Objectives

Data-driven innovations are transforming our economy and society. They reshape the way we produce, consume, and share food. Changes are fast and profound. Benefits of data-driven food innovations are expected in every aspect of our lives, ranging from more personalized and healthy diets to more transparency about the food we are offered and more customized, local and sustainable food production (EU, 2020). While these changes are promising, the **digital transformation of food systems nevertheless entered a twilight zone**: data-driven innovations do not concur in food in Europe as quickly as expected and it is unclear how their broader integration (in an inclusive and responsible manner) can be realized in a variety of food system contexts across the EU (Wolfert *et al.*, 2021). As presented in Figure 1, this twilight zone is situated at the present point of development where Food Systems, supported by data-driven innovations and Data Platforms, are expected to transform into a Food Data Economy grounded in Data Spaces (EC, 2021a). But whether this happens and how fast, will depend on encompassing technological and social developments, which are closely intertwined. There is a **need for design principles and a clear roadmap** towards fair, inclusive data spaces which support sustainable Food Systems in Europe.

Several initiatives are undertaken at present to get past the twilight zone and foster a Data Economy for Food Systems (DE4FS). The International Data Space Association aims to guarantee data sovereignty by an open, vendor-independent architecture for a peer-to-peer network which provides usage control of data from all domains (IDSA, 2021). A specific **Agricultural Data Space is planned** to be developed (ADS, 2021), while a first reference architecture of smart farm management systems relies on a 'system of systems' vision aiming at breaking the silos of information associated to the several vertical smart solutions, information systems and connected devices (FIWARE, 2018). In the GAIA-X project representatives from politics, business and science in the EU create a proposal for the next generation of a data infrastructure for Europe as a secure, federated system that meets the highest standards of digital sovereignty while promoting innovation (GAIA-X, 2021). The European Commission has also proposed a **European partnership "Agriculture of Data"** to be set up under the Horizon Europe Programme, which will also benefit food systems (EC, 2021c).

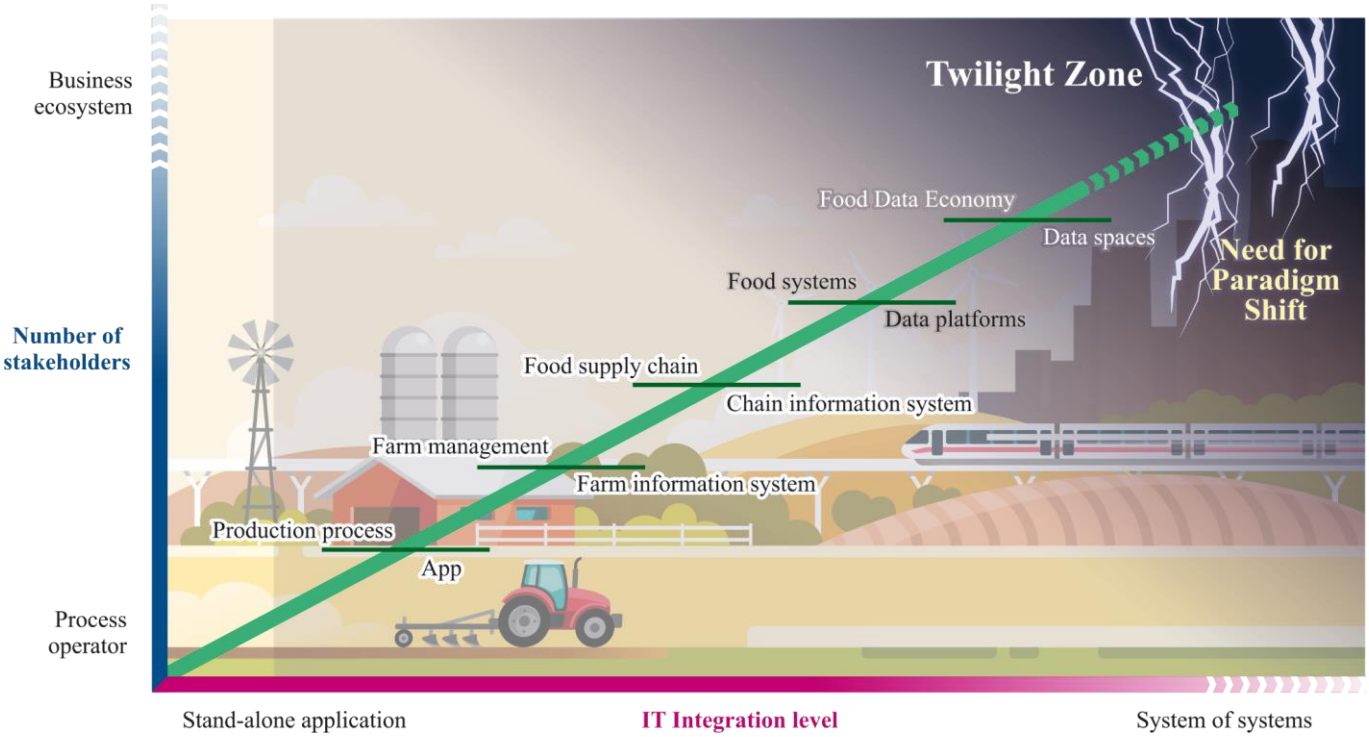

Figure 1 The evolution of IT in agri-food along two axes of integration level and number of stakeholders currently moving into a twilight zone that requires a paradigm shift to properly navigate through.