Delphi forecasts for adoption of precision agriculture enabling technologies in Swiss outdoor vegetable production

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Introduction

Precision agriculture enabling technologies are a promising mean to tackle the increasing global challenges (e.g. climate change, water pollution, soil degradation) and revolutionising agricultural production. In Switzerland, vegetable farming had the highest level of technology adoption in the plant production sector in 2018. Building on this knowledge, we conducted a two-stage Delphi study to identify the key drivers and barriers, the most promising technologies and possible measures to support technology adoption.

Method: Delphy Survey

Expert selection	Round 1	Round 2
34 Experts • Farmers, contractors • Input suppliers • Intermediates • Research • Advisory	30 Experts • Online survey • ca. 30 minutes • Open-ended questions	26 Experts • Closed-ended questions • Feedback from previous round

Figure 1: Experiment design for the 2-round Delphi study

The Delphi method aims to achieve a convergence of opinion and follows four main criteria:
- Delphi experts are anonymous, their identity remains unknown to the expert panel
- A series of rounds is conducted to offer experts the possibility to modify or reconsider their statements
- Experts receive controlled feedback summarising the results of the previous round
- The Delphi moderator summarises the results as statistical group response using measures of central tendency (e.g., mean, median)

Results and Discussion

More than 50% of the experts identified *GPS and RTK*, *robots and autonomous machines*, and *camera technology and image recognition* as **promising technologies.** Drones seem to play a minor role in vegetable farming.

As **promising applications,** more than 50% of the experts named *weed control and hoeing* as well as *data collection and monitoring*.

Experts indicated the highest **rates of adoption** for irrigation and hoeing (Figure 2), possibly as a result of climate change and increasing pressure to reduce plant protection.

When we asked about drivers of technology adoption, 88% of the experts named *resource saving* as an important **driver.**

In terms of **barriers,** more than 50% of the experts named the *high technology costs* and that *technologies were prone to failure or not sufficiently mature.*

As possible **solutions** to overcome these barriers, experts identified *educational offers* and *financial support*.
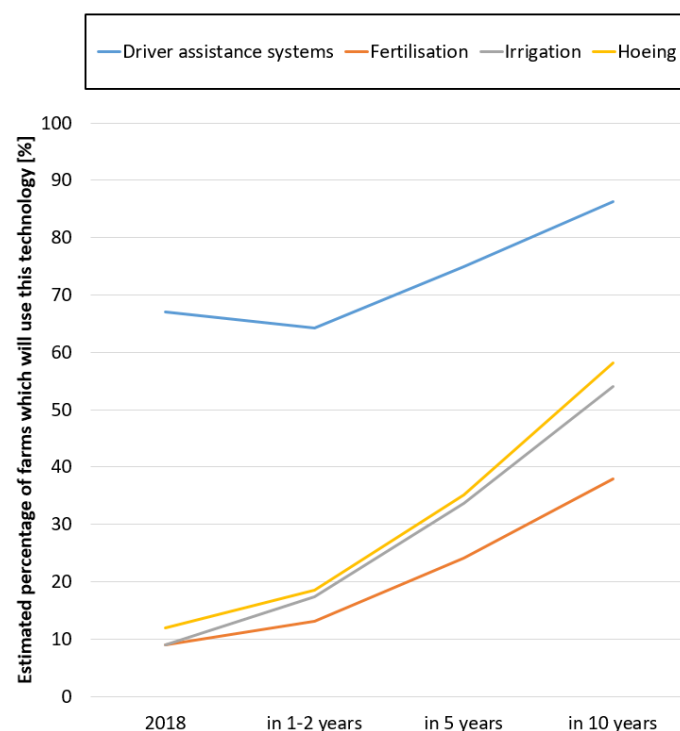

Figure 2: Experts' prognoses for technology adoption

Conclusion
Increasing practical relevance emerged as promising measure to help technology adoption. We further identified a pronounced demand for financial support to overcome the costs barrier. Training and advisory support can help build more practical relevance and support farmers in technology adoption.

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