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# Determinants of farmers' adoption of field robotics and drones: a systematic review

## Context / theoretical background / research questions

Sustainable development goals are under pressure due to the increasing world population (Godfray et al., 2010). The development and use of new technologies, like sensors, robotics and the Internet of Things, are rising to decrease the environmental footprint of agriculture (Araújo et al., 2021; Dayioglu & Turker, 2021). In literature, this phenomenon is called "Agriculture 4.0" (da Silveira et al., 2021). Since Agriculture 4.0 is a very broad concept, this study will only focus on drones and robotics. Robotics and drones can be used for many agricultural tasks like soil preparation, sowing, plant treatment, and crop monitoring (del Cerro et al., 2021; Oliveira et al., 2021). Their use can have economic and environmental benefits, for instance, reducing labour costs for farmers, reducing the amount of agricultural inputs, and mitigating soil compaction due to heavy machinery (Aravind et al., 2017; del Cerro et al., 2021; Sparrow & Howard, 2021). Even though the benefits of using robotics and drones are clear, the actual adoption of these machineries remains low (Dayioglu & Turker, 2021; Klerkx et al., 2019; Lowenberg-DeBoer et al., 2020). This study aims to get an insight into farmers' readiness to adopt drones and robotics and to identify the determinants of the adoption.

## Methods

A systematic review method was used to explore farmers' readiness to adopt drones and field robotics. The initial search for relevant articles was done through Web of Science and identified 313 articles. Subsequently, all articles were screened based on title, abstract and full-text reading; and a final dataset of 19 papers was retrieved. Data related to methods and results were extracted from this list of papers.

## Results

The use of drones and robotics is still limited in current agricultural practices. However, farmers seem to be interested in these technologies. Both internal (factors related to farms or farmers) and external (factors related to farmers' environments) factors were identified in this study. The most important internal factors are gender, age, farm size, income, expected benefits, perceived ease of use and attitude of confidence. The price of the technology, availability of labour and compatibility with other machinery were identified as the most important external factors. Both quantitative and



qualitative methods were used in the studies identifying the factors affecting the (intended) adoption of drones or robots. Surprisingly, only a limited number of studies employed an existing theoretical model.

## Conclusions

This review highlighted the potential of field robotics and drones. Furthermore, internal and external factors affecting the (intended) adoption of these technologies were identified. The results from this review are important for scientists, policy-makers and the machinery industry.

## Literature

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