General information	
PPP-number	DFI-AF-18019 formerly AF-15216
Title	Use cases 3D Food Printing (DFI)
Theme	Slimme Technologie
Implementing institute	WFBR (coordinator), TNO (subcontractor), Wageningen Startlife (subcontractor).
Project leader research (name + e-mail address)	Martijn Noort, martijn.noort@wur.nl
Coordinator (on behalf of private partners)	WFBR
Project-website address	**https://www.wur.nl/nl/Onderzoek-Resultaten/Onderzoeksprojecten-LNV/Expertisegebieden/kennisonline/DFI-AF-18019-Use-cases-3D-food-printing.htm**
Start date	01/10/2018
Final date	30/06/2020

Approval by the coordinator of the consortium The annual report must be discussed with the coordinator of the consortium. The "TKI's" appreciate additional comments concerning the annual report.	
Assessment of the report by the coordinator on behalf of the consortium:	x Approved ☐ Not approved
Additional comments concerning the annual report:	

Summary of the project	
Problem definition	Innovation in food and agriculture has come a long way in the past century, resulting in the production of more food than ever before. However, the food industry is facing new challenges due to rapid societal changes: in 2040 there will be 9 billion people to feed; there is an increasing demand for personalized, nutritious, and healthy food; and food production should be done in an affordable way without harming the environment. Radical innovations are required to meet the demands of the near future. 3D printing provides the food industry the opportunity to adapt and change. In order to accelerate and facilitate the application of 3D food printing processes in the food industry, we assist a group of food industrial partners to define use- and business cases using 3D printing, along with gaining initial practical experiments based on WFBR/TNO state of the art 3D printing facilities.
Project goals	The aim of the project is to create use-cases for targeted 3D printed food applications to evaluate the possibilities of 3D printing to stimulate innovations in the food industry that contribute to sustainability and health. The use cases focus on 3D printed food products with added value over conventionally mass produced foods, in terms of product properties, process flexibility, consumer experience and/or level of personalization. Some of the possible application areas are personalized nutrition and specific applications in food service and retail. Together with the industrial partners we will build knowledge on the value of 3D printing as a food manufacturing process to create innovative food product concepts and the

	added value of this new technology in the value- and supply chain as well as extending consumer interactions.

Results	
Planned results 2019	In this project, 4 pilot studies with industrial partners will be conducted, to study the feasibility and added value of 3D food printing, as well as the new business models and commercial opportunities it offers to the food industry. The aim for 2019 was to complete these 4 pilot studies successfully.
Achieved results 2019	The workshop format for efficient dissemination of the 3D food printing expertise of WFBR/TNO, which was developed in 2018, was successfully applied in the first pilot studies 1 and 2. These pilots have been completed, and pilot study 3 has been started. Pilot study 1: Lamb-Weston/Meijer - 3D printing as innovative process for manufacturing potato products. Pilot study 2: Savanne Brossard - 3D printing as innovative process for creating personalized bakery products. Pilot study 3: GoodMills Innovation - 3D printing of personalized nutrition based on special grain fractions with biological functions. Pilot study 4: t.b.d. we are currently discussing with multiple partners. The workshop format used to provide the state-of-the-art of print technology and its possibilities for food manufacturing consists of the following elements: • 3D (food) printing, equipment, current commercial applications and (future) upscaling; • Materials and formulations for 3D food printing, material requirements and innovation opportunities of 3D printing in product design, i.e. structure, sensory, health. • Shaping, software and design rules, consumer interfaces, etc. Furthermore, we organized business case modelling workshops in collaboration with Wageningen Startlife using their "Accelerated adoption of Innovations"- toolset. Finally, we aim to organize interactions and synergy between the industrial partners of the consortium as well as other relevant companies, to form an ecosystem of companies. As the pilot studies didnt run in parallel, we already organized a first consortium meeting for the first 2 partners, and will continue this process in 2020.
Planned results 2020	In 2020 pilot study 3 will be completed and together with a 4th industrial partner also the last pilot study will be conducted. By organizing a consortium meeting and further discussions, we will explore the synergy between the consortium partners as well as other relevant companies. In these sessions we will map their mutual required technology developments and how this could be approached. This could for instance lead to a shared research and development program. Finally, WFBR and TNO will actively dissiminate the gained knowledge as well as the benefits of the approach of this consortium project by means of writing a white paper, articles in professional journals and presentations at symposia and industrial exhibitions.

Deliverables/products in 2019 (provide the titles and /or a brief description of the products/deliverables or a link to a website.

Scientific articles:

External reports:

Articles in professional journals/magazines:

Martijn Noort (2019) L'IMPRESSION 3D ALIMENTAIRE, proceedings of Futur du pain, pains du futur et autres aliments céréaliers, in ALVÉOLES 47 (Juin/Juillet) p29-31

Martijn Noort and Kjeld van Bommel (2019) 3D food printing way beyond fancy shapes, Baking Europe, Summer 2019, p18-22

(Poster) presentations at workshops, seminars, or symposia.

Martijn Noort (2019) Powder based 3D food printing technologies, key note presentation at International Symposium "Additive Manufacturing" (ISAM) 2019, January 31, Dresden, Germany

Martijn Noort (2019) 3D food printing, invited presentation at Futur du pain, pains du futur et autres aliments céréaliers, 7 February 2019, Paris

Lu Zhang, Martijn Noort, Maarten Schutyser (2019) 3D Printing of Foods with Desired Functionality towards Personalised Nutrition, invited presentation at Symposium on Designing Food Structure to Control Digestion and Improve Health Impacts, 11-14 March 2019, Grasmere, United Kingdom

Martijn Noort; Kjeld van Bommel and Esmee Doets (2019) 3D printing of personalized nutrition, poster at EFFoST International Conference, 12-14 November 2019, Rotterdam, The Netherlands

TV/ radio / social media / newspaper:

Interview in: Romy de Weert, Een 3D-printer op je aanrecht, www.oneworld.nl/food, 12-03-2019

Interview in: Harry van Brandenburg, Samenwerkingsverband DFPI vergroot mogelijkheden 3D-foodprinting, VMT 12 dec 2019.

Remaining deliverables (techniques, devices, methods, etc.):

https://www.wur.nl/en/Research-Results/Themes/Nutrition-Health/Food-innovation/3D-food-printing.htm
https://www.wur.nl/nl/Onderzoek-Resultaten/Onderzoeksprojecten-LNV/Expertisegebieden/kennisonline/DFI-AF-18019-Use-cases-3D-food-printing.htm