Possible directions for the European agri-food industry

Currently, thanks also to the European Green Deal, two directions are emerging for European agri-food development: one is digitalisation and the other is further greening. While digitisation solutions can help to improve efficient production and food safety in organic farming, digitisation is primarily about the diffusion of digital technologies. These are expected to increase production efficiency, thus optimising costs and income, and reduce environmental impacts (Lioutas et al, The development of technology would therefore also serve to achieve environmental, economic and social sustainability, similar to Industry 4.0, with which many parallels can be drawn, and which many have modelled on Agriculture 4.0 (Liu et al. 2021).

Alternatively, a more ecologically oriented development pathway, called 'ecologisation', can be identified on the basis of literature examples (Maraux et al., 2013; Schnebelin et al., 2021), which aims to spread agricultural production practices that aim at regenerating ecosystem services, thus going beyond the objectives of greening and digitalisation from an environmental point of view (Schnebelin et al., 2021; Simoniello et al., 2022).

However, both development directions can be associated with pro and con arguments based on the results of previous research. For example, the yield of organically produced cereals in Europe is 30-40% lower than that of conventionally grown cereals (Paarlberg, 2022). In particular, there is a higher variability in yields based on model calculations when crops (e.g. To avoid this, farmers will have to pay even more attention in the future to the selection of resistant crop varieties that can adapt to changing climatic conditions.

In the context of Agriculture 4.0, it can be highlighted that the shift to digital technology has the potential to eclipse equity concerns that emphasise both environmental and social aspects, further increasing existing inequalities between farmers with different farm sizes (Galli et al., 2020; Klerkx - Rose 2020; Rijswijk et al., 2021). Although digital technologies and the collection of different agricultural parameters promise efficient production with optimized resource use, a "digital divide" can be observed in Hungary, which results from unequal knowledge ownership related to the use of technologies. It should also be mentioned that the environmental benefits of precision agriculture, which makes maximum use of the potential of digital technologies, lie not in the ecological use of cultivation, chemicals or the varieties used, but in the precise application of plant nutrition, crop protection or irrigation, which is tailored to the needs of the crop. Another controversial issue in the international literature is the impact of technological developments on the labour market, which also affects the quantitative and qualitative aspects of human resource requirements. Furthermore, the differing characteristics of production units and sectors are not independent of the differing economic activities of individual technologies (Scuderi et al., 2022). In Hungary, there is a clear tendency to improve the digital skills and equipment of those involved in agriculture, but the gap in terms of knowledge and equipment, especially for small and medium-sized farms, is still not negligible. Another sensitive issue is the management, storage and use of the large amounts of data generated by digitisation, which is not only a computational problem but also requires the development of a legal framework (Ferrag et al., 2021; Fraser, 2022).

It is also worth pointing out that, alongside crop production, livestock production is generally less discussed in the context of sustainability. The literature focuses mainly on the sector's

negative impact on GHG concentrations (Garnett, 2009). However, in recent years, several studies (Martin et al. 2020; Gill et al. 2018; Sundrum, 2001; Prudhomme et al. 2020) have highlighted the impact of livestock production on the environment that support the beneficial environmental effects of extensive livestock production (such as providing ecosystem services, increasing biodiversity, improving carbon and nitrogen cycles) and linking social and economic benefits to livestock production (Bassignana et al, 2022).

CAPTIVATE project, funded under the Erasmus + program of the European Union, is dedicated to knowledge transfer and vocational training of farmers and agricultural advisors related to the current EU strategic lines, such as the Green Deal, Farm to Fork Strategy and Organic Action Plan. One of the CAPTIVATE's main objectives is that farmers better understand conditionality, eco-scheme and rural development regulations, they choose and participate in the certain schemes with more responsibility and awareness, carrying out the new CAP measures more effectively.

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