DIGITAL TRANSFORMATION
OF FOOD & FARMING

KEY DIGITAL TRENDS

AUTOMATION
Automation technologies such as artificial intelligence and robotics are expected to change or replace some jobs while at the same time create new occupations that require a different set of skills. In agriculture, automation can increase the productivity by reducing the need for human workforce in operating vehicles, completing specific tasks (e.g. harvesting, weeding etc) or automating parts of the production process. According to one of the scenarios, Germany might face a 30% reduction in agricultural employment by 2030 due to automation.

CHANGING AGE STRUCTURE OF THE FARMING POPULATION
Europe’s farming population is ageing: 59% of farmers are 40-64 years old and only 6% of holdings manged by farmers under 35. This trend has implications for the uptake of the emerging technologies that require new skills as well as the ability to invest in the upgrade of the equipment which the young farmers often struggle with. In Romania, over two-thirds of the farmers are above 64 and a high percentage of Romanian youth is not in education, employment and training.

CORPORATE CONSOLIDATION
The Big Three companies (Bayer-Monsanto, Corteva and Syngenta-ChemChina) currently own over 75% of the global agricultural input markets and a number of tech companies (e.g. Alibaba, Amazon and Google) are moving into the agricultural sector. At the same time, the agri-food giants are buying the emerging agri-tech start-ups that provide data analytics platforms and services to ensure the control of the big data.

DATA ACCESS AND OWNERSHIP
One of the consequences of corporate consolidation is the spread of corporate-owned digital platforms that allow the farmers to upload their data and get the analytics and decision-making insights in return. While farmers get access to cloud computing and data exchange, they often trade in the ownership over their data for the ease of access to the platform. This trend might lead to a lock-in of farmers to specific digital platforms and service providers.

HIGH INVESTMENT COST AND LOW RATE OF ADOPTION
New technologies are not (yet) affordable for many farmers - the cost of a precision tractor could be as high as 440 000 – 900 000 euro. The low adoption rate of the new technologies among European farmers is linked to the household income levels, among other factors such as age and trust in technology and future returns on investment. Yet, as with other technologies, the prices are expected to go down as they become more widespread. In addition, services similar to Hello Tractor that connect smallholder farmers in developing countries to the providers rent low cost AI-equipped tractors from service providers via an app can help make the technology more affordable for farmers.

Platforms such as Hello Tractor and Farm Hack can help small and medium farmers access the technology and modify it for their needs.

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We are on the brink of a digital revolution which promises the fusion of biological, digital, and physical worlds connecting billions of people via digital technologies. Such technologies aim to improve the efficiency of food production, address environmental challenges and enhance consumer trust in the agri-food systems.

How the digital revolution will unfold and what impact it will have on organsics is uncertain. We invite you to reflect on the implications of the digital transformation at the European Organic Congress 2019.

To get started, explore some of the current and future trends in food and agriculture and the key issues of the data driven technologies that we identified in this paper.
INTENSIFICATION OF DATA EXCHANGES
Agricultural operations are generating an enormous amount of data. By 2050 it is predicted that an average farm in the industrialized countries will produce 4.1 million data points daily compared to 190 000 data points in 2014. The data points capture various parameters, such as physiological, environmental conditions, or animal behaviour, among others.

INNOVATION IN E-COMMERCE
Retail industry has been revolutionized by digital technologies. An emerging trend that might disrupt the industry further is the cashier-less, automated stores pioneered by Amazon. The stores use artificial intelligence, multi-sensors and CCTV cameras to offer a new way of shopping without cashiers or even check-out stations.

TOP-DOWN TECHNOLOGY DEVELOPMENT
Some of the technologies promoted to farmers are developed without farmers’ engagement or consideration of real farmers’ needs and are more aimed at specialised production systems (e.g. soybean, viticulture).

RESTRICTED REPAIR RIGHTS DUE TO PROPRIETARY SYSTEMS
Farm machinery equipped with digital technologies is increasingly more complex and protected by proprietary computer systems that do not allow the farmers to fix even minor bugs or adapt the systems to their specific needs without contacting the machinery provider. As a counter trend, online communities such as Farm Hack emerge to address the issue through an open source library of farming tools and knowledge.

WIRELESS COVERAGE LAGGING BEHIND IN RURAL AREAS
Digital transformation of agriculture requires a high level of connectivity in both urban and rural settings. Currently, only 40% of rural areas in Europe have wireless coverage with disparities between regions and countries.

What farming could look like

Source: NESTA
TECHNOLOGY EXAMPLES FROM FOOD AND FARMING

Precision agriculture has existed for decades but with the emerging digital technologies it is moving into a new phase where the hardware solutions are reinforced by the use of internet of things (IoT), cloud computing and artificial intelligence (AI).

ROBOTICS
The new generation of agricultural robots are equipped with machine learning and programmed to perform different tasks that do not strongly rely on human intelligence or effective eye-hand coordination. Currently, robotic milking systems are quite common in Europe. To a smaller extent, robots and advanced machinery are available in horticulture (mainly glass houses with high value-added products) for producing cuttings, planting in trays, plant protection, sorting and packing.

Check out the greenhouse harvesting robot Sweeper

DRONES & SENSORS
Drones represent a new generation of aerial robots. Drones allow farmers to have a bird view of the farm. In combination with all types of sensors and images from satellites they can provide precise information about the state of the soil, individual plants or can be used for applying inputs with a high degree of precision in the areas that need them.

Read about the use of drones on an organic farm in the USA

RADIO-FREQUENCY IDENTIFICATION (RFID) AND SATELLITE POSITIONING
A radio-frequency identification system uses electromagnetic fields which are integrated in tags, or labels attached to the objects to be automatically identified. Satellites systems such as GPS or Galileo has been used in precision agriculture and new ways of using data from satellites are emerging. The technologies have been in use in organic farming to track animals in the field to identify stress or any abnormality in behaviour as well as to record the grazing time.

See how the RFID technology combined with IoT can be used in fruit logistics and a GPS tracker for monitoring grazing cows

BLOCKCHAIN
Blockchain is most simply defined as a shared registry of all transactions made by different actors and available online. It is unchangeable in its nature, which facilitates the process of tracking tangible and intangible assets as well as recording transactions. The main feature of this data storage is that it is secure, transparent and independent from any central body. The transactions are encrypted and cannot be deleted or changed once made.

Read how blockchain can increase supply chain transparency in organic

SYNTHETIC BIOLOGY
Synthetic biology is a new generation of genetic engineering that introduces synthetically produced DNA in animals or plants through gene editing and develop food stuffs, ingredients, flavours in controlled factory conditions. The organic sector has a unified position regarding all types of genetic engineering techniques in agriculture like CRISPR-Cas. They are not compatible with the principles of organic agriculture and must not be used in organic farming. The topic is an important part of the current developments in the agri-food sector but won’t be discussed at the European Organic Congress 2019.
GAMIFICATION

Gamification is the application of gaming mechanics to non-gaming contexts to encourage engagement with a product or service. As such, gamification is about using game design elements to improve e.g. productivity, learning or physical activity.

Learn how the organic bakery De Trog uses gamification for training employees