

**Title:** Developing a digital twin for strategic decisions at the farm scale

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**Abstract:**

Process control and system management in farms are subject to specific characteristics causing complex challenges. They require the targeted use of spontaneously occurring, stochastic natural processes with incomplete information on the process status, limited predictability, a wide range of response times from real-time to long-term reactions and a wide variety of alternatives for action. Digital twins offer the potential to meet these challenges. They provide high-resolution information about the processes, obtained with modern sensors and processed with innovative methods, generate model-based predictions of future process states and realise automated reactions or recommend options to human actors. Collecting and analysing the data over longer periods, they can also contribute to deeper process and system understanding. At current, process control in farms by digital twins is in its infancy and their development mainly directed towards direct coupling with technical facilities and the operational level. The goal of this research project is to develop a digital twin that can support strategic management and medium to long-term decisions at the farm scale. The concept should be flexible and allow for the integration of different modules for typical farming activities, such as arable field production or animal husbandry, within a digital representation of the farm. The digital twin development can take advantage of existing units at the Leibniz-Innovationshof for use as physical object.

**Desired skills of the applicant:**

Required: Agricultural engineering; systems analysis and assessment of agricultural systems

Optional: Mathematical modelling; Programming

**References:**

Nasirahmadi A, Hensel O (2022): Toward the next generation of digitalization in agriculture based on digital twin paradigm. *Sensors* 22, 498, <https://doi.org/10.3390/s22020498>.

Purcell W, Neubauer T (2023): Digital Twins in Agriculture: A State-of-the-art review. *Smart Agricultural Technology* 3, 100094, <https://doi.org/10.1016/j.atech.2022.100094>.

Pylaniadis C, Osinga S, Athanasiadis IN (2021). Introducing digital twins to agriculture. *Computers and Electronics in Agriculture* 184, 105942. <https://doi.org/10.1016/j.compag.2020.105942>.

Verdouw C, Tekinerdogan B, Beulens A, Wolfert S (2021): Digital twins in smart farming. *Agricultural Systems* 189, 103046, <https://doi.org/10.1016/j.agry.2020.103046>.