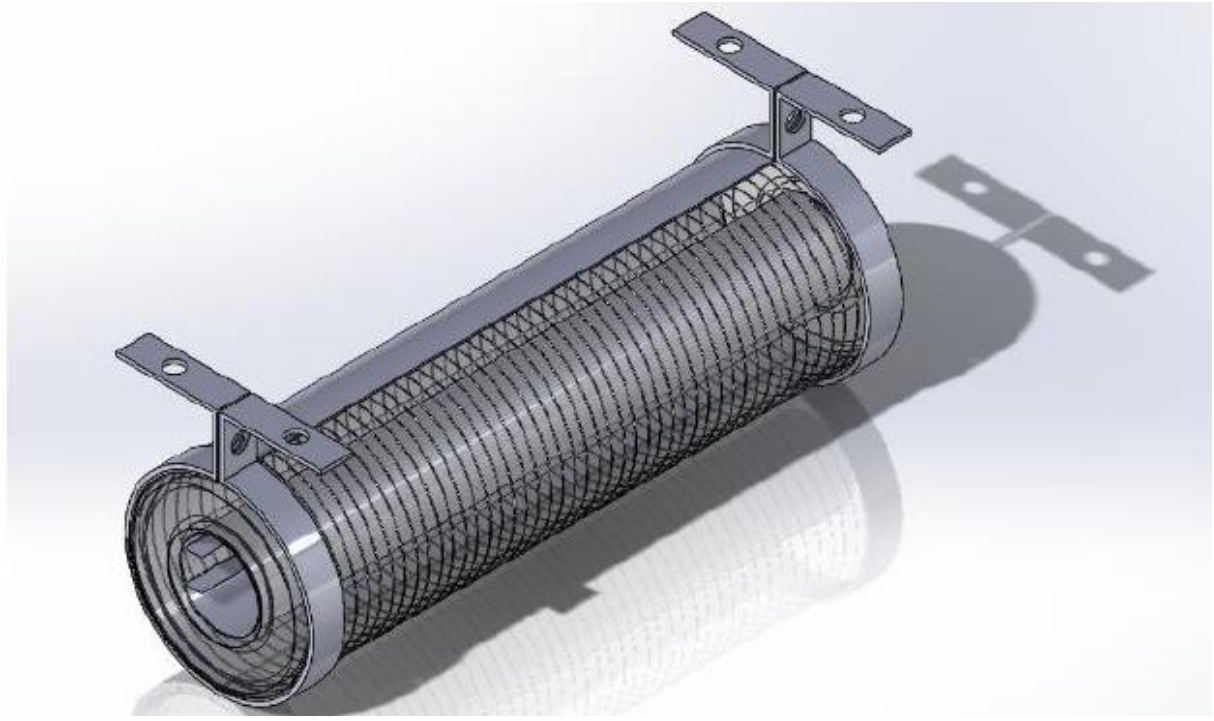

**Figure 1: Excimer lamps (Ovoshine EU project)**

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Starting with the excimer lamps industrial development, the final design has been developed and manufactured by Fraunhofer, and several tests with different pressures and power supplies have been performed, in order to characterise the final prototype. Several designs have been tested by Ateknea in order to obtain the best topology for the power supply, which has been manufactured and tested. Some improvements have been included into the design, in order to optimise its functioning. In parallel of the power supply development, the final lamps have been produced in Fraunhofer with the filling station developed in WP2. Moreover, the mechanical design of a UV module to integrate the lamps and the power supply, while assuring the safety, has been developed by Fraunhofer. The lamp consists of a quartz hollow cylinder. The centre tube holds the high voltage electrode. The electrode is manufactured of stainless steel, which is a suitable material for food applications. It is also elastic which makes the electrode pushing against the quartz tube. Close contact between quartz and electrode is an important fact for optimal energy coupling. The gap in the electrode gives the gas in the tube the possibility to build up homogeneous atmosphere. The gap must be in a nearly horizontal position to induce a convective flow. This flow lets the whole lamp heat up homogenously, which leads to constant discharge conditions over the whole volume. As the inner electrode carries the high voltage, a suitable cable for high voltage applications is soldered to the electrode. For good efficiency, a compromise between electrode surface and open quartz surface is necessary.

**Figure 2: Excimer lamps units for Ovoshine prototype**

For the prototype, in total eight units were delivered to Ateknea for installation.

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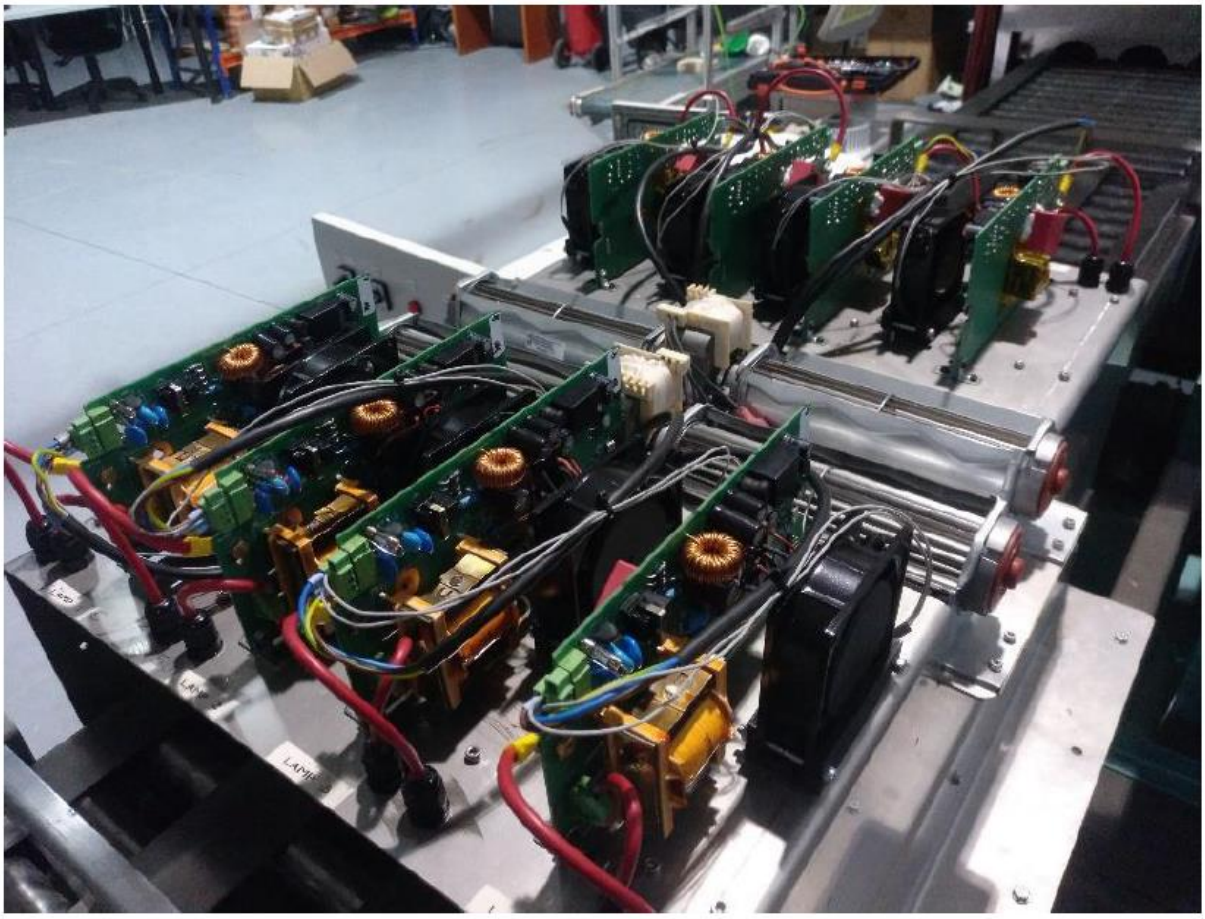

**Figure 3: Power supply for Ovoshine prototype**

The power supply design matches with the AC/AC conversion in frequency and level, and it can be mentioned, in the following sections as: electronic AC/AC converter, electronic ballast, or simply, power supply. In this design it has to be preserved the proper conditions for the lamp's ignition, certain energetic balance, and several safety achievements. For the first part, the best conditions of operation are explained in the following section, as it is the purpose of this part of the project. The second design target, conditions the size and power of the electronic components selection, and in combination with the safety achievements, it will define the topology and grounding of the power supply or AC/AC converter.

In parallel with the excimer lamps development, the industrial hot air applicator has been designed and developed by Ateknea, and the egg conveyor has been selected, purchased and adapted to the prototype. The parameters and specifications of the Hot Air Applicator, to carry out the heating of the air until a temperature around 400°C, were fixed keeping in mind the power consumption to design a viable prototype on terms of operating costs. Per fan, an airflow of 600 $m^3$/h and power consumption of less than 1.5 kW were specified. In total, 6 fans were integrated in the system leading to a total power consumption of less than 9 kW. To select the heating resistances in charge of increase the air temperature from the ambient conditions until 450ºC, several options have been considered, regarding the geometry of them and keeping in mind the tests carried out in the laboratory scale prototype.

It has been decided to employ 10 resistances in seral connection.

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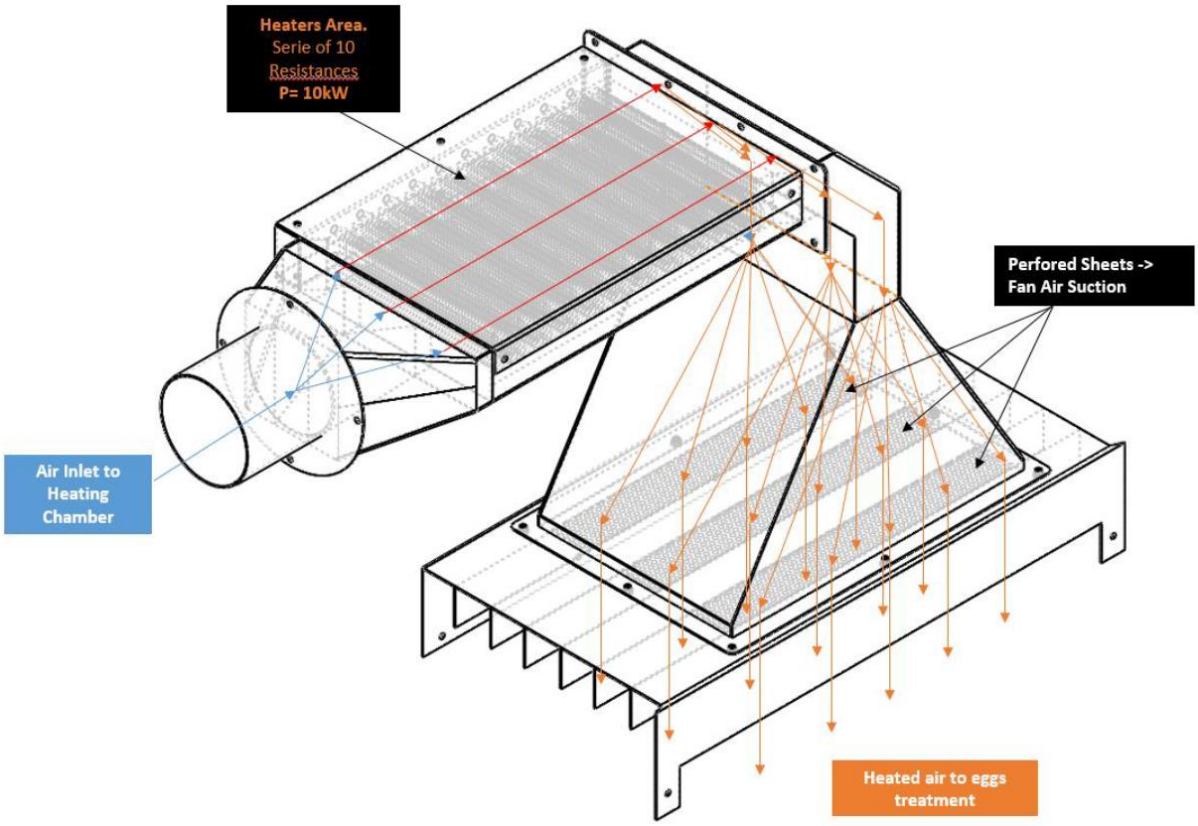


**Figure 4: Heaters for Ovoshine prototype**

Heaters and fans were integrated for downstream treatment of the eggs.

Finally, the power supply and the excimer lamps have been integrated into the UV module that has been then installed onto the prototype. For the egg transport, it has been selected a second hand conveyor from Moba Coenraadts supplier, which is the world leading manufacturer of egg grading, packing and processing machines. The main parameter is the treatment capacity of the industrial prototype, which was defined with a value of 10.000eggs/hour. It is required a rotation of the roller conveyor during the eggs transportation to ensure a total disinfection of the surface eggs.

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**Figure 5: Ovoshine industrial prototype**

At this point, the OVOSHINE industrial prototype has been fully integrated, commissioned and tested, and final pathogen tests has been conducted in order to validate the final performance of the prototype.

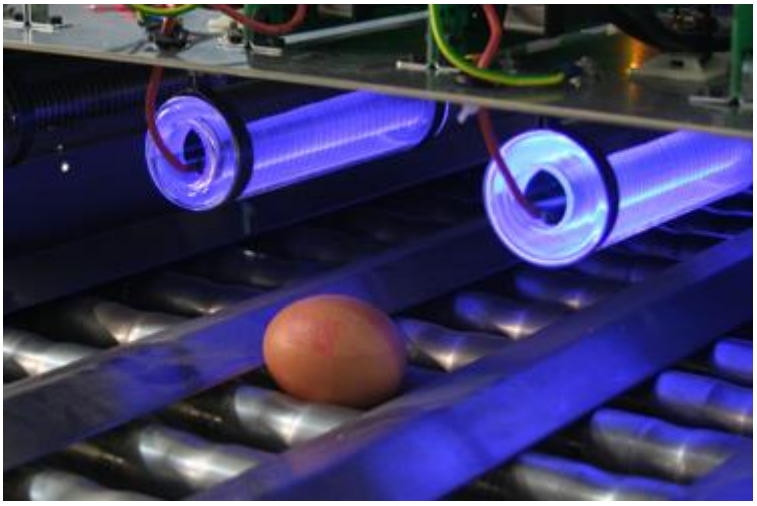

**Figure 6: Ovoshine prototype - final pathogen tests**

In the last stage of the project (WP5), the prototype has been sent to EL CANTO for validation, and several batches of eggs from EL CANTO and IBERTEC have been treated with the prototype and sent to the laboratory to analyse the disinfection performance and hatchability effects of the prototype.

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**Figure 7: Validation of Ovoshine prototype at EL CANTO facilities**

The RTDs have explained to the SMEs and SME-AGs all technical developments, thus they are completely able to explain these developments to their members in the annual and semi-annual association meetings. Moreover, a training video of the OVOSHINE industrial prototype has been prepared (WP6).

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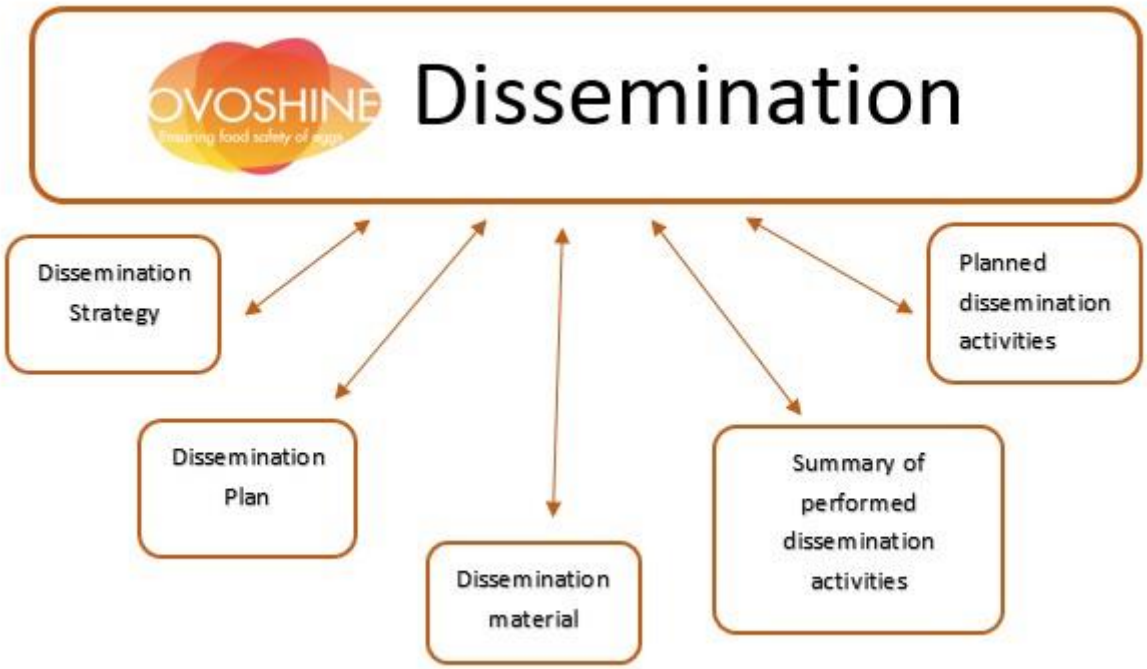
## Potential Impact, Dissemination & Exploitation

DISSEMINATION




*DISSEMINATION STRATEGY*

Dissemination is a horizontal activity and concentrates on disseminating the results of OVOSHINE project itself to a wide range of existing or potential stakeholders. Clear channels of communications between the project partners themselves as well as between the Consortium and the wider business community will play a crucial role in the success of the project.

The communication strategy was articulated over a number of dissemination mechanisms that were integrated organically (i.e. reinforcing their effectiveness to the greatest possible extent). Each activity started from the identification of target audience, followed by the definition of the most appropriate message; the expected target audience and the nature of the message determined the choice of the tools and channels of communications that were used.

A short-cycle iterative process was adopted to make sure that an evaluation phase always follows the actual communication of the content; the output of the evaluation was used to adjust target and message before the following iterations (i.e. after a social media campaign the actual results were used to evaluate the effectiveness of the advertising message and target, in order to eventually recalibrate to reach a more specific and involved audience).

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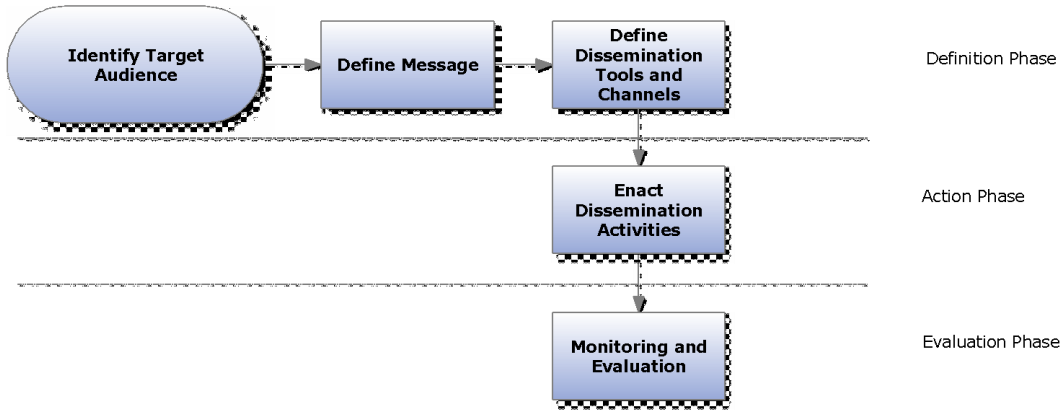


*Definition of the target audiences and the message*

The main target audiences include: 1) potential clients, 2) scientific community, 3) industry, and 4) general public.

The main messages are divided into two:

1) messages reinforcing the pre-marketing activities in order to enhance the commercial potential of the system, and
2) awareness raising of project's results and its benefits.

The following table shows the definition of target audiences and key messages:

**Table 1: Target audiences and messages**

| Target audience | Timeframe | Message | Channels |
|---|---|---|---|
| Potential clients: Egg producers and packers (Table eggs) | M14-M36 | OVOSHINE will help you detect and control Salmonella and other zoonotic agents present in your products | Trade fairs, online blogs, association training sessions, professional LinkedIn groups etc. |
| Potential clients: Egg-product producers (Egg products) | M14-M36 | OVOSHINE will help you detect and control Salmonella and other zoonotic agents present in your products | Trade fairs, online blogs, association training sessions, professional LinkedIn groups etc. |
| Potential clients: Hatch egg producers (Hatching eggs) | M14-M36 | OVOSHINE will help you detect and control Salmonella and other zoonotic agents present in your products | Trade fairs, online blogs, association training sessions, professional LinkedIn groups etc. |

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| | | | |
|---|---|---|---|
| Scientific community | M1-M36 | Important advances in the egg hygienisation process: Excimer UV lamps and hot air system for a more cost effective egg-shell hygienisation | Conferences, trainings, scientific publications etc. |
| Industry: Industry, Research & Government | M12-M36 | OVOSHINE provides a secure and cost effective technology for the hygienisation of eggs. | Trade fairs, online blogs, professional LinkedIn groups |
| General public | M1-M36 | EC is supporting an innovative project advancing in the field of food safety | Website, Cordis Wire, press announcements, printed media |

*DISSEMINATION PLAN*

The overall objective of the dissemination plan is to execute the dissemination strategy, via the following specific objectives:

- To prepare the adequate dissemination mechanisms and materials to be used by the partners
- To organize the activities to be performed in order to promote the commercial exploitation of the project's results and the widest dissemination of knowledge from the project.
- To monitor and evaluate dissemination activities and propose corrective measures when goals are not met.

While many of the dissemination activities were carried out online and thus took place in an international medium, attention was paid by the consortium to specific dissemination in the partner countries as these represent the initial markets for commercial activities. Thus, all SME partners were responsible for dissemination in their own countries and in additional countries in which they have strong presence and interest. Country overlapped or European-wide activities were carried out together by the project consortium. The RTD performers actively participated in the demonstration and transfer of knowledge and the project results to the consortium SMEs.

As much as possible, the project monitored the outreach of its activities to the different European countries. The Ovoshine website used an analytics tool allowing to detect the countries from which visitor traffic came from.

*1) Creation of a Public Access Website*

The OVOSHINE public website was launched in M3. The website is maintained by ATEKNEA and contains general public information about the project objectives, partners, meetings and progress. The website also include a restricted access to OVOSHINE's private area (only accessible to project partners).

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*2) Online advertising campaign planning*

During the first period (M1-M15) these activities mostly included posts and news items on partners' websites and some online professional fora. During the second period of the project (M16-M40) the consortium focused more on the direct communication channel. Online advertising will be expanded by the partners post project.

*3) Creation and distribution of printed materials*

A project leaflet has been designed and printed (see under dissemination material), providing general and reader-friendly information about the project. The leaflet clearly exhibits the visual identity of the project, chosen by the partners. Moreover, the leaflet has been translated and printed in Spanish, as the Exploitation Manager has and will emphasise dissemination activities in the Spanish market.

*4) Establishment of a commercial presence at conferences and trade shows*

Participation in events to promote OVOSHINE and SMEs networking within the target industry during the whole duration of the project.

*DISSEMINATION MATERIAL*

To brand the project and the technology, the first step was to choose a visual identity that will let the public easily distinguish all dissemination material regarding OVOSHINE. The Consortium established a voting round and then the final visual identity for OVOSHINE was developed.

The logo option chosen, is a pictogram as a reference to an egg moving, describing how the impact of the message or an online action affects everything around it.

An Ovoshine leaflet was established, printed and distributed by Partners.

*PUBLISHABLE RESULTS*

OVOSHINE is operating in a highly regulated industry in which costs of production frequently increase. Thus, any technological developments that could have a potential positive economic impact should be maintained confidential. Project results are key to protect OVOSHINE´s market potential. For this reason, it is highly important to clarify which information can be publicly shared, and which has to remain classified.

This section provides a publishable summary of the results generated by the project.

As described in the DoW, the expected results of the project are:

1. **The Excimer Ultraviolet lamps for sterilization purposes**
2. **Hot air generator with temperature control**
3. **The whole OVOSHINE hygienisation module**

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According to the final status of the project, the expected results could be achieved as follows:

1. **The Excimer Ultraviolet lamps for hygienisation purposes:** The setup built at the Fraunhofer IGB was suitable to produce enough lamps for the Prototype with the same characteristics. For the electronics, we obtained good results to operate the lamps. A suitable housing was designed and build which puts electronics, lamps, cooling and safety shielding together.

2. **Hot air generator with temperature control:** Based on the results of the laboratory prototype for different air flows, residence times and heat, the final prototype was build. After smaller heat dissipation issues and additional insulation, the prototype works within the specifications. The hot air generator shows significant positive results within the salmonella reduction process.

3. **The whole OVOSHINE hygienisation module:** The final prototype was successfully built. All components were assembled in a modular way so that the device is easy to use and to maintain. It can be transported without disassambling. It has the full specified functionality.

**Table 2: Ovoshine results and means of dissemination and exploitation**

| Result | Dissemination | Exploitation |
|---|---|---|
| **The Excimer Ultraviolet lamps for sterilization purposes** | The new excimer lamps can be used also in other sectors, not only in the egg sector. Other sector with superficial hygienisation needs can be interested in this new lamps | UV lamps producers, UV hygienisation equipment manufacturers |
| **Hot air generator with temperature control** | The hot air generator can be useful to others sectors to dry elements in a fast way | Industrial equipment manufacturers and installers |
| **The whole OVOSHINE hygienisation module** | Egg producers, packers and egg product manufacturers | Egg handling equipment manufacturers and installers |

After presenting the expected project results and drafting the current intentions of the consortium in relation with these results a more detailed description of the plans for Disseminating and Using the Foreground obtained during the project is presented in the following sections.

*SUMMARY OF PERFORMED DISSEMINATION ACTIVITIES*

This section provides a summary of dissemination activities during the Ovoshine project.

*GENERAL DISSEMINATION ACTIVITIES*

These include activities and tools developed by the consortium as a whole.

i. Press release

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At the beginning of the project the consortium prepared a press release that has been translated to the different languages of the consortium members (EN, NO, ES, HU, PT, FR, DE) and distributed among printed and online media channels. The document has been published on the project website as well: http://ovoshine.eu/kick-off-meeting-press-release/

As described in the DoW, demo sites, case studies and videos were produced and distributed (within the consortium) during the second period (see training section).

ii. Project website

Project website is operative since Month 3: www.ovoshine.eu. New items are posted on the website periodically to note events such as project meetings.

**Website statistics** collected using Google Analytics show a total of 623 visits made by 551 users to the OVOSHINE website since its launch. The average session duration (00:01:03) and the average number of pages per session (1.51) imply a depth of engagement with the website that goes beyond just a swift view of our homepage.

Examining the data on the geographic distribution of our visitors, we can see that around 20% of visits came from European countries such as: Spain (5.62%), Germany (4.33%), France (2.73%) and United Kingdom (2.73%). This data show that the partners have succeeded in creating exposure to the project website in their countries, especially INPROVO having reached almost 6% of OVOSHINE visits in Spain. Nonetheless, the SME AGs hope to considerably improve these statistics both in terms of numbers and length of visits, as well in terms of outreach to all European countries.

*iii. Standard project presentation*

Inprovo elaborated a standard PowerPoint presentation to have for different dissemination events. Moreover, this presentation was used for training activities for the first training activities to the potential clients as it is a good introduction of the OVOSHINE project.

The outline of this presentation entails:

1. The egg industry in Europe
2. About Ovoshine
3. Limitations of exciting technologies
4. Ovoshine Solution
5. Consortium presentation
6. Problem: Salmonella Egg Contamination
7. EU legislation and other requirements

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The presentation was updated during the second period of the project and can be used by partners also for post project dissemination activities.

*INDIVIDUAL DISSEMINATION ACTIVITIES*

Individual dissemination was and is still ongoing: press releases, fair exhibitions, publications, media briefings etc.

EXPLOITATION

The exploitation scenarios strongly depend on the final results of the RTD performers. Still, some optimization has to be carried out, e.g. test of long-term duration. Development of a working industrial unit could be expected earliest within 9-18 months after the end of the.

*FURTHER RESEARCH IF APPLICABLE*

The fields of application can be extend beyond the treatment of eggs for the OVOSHINE technology. Other food industries like the fruit industry, but also packaging industries may be interested. Moreover, further research on the hatchability of the treated eggs is necessary in order to convince the hatcheries to apply the technology. In particular process times and throughput should be individually optimized

*PROMOTION STRATEGIES*

As with all our new products that are produced and developed by DARO and OVOBEL, the OVOSHINE technology can be promoted through established channels.

*DISTRIBUTION CHANNELS*

DARO and OVOBEL products are available for direct sales at their establishments. This offers the advantage that technical issues can be addressed directly and solved together with the end-user. Prices are kept to a minimum through direct sales.

*BUSINESS MODEL*

Based on the previous information and the market study described in Deliverable 8.2, OVOSHINE partners completed a business opportunity analysis and cost-effectiveness evaluation by breaking down the potential direct benefits. First of all the potential market for OVOSHINE technology was calculated. In order to estimate the potential market for OVOSHINE technology, an estimation of target customers has been done for the different countries, based on the information facilitated by the SME AGs and other official sources such

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as the International Egg Commission. With the four countries, the total number of potential devices to be sold could range between 2732 and 5464 units which will be taken as potential expected market.

All project SME Associations, as joint owners of project results, will benefit directly from the profit deriving from sales revenues, estimated at more than 500k€ for each association in the first 5 years. Finally it is important to notice also the costs for sterilization per egg. Based on the device being able to treat 10.000 eggs per hour and depending on whether one or two shifts are run per day, costs shall range between 0.059 and 0.084 Cent.

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