DISSEMINATION ACTIVITIES

Project Website

Primary platform for public and consortium level communication. This platform has been developed and hosted by EFFoST and is described in Deliverable 9.1.

The domain name is www.musetech.eu

Figure 3.1 Homepage of the MUSE-Tech project website

The project website contains 2 domains:

The public domain: The public domain contains general information about the project objectives, on-going activities and dissemination events. The website will be maintained 3 years after the end of the project.

The private consortium domain (intranet): the private domain is only accessible to the consortium and the EC and hosted internal documents, reports, meeting summaries and served as information exchange and communication platform between partners. During the project Partners have decided to use Dropbox as tool to share project documents within the consortium as this tool is more user friendly than the intranet established on the MUSE-Tech website.

Promotional materials

Project Promotional Materials included items such as project logo, leaflets/brochures, powerpoint templates, pens and USB sticks. These promotional tools were used to support the dissemination and communication activities to inform the various stakeholders on the MUSE-tech project activities. This is further described in Deliverable 9.3.

Figure 3.3. Final MUSE-Tech flyer

Figure 3.4 MUSE-Tech pen, USB stick and cup.

Press releases

Press releases of the meetings and project outcomes have been produced by consortium partners to inform the stakeholders on the MUSE-Tech project activities. This has resulted in news items on various news website targeting the food industry, scientific community and general public. Publications have appeared in Spanish, Polish and French next to English.

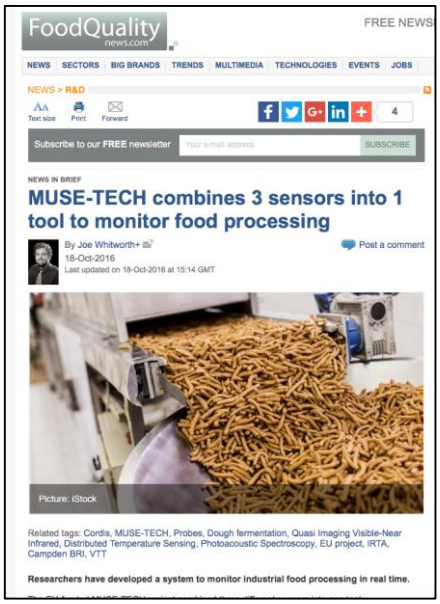


Figure 3.5 Article on MUSE-Tech on FoodQualityNews.com

Figure 3.6 Article on MUSE-Tech on StudentNews.pl (Polish)

Figure 3.7 Article on MUSE-Tech on Techno-Science.net (French)

Figure 3.8 Article on MUSE-Tech on Powder&Bulk Solids.

Some partners also published some articles in **internal magazines** like in the case of CBRI:

Figure 3.9 Articles on MUSE-Tech on the Campden BRI internal magazine.

Newsletters

MUSE-Tech activities have been disseminated through the EFFoST Newsletters, AnugaFoodTec quarterly newsletter. Additionally, the MUSE-Tech project will be further promoted by including articles on the results obtained in the final months of the project in upcoming EFFoST Newsletters.

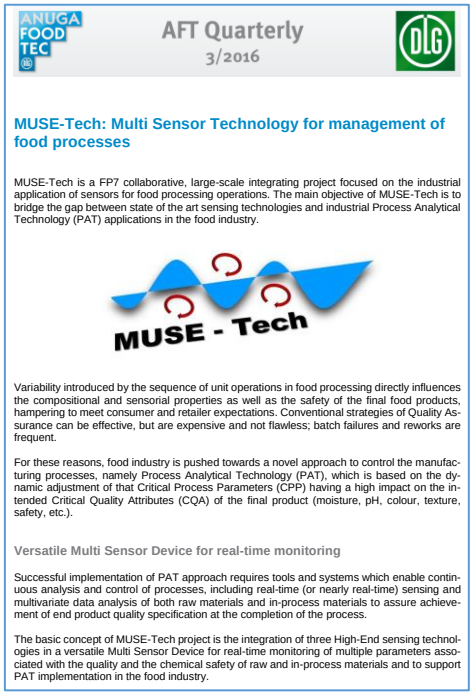


Figure 3.10. Example of MUSE-Tech project coverage (AnugaFoodTec quarterly newsletter).

Conferences and events

The MUSE-Tech project was promoted by consortium partners at a range of international, European and national conferences and events through presentations, stands, distribution of flyers and poster sessions. In the tables below and overview can be found of events that have taken place where the MUSE-Tech was showcased or promoted by project partners.

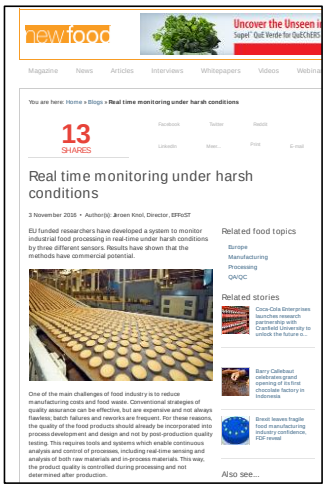
Table 1. Overview of past events/activities.

Event	Date & Location	Remarks
PITTCON 2014, Pittsburgh Conference on Analytical Chemistry & Applied Spectroscopy	March 2-6, 2014, Chicago, Illinois, USA	The MUSE-Tech project was highlighted by dr. Ismo Kauppinen, CEO of Gasera Ltd.
CEFood 2014, 7th Central European Congress on Food	May 21-24, 2014, Ohrid, Macedonia	The MUSE-Tech project was mentioned in the invited plenary presentation of dr. Jeroen Knol, director of EFFoST
IUFoST 2014, 17th World Congress of Food Science & Technology	August , Montreal, Canada	The MUSE-Tech project was mentioned in the presentation of dr. Jeroen Knol, director of EFFoST
JASIS 2014	Sept. 3-5 , Makuhari Messe, Tokyo	The MUSE-Tech project was highlighted by dr. Ismo Kauppinen, CEO of Gasera Ltd.
1st Congress on Food Structure Design	October 15-17, 2014, Porto, Portugal	The MUSE-Tech project was mentioned in the invited plenary presentation of dr. Jeroen Knol, director of EFFoST
10th Food Valley Expo	October 23, 2014, Arnhem, The Netherlands	The MUSE-Tech project was mentioned in a workshop headed by dr. Jeroen Knol, director of EFFoST
28th EFFoST International Conference	November 25-28, 2014, Uppsala, Sweden	The MUSE-Tech project leaflet will be included in the conference bag and the project will be showcased at the EFFoST stand. http://www.effostconference.com
ANUGA FoodTec	March 21-25, 2015, Cologne,	EFFoST had a stand and showcase the MUSE-Tech project. Project coordinator Massimo Castellari was as a speaker at this event to present the MUSE-Tech project. http://www.anugafoodtec.com/en/aft/home/index.php
NEEFood 2015, 3rd North and East European Congress on Food	May 20-13, 2015, Brasov, Romania	The MUSE-Tech project was mentioned in the invited plenary presentation of dr. Jeroen Knol, director of EFFoST. http://neefood2015.rosita.ro
Annual Campden Day	June 2015, Campden, UK	The Annual Campden Day is attended by senior staff from food and drinks companies. The MUSE-Tech project was promoted by a flyer detailing the project. https://campdenbri.co.uk/campdenbri-day.php
29th EFFoST International Conference	9-13 November 2015, Athens, Greece	The first MUSE-Tech workshop was held at this Conference. http://www.effostconference.com
CEFood 2016, 8th Central European Congress on Food	23-26 May 2016, Kyiv, Ukraine	The MUSE-Tech project was mentioned in the invited plenary presentation of dr. Jeroen Knol, director of EFFoST
Annual Campden Day	8 June 2016, Campden, UK	The second MUSE-Tech workshop was held in conjunction with this Annual Campden Day The MUSE-Tech project was promoted by a flyer detailing the project.
4th International ISEKI_Food Conference	6 - 8 July 2016, Vienna, Austria	The MUSE-Tech project was mentioned in the invited plenary presentation of dr. Jeroen Knol, director of EFFoST
18th IUFoST World Congress on Food Science & Technology	21-25 August 2016, Dublin, Ireland	The third MUSE-Tech workshop was held in conjunction with IUFoST 2016. The MUSE-Tech workshop was promoted by a flyer, and the general project flyer was distributed amongst conference participants.

Trade journals and magazines

The outcomes of the MUSE-Tech project have been published in leading trade journals and magazines, giving a wide exposure amongst experts in the food industry.

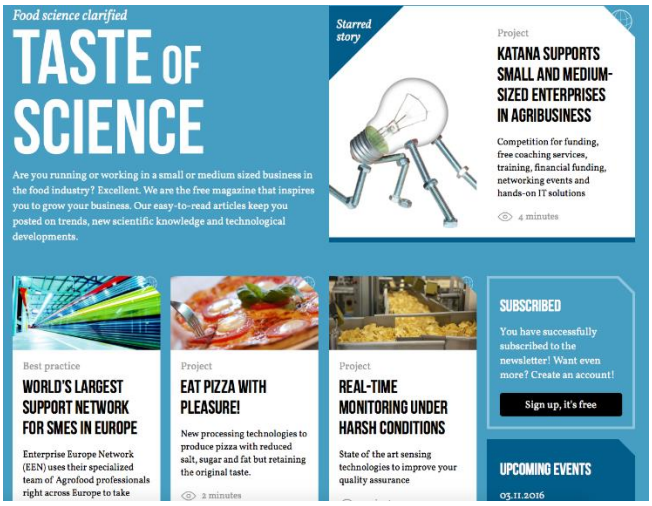
EFFoST also has a special relationship with trade journals, including New Food Magazine. New Food Magazine is the leading bi-monthly magazine and essential reading for anyone involved in the European food and beverage industry. New Food Magazine covers the major topics that impact on this sector, including food safety, packaging, hygiene, processing, legislation and analytical techniques. Leading industry experts write about new technologies and developments. The outcomes of the MUSE-Tech project have been published in this magazine with a reach of more than 13,000 food experts working in the food industry. They also promoted the article via their Twitter channel with more than 6,000 followers.



Online article about MUSE-Tech outcomes on New Food Magazine website.

Promotion of the MUSE-tech article in New Food Magazine via their Twitter channel.

EFFoST has developed a new SME oriented Food Processing Innovation Journal *called Taste of Science.* EU R&D project outputs rarely reach SMEs despite excellent dissemination activities, primarily due to the lack of in-house scientific expertise required to assimilate it. Taste of Science helps to overcome this by rewriting existing scientific papers into a more 'SME relevant' form. The outcomes of the MUSE-Tech project have been published in Taste of Science, which has over 7,000 subscribers.



Online article about MUSE-Tech outcomes on Taste of Science.

The MUSE-Tech project was also covered by Baking Europe, the definitive quarterly publication for the latest trends and innovation in the European bakery, confectionary and allied trades.

Publication in Baking Europe.

The MUSE-Tech project was also covered by Impact Magazine, a series of high-quality, open access and free to access science reports designed to enable the dissemination of research impact to key stakeholders. The publication features content from the world's leading research agencies, policy groups, universities and research projects. Impact is published under a CC-BY-NC Creative Commons licence.

The article will be distributed in printed and digital format in December to 35'000 readers worldwide and will be read by all major stakeholders within end users, private sector, universities, research institutes, national and regional funding agencies, policy, NGOs, government and public sectors - a full breakdown is shown below.

The publication will also be made available open access on IngentaConnect, the world's largest online scholarly resource (used in 30'000 research and industry libraries and with 1.5 million visits

per month), your article would also be deposited in the Portico repository and receive a CrossRef DOI. As a result of the distribution through IngentaConnect the article will also be available through Google Scholar, EBSCO Connect, Primo Central, WorldCat Discovery and Summon.

Food quality by design

*The **MUSE-Tech** project brings together a consortium of interdisciplinary institutions and companies from across Europe to develop new sensors for monitoring key stages in food processes. It is envisaged this work will ensure products like bread, beer and potato chips are perfect every time*

In an industrial food production plant it is simply not practical to consistently taste-test food, and as a result the quality of food produced industrially is often not assessed until the end of the process. This means that any mistakes, impurities or poor quality ingredients introduced earlier in the production are not noticed until it is too late. Ultimately, this leads to entire batches being thrown out and remade, wasting time, money and food.

The EU-funded MUSE-Tech project, which commenced in late 2013, has brought together companies and institutions from around Europe representing SMEs and RTD institutions that offer knowledge and experience that is not generally available at an individual country level. They are working to develop state-of-the-art sensors that can be integrated into a single Multi Sensor Device (MSD). These sensors can then be placed in-line and on-line in production to monitor critical processes. When coupled a distributed temperature sensor (DTS), which can gather information about the temperature of various points within the system, a quasi-imaging visible near-infrared (QIVN) sensor, and a photoacoustic sensor (PAS), which can detect volatile and non-volatile compounds. Software is also integrated into the MSD which uses experimental models and the sensors' measurements to predict the quality of the finished product.

Industrial food production poses particularly difficult challenges. The sensors need to be designed to work on-line, under particularly harsh conditions. To achieve this, the MSD, probes and data processing were designed to be robust enough to work in industrial conditions. Flexibility is also an integral aspect the of design of the MSD, as Project Coordinator Dr Massimo Castellari of the Institute of Agrifood Research and Technology in Barcelona explains: 'MSD prototypes are based on a potato chip frying. For the brewing process the sensors were developed to monitor the mashing and boiling processes. The QIVN signals were observed to change dramatically during the mashing and hop boiling, as the mixture changed colour. The PAS sensor was also able to detect volatile compounds given off during the process. The DTS was shown to be particularly useful in the boiling process. This is because the sediments in the system conduct heat poorly, so a distributed temperature system gives a clearer picture of the temperature profile throughout the boiler than a single thermometer.

In the bread-baking process the MSD was shown to successfully monitor the proving process. During proving, the dough is left in a warm humid chamber while the yeast ferments to produce CO_2, and causes the bread to rise. During the MSD test, the DTS detected small variations in temperature throughout the proving

Publication in Impact Magazine (1)

The MUSE-Tech has also been covered by non-English trade journals and magazines.

Czech magazine

Věda, výzkum a inovace ve VÚPS: Mezinárodní projekt MUSE-Tech

Partneři projektu:

M. Dienstbier, J. Škach, M. Slaby: Mezinárodní projekt MUSE-Tech - Experimentální testovací varné zařízení (International Project MUSE-Tech - Experimental Testing Brewhouse Device) Kvasny Prumysl, 2017, Vol 63, No. 1.

Spanish magazine

Industria alimentaria

Automática e Instrumentación — Septiembre 2016 / n.º 486

Sensores para el control de calidad

La interesante propuesta MUSE-Tech

En el marco del nuevo enfoque de la llamada *Process Analytical Technology* para el control de calidad en la industria alimentaria, se ha desarrollado un nuevo proyecto basado en un dispositivo multisensor que permitirá un control más eficaz del proceso y un aumento de la consistencia del producto, disminuyendo las no conformidades de los productos finales.

"Automática e instrumentación". M. Castellari - *Sensores para el control de calidad,* Setiembre 2016 / nº 486. 2-4.

EXPLOITATION RESULTS

The MUSE-Tech project reached some important objectives, demonstrating that sensors work quite properly under industrial conditions, and providing important statistical tools to model and adjust different food processes. The most interesting project results able to be exploited in a short/mid-term future would be:

- The implementation of 3 different tailor-made sensors capable to work and collect data under industrial conditions:
    - **DTS**: a very robust Distribute (*i.e.* multipoint) Temperature Sensor, worked properly for the three case studies at both pilot plant and industrial level. It allowed the monitoring of complex temperature profiles under harsh environments such as: i) in the prover during dough fermentation, ii) in the frying oil of continuous deep fryers, iii) in the lauter tun and in the copper/brew kettle during beer production.
    - **QIVN**: Quasi Imaging Visible-Near Infrared sensor, was designed to work at high speed and gather data simultaneously from different points of the process. Although the quality of the data needs some improvement, the QIVN provided satisfactory results under pilot plant and industrial especially in the case of the frying process.
    - **PAS**: the Photoacustic sensor has been positively tested for the bread process under pilot plant and industrial condition. PAS simultaneous monitored CO_2, Ethanol and Humidity in dough prover under real industrial conditions. For frying and brewing promising results were observed at lab or pilot plant scale, but further refinements to be implemented at industrial level should be performed.

- **Three Multi Sensor Devices** prototypes (MSD) were assembled and tested at pilot plant and industrial level in three case studies (bread production, fried potato chips and beer production).

- **Specific statistical treatments** of the raw data, carried out by applying with the most recent statistical tools, and **targeted software routines** and **user interfaces** are other interesting findings of the project. With specific data processing, it was possible to obtain suitable Vis-NIR calibrations to monitor on-line several parameters related with the quality and safety of raw potatoes and frying oil, as well as to monitor at-line flour and wort characteristics. The **Mathematical Models, developed to predict** the quality of the final product based on data gathered on-line by the MSD during the process, were other interesting result for the potato chips and beer case studies.

The main industrial sectors that could benefit from these results would be:

- Food industry, which can benefit from the novel tools to monitor the production processes on real time, and to gather relevant information to improve them. The implementation of the PAT strategy allows the food industry to ensure consistent levels of quality in the final product, reducing at the same time costs and wastes.
- Providers of sensing technologies: demonstration of novel sensing technologies in food processes could open new markets to the developers.
- Companies assembling food process equipment: they could design and commercialize innovative equipment with tailored MSD to monitor and control the specific food processes in the framework of the PAT strategy with a high degree of automation.
- Finally, the concept of a multi sensor device, capable of data fusion and equipped with predictive tools is conceptually transferable to other production process where PAT strategy could be relevant as Pharma and Biotechnology industries.

Exploitation of foreground has been described and agreed in the D9.7, which includes a list of identified exploitable results and the exploitation agreement signed by all the partners.

As an example of a relevant result, the DTS sensor has been proved to be enough reliable and effective to start the initial steps for its future exploitation and commercialization. Actually, the Consortium is carrying out negotiation with a technology producer interested in the industrial exploitation of this sensor.

Anyway, further research and development are needed, which will be especially focused on:

i) the design of robust and efficient probes to be coupled to the QIVN to monitor on-line critical medium as wort and dough during mixing;
ii) the improvement of the PAS sensor, which requires specific studies in frying and beer production;
iii) the refinement of calibrations and predictive models for the different case studies.

IMPACT

The MSD demonstrated a strong potential to help food makers achieve consistent levels of quality and reduce time costs and wastes. Anyway, it should be underlined that MSD concept and technologies developed (*e.g.* hot measurement cell from Gasera) could be also implemented in some other sectors such as the Pharma and Biotechnology industries.

MUSE-Tech will have a positive impact on European food industry, by providing innovative tools to boost the implementation of high technologies in different food areas (bread, potato chips, and beer). The Multi Sensor Device (MSD) will enable a more efficient control of the process and an increase of the product consistency, decreasing the nonconformities and the percentage of food waste. Even if in this moment estimations are difficult, it could be expected that the use of the multi-sensor devices would reduce waste and energy consumption in food processes, as well as oil use in frying process.

Results of the demonstration activities in different industrial sites under real processing conditions, shows the feasibility and flexibility of this innovative technology that, when fully developed, will offer a benefit to both food manufacturers and consumers.