

Digitalisation of fruit production in Germany

This policy brief presents the results of stakeholder interviews and workshops conducted in the Living Lab (LL) of the Lake Constance region. The guiding question of this LL was **"How can digitalisation contribute to sustainable fruit production by 2031?"**

In this context, two scenarios were elaborated. The "Better but not best" (BnB) scenario assumes high availability, acceptance and implementation of digital fruit production technologies with positive socio-economic impacts but low environmental improvements. The "Bad but not worst" (WnW) scenario assumes low availability, acceptance and implementation of digital fruit production technologies with negative socio-economic impacts and environmental benefits.

Four policy measures required to harness the potential of digitalisation for sustainable development in fruit growing have been identified: (1) Holistic and independent evaluation of individual and overall digital solutions, (2) improving the applicability and affordability of digital solutions in family farms, (3) developing a legal framework to regulate data security and data sovereignty, (4) developing digital infrastructure in rural areas, and (5) promoting digital skills.

CONTEXT

The most popular fruit among German consumers is the apple. Every fourth apple consumed in Germany comes from the Lake Constance region. It is one of the largest fruit-growing areas in Germany. Consumers want high-quality and healthy apples. They should always look the same and be available freshly harvested all year round. At the same time, they should be cheap, environmentally friendly and produced regionally. Due to these different consumer demands, family fruit farms in the Lake Constance region are faced with ecological, socio-economic and structural challenges. The biggest are the availability of reliable and cheap seasonal labour, the need to reduce pesticides and maintain biodiversity, and weather extremes due to climate change. These challenges put pressure on family farms to adapt their current practices. Digitalisation is seen as a promising development to address these challenges. Among others, autonomous driving tractors, spraying drones and fruit harvesting robots are being tested for their applicability. The current main needs identified by the Living Lab (LL) Bodensee can be summarised as follows:

1. More sustainability and regionality in fruit production through digitalisation.
2. Develop laws and standards for compatible, reliable and secure management and storage of sensitive data and information while respecting property rights.
3. Improve access to easy-to-use and affordable technologies for automated and accurate management and monitoring of fruit production for family farms.
4. Expansion and improvement of infrastructure for high-quality data access in rural areas.
5. Promote digital literacy and lifelong digital education for fruit growers and their advisors.

The main policy measures identified in the Lake Constance LL to achieve these goals are (1) supporting the development of digital technologies that are adaptable and applicable to family farms and (2) strengthening digital infrastructure and skills for sustainable, fair and affordable regional fruit production by family farms.

RESEARCH APPROACH

The aim of the LL Bodensee was to anticipate possible developments in the next decade. The focus was on different transformation paths that integrate the expectations, concerns and knowledge of stakeholders and decision-makers and offer food for thought and discussion.



THE LL BODENSEE SHOWS HOW DIGITALISATION CAN CHANGE REGIONAL FRUIT PRODUCTION ON FAMILY FARMS OVER THE NEXT TEN YEARS.

The LL Bodensee conducted an online scenario workshop in November 2021. There, the drivers of digital change and different future paths were identified and the narratives for different scenarios were developed. The scenario guiding question of the narratives was: **How can digitalisation contribute to sustainable fruit production by 2031?** The workshop participants identified two main scenarios characterised by different plausible developments of the socio-economic, ecological, political and technological influencing factors. In addition, two extreme scenarios relating to "utopian" and "dystopian" visions were presented.

DEVELOPED SCENARIOS

The workshop participants developed scenario narratives based on two intermediate scenarios. These included the "Better but not Best" (BnB) scenario, which considers high availability, acceptance and implementation of digital fruit production technologies with positive socio-economic impacts but environmental drawbacks. The "Worse but not worst" (WnW) scenario assumes low availability, acceptance and implementation of digital fruit production technologies with negative socioeconomic impacts and environmental benefits.



In the BnB scenario, the needs of family farms are taken into account in research and development. They can choose between different cost-effective technologies. The cost-benefit ratio of digitalisation improves and fruit farms can reduce the need for seasonal labour and increase the attractiveness of their family farms for farm successors, which facilitates the continuation of traditional fruit farms. Digitalisation can reduce the need for pesticides, promote biodiversity conservation, and improve the image of fruit growing and the regional attractiveness for local recreation and tourism.

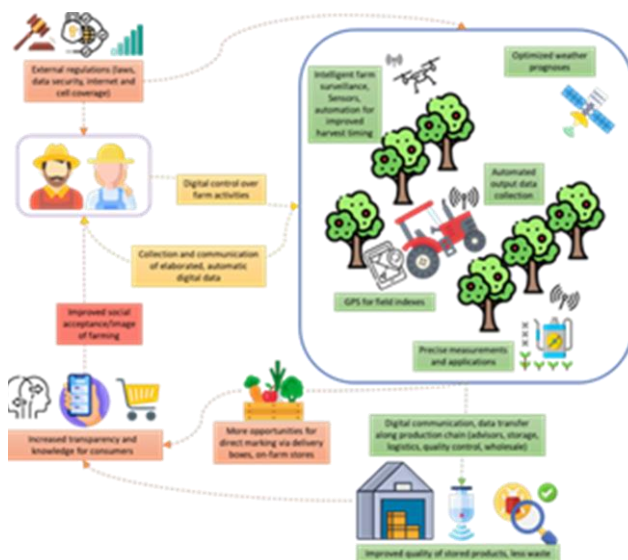
In the WnW scenario, digitalisation is rejected due to concerns about data sovereignty and security, but the farms are partly forced to digitalise by the market. Another concern relates to the negative image of industrialised fruit production away from nature, with negative effects on the landscape, local recreation and tourist appeal. Family farms are being left behind by digitalisation, as the acquisition of skills is expensive and time-consuming. Biodiversity continues to decline due to high-tech cultivation and increased interventions to protect production from climate-related weather influences. Digitalisation on family farms is not economically viable due to the high costs, even with state support, as this is too low.

POLICY RELATED DISCUSSION

During the LL workshop, stakeholders were encouraged to identify policy actions based on the following questions: **"What actions would need to be taken if we want to benefit from plausible future opportunities or mitigate risks that the future might bring?"**

Later, participants considered whether the policy measures and ideas from the BnB scenario would also be effective in the WnW scenario and vice versa. As a result, policy recommendations were identified, whose are potentially effective for both scenarios since they promote opportunities in the BnB scenario and mitigate the risks in the WnW scenario.

A key measure is political support for flexible technology development adapted to the needs of family farms. These include the promotion of cooperative cross-farm digitalisation approaches and independent advisory facilities for family farms. In both scenarios, an improvement of the digital infrastructure and the competence and service network in rural regions is required to enable continuous and high-performance data transmission and high-quality digital applications.



There is uncertainty about how family farms can benefit from digitalisation. It is hoped that digitalisation could help to optimise the processes of sustainable fruit production with high quality and low labour and environmental impacts, while at the same time taking into account societal goals such as the preservation of biodiversity and the recreational value of the landscape.

One of the biggest challenges in both scenarios is to improve standardisation, management, security and sovereignty of the collected data and sensitive information in order to overcome the scepticism of fruit growers towards digitalisation.

In both scenarios, family farmers are threatened by the high demand and rising minimum wages for foreign seasonal workers for fruit harvesting and the associated bureaucratic burden. However, the digital technologies developed do not always meet the expectations and requirements of family farms.



PRIORITY IS GIVEN TO IMPROVING THE DIGITAL INFRASTRUCTURE AND SKILLS OF FAMILY BUSINESSES AS WELL AS PROMOTING THE COOPERATIVE USE OF DIGITALISATION SERVICES.

Decision-makers in politics, administration and business should develop well-resourced and suitable support measures and facilitate investment in the digitalisation of family businesses.

The image of fruit farms could improve if process-related environmental impacts in orchards are reduced through digital technologies.



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POLICY RECOMMENDATIONS

Holistic and independent evaluation of individual and overall digital solutions

- We recommend an inter- and transdisciplinary technology development with experts, stakeholders and practitioners to assess the advantages/disadvantages and applicability of individual technological solutions as well as a coherent overall system and its integration into cooperative structures from a techno-economic, legal, ecological and social perspective. This concerns sensor-assisted apple harvesting robots, autonomously driving tractors for crate transport, mini-drones for monitoring and maintaining the plant stock and for preserving biodiversity.

Improving the applicability and affordability of digital solutions in family businesses

- We recommend supporting the development of technologies and new concepts to improve the applicability and affordability of digital technologies for family farms, in order to prevent a technological push from "outgrowing" them and accelerating structural change.

Development of a legal framework to regulate data security and data sovereignty

- We recommend the development and improvement of legal and regulatory tools to promote an ethically responsible and standardised approach to the values and requirements of family businesses in the areas of data protection, cyber security and artificial intelligence. This should actively address their concerns about losing control over data sovereignty, data and process management and independent management competencies.

Expansion of the digital infrastructure in rural areas

- We recommend a rapid expansion of broadband access in rural regions as a prerequisite for the digital collection and analysis of data and process control. Without a fast and reliable internet connection, family farms in their sometimes remote orchards cannot take advantage of the opportunities offered by digitalisation.

Promotion of digital competences

- We recommend improving the digital skills of family businesses through government support for education and training, and supporting the use of professional and independent digital advisors.

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