Northern Lights on Food – *A center to build up the competence towards a sustainable and competitive food system*.

Food is a complex material consisting of proteins, lipids, polysaccharides, and minerals. The food processing and composition results in a structure that together with the chemical make-up codes for the properties. The structure of foods is often heterogeneous, hierarchical, and multiphase, evolving during processing and storage as well as during digestion in human gastrointestinal tract. Structures at different length scales ranging from sub-nanometer up to millimetres cooperate and determine the texture, shelf-life, taste, appearance, mouthfeel, safety amongst other things of the food. Furthermore, the relation between food structure and nutritional value and health benefits are not fully understood. Consequently, it is of utmost importance to be able to characterize food structure at different length scales and the spatial distribution of different food components during structure evolution as well as in its final form. This is necessary to enable us to design new healthy and attractive products, and to optimize processing and formulation in a way that can reduce energy consumption, production time and waste providing a more sustainable food supply chain.

The full understanding of the complexity of food and food processes requires a combination of techniques and a new toolbox with unsurpassed spatial, chemical and time resolution. In this respect Sweden in collaboration with European countries have made large investments in building and development of large-scale research infrastructures (LSRI), MAX IV and ESS with unprecedented opportunities for materials and life sciences. There is now an opportunity to bring leading investigative tools and to attract scientific talent so that major challenges in the food industry and in food science and technology are addressed. This can ensure that Sweden is world-leading in a future industry sector that is driven by a sustainable process technology and supply chain. While the facilities offer advanced technologies for the study of matter it is necessary to build up competences for the use of these techniques also in the food science and food industry sector. The facilities also need to access competence from the food sector to develop proper analysis tools and sample environments that a necessary for food related research. The Northern Lights on Food center aims to support basic and applied food research by enabling researchers in the food field to take full advantage of the new research tools provided by ESS and MAX IV in Lund. The center will bring industry, academia, and institutes as well as other stakeholders together to strengthen needs-driven research and create environments that promote innovation in the food system through the use of advanced techniques and unprecedented understanding of food structure in relation to function. This unique knowledge on food structures, texture and interactions will give new ways for sustainable food products that will satisfy consumer demands regarding, e.g. texture, sustainability, taste, appearance, mouthfeel, health benefits and safety.

The work will be organized in four overarching themes that are well-aligned with the Swedish national strategic research agenda: "Towards a sustainable and competitive food system", and are defined as:
- **The structure of taste and sensory perception**
- **Food and Health**
- **New food products and processing for improved functionality & properties**
- **Food and Environment**

The Northern Lights on Food Center (NLF) will be focused on competence building in the areas were the LSRI can provide research of highest scientific quality while at the same time meeting the needs of new knowledge in the business sector, to enable a transitioning to a sustainable and competitive food system. With this in mind, the partnership is dedicated to be
- *Inclusive and interdisciplinary – academia and industry together*
- *Fundamental and applied research together*
- *Open and inclusive both in terms of ideas and partners*

The planned activities will include the training of both PhD-students and Postdoctoral fellows shared between the involved organizations and industrial partners. The center will also include smaller exploratory projects that can reduce the threshold for a larger industrial involvement as these types of projects have incited greater industrial use of LSRI techniques[1]. The center will also put a great focus on networking and outreach activities and will organize yearly courses (Masterclasses) inclusive of both industry and academia. The NLF organized Masterclasses will also be provided to the graduate school LIFT.

The engagement of industry and other stakeholders is crucial already when defining the research questions that will be the initial focus of the center. So far, a positive response for active involvement in the NLF center has come from companies including TetraPak, Lantmännen, Orkla, Findus, AAK, Ikea, and Aventure as well as other important centers such as ScanOats.

The NLF center currently involves key actors in academia/institutes in food research that apart from several groups organized in Food Faculty at Lund University, Chalmers, SLU, RISE as well as the Food industry organization "Livsmedelsföretagen".

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[1] https://www.vinnova.se/m/storskalig-forskningsinfrastruktur/industriell-anvandning-MAX-IV-ESS/