NEEDS, EXPECTATIONS AND IMPACTS OF DIGITALISATION IN EUROPEAN AGRICULTURE, FORESTRY AND RURAL AREAS

Briefing

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1. Introduction

This briefing summarises the synthesis report of the Living Labs' (LL) assessment of Needs, Expectations, and Impacts (NEI assessment) of digitalisation.

Agriculture, forestry, and rural areas have inherited a complex political, economic, geographical, cultural and regulatory matrix. Digitalisation is taking place in a European context full of opportunities, yet challenged by various threats such as rural depopulation, illegal wood logging and trade, biodiversity decline, and the dominance of corporative and consumerist food systems. Understanding the contextual threats and opportunities sets the basis for each LL's focal questions.

The LLs applied the concept of a Socio-Cyber-Physical System (SCPS) as an analytical lens through which to research and gain insights on its past and present impacts. To perform their NEI assessments, Living Labs used a mix of data collection tools (desk research, semi-structured interviews, a standardised online survey, and interactive workshops).

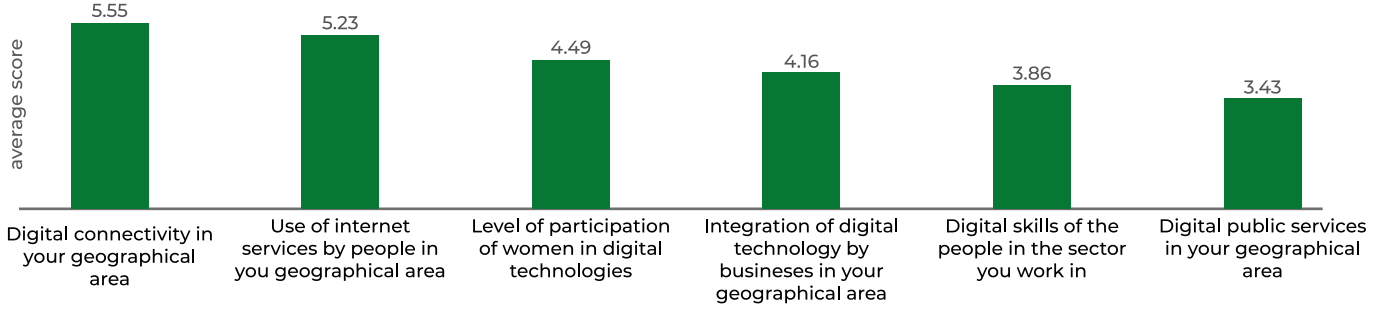
These tools were applied in three phases:

- Context analysis and assessment of main needs.
- Description and visualisation of SCPS.
- Participatory impact assessment.

2. Level of digitalisation across the LLs' focal questions

Harmonised statistical data on the level of digitalisation in European agriculture, forestry and rural areas is lacking at lower administrative levels (e.g. DESI index). Semi-structured interviews and the DESIRA online survey were used by each LL to deepen the context analysis. Figure 1 shows the level of digitisation, assessed according to DESI dimensions and their focal question, as perceived by LL's stakeholders. Levels of digital connectivity and broadband coverage are generally perceived as medium-high, as are levels of women's participation and use of internet services. However, the level of digital skills and use of digital tools in public services were considered low.

Figure 1. Average scores (from 1=low to 7=high) given by online survey respondents on the current level of digitalisation in the Living Lab's focal questions (N=273)



Source: own elaboration

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Stakeholders also offered their views on the level of use of different technologies in their work activities. Websites and online platforms, social internet services such as websites and online platforms, social media, cloud services and applications are the leading digital technologies, trumping more advanced digital technologies such as sensors, drones, satellite imagery, blockchain, and 3D printing.

2. Socio, cyber and physical entities are increasingly integrated

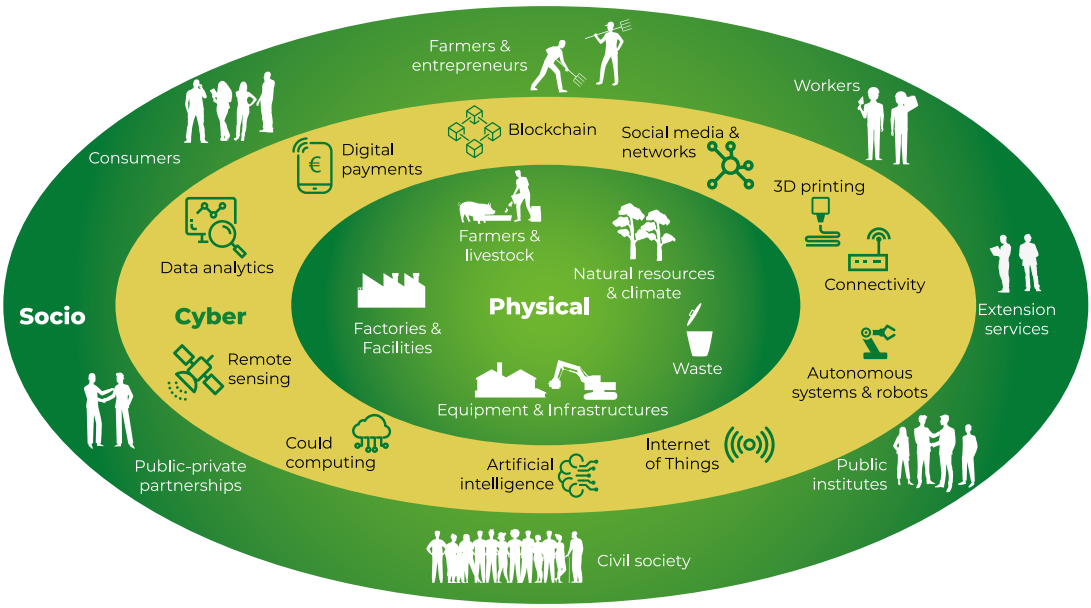
Figure 2 provides a graphical visualisation of all the entities involved in an agri-rural and forestry SCPS. Despite their diversity, SCPS entities were clustered under broad categories with common characteristics (macro entities), to map:

- actors, communities and institutions concerning the socio domain.
- digital constructs and artefacts, including also data and algorithms, concerning cyber domain following the taxonomy of digital game changers; and
- natural or artificial elements, resources, and (living or inanimate) physicality concerning physical domain.

The main cyber-entities emerged in the DESIRA Living Labs' participatory mapping exercise were:

- **internet connectivity**
- **social media and network**
- **web-based technologies**
- **autonomous systems and robots**
- **cloud/edge computing**
- **remote sensing**
- **data-analytics software**
- **artificial intelligence**
- **the Internet of Things**

Figure 2. A graphical visualisation of an agri-rural and forestry SCPS and its entities.



Source: own elaboration

Digitalised milieux

With the increasing datafication and connectivity in agri-rural and forestry areas, social entities, physical objects, and their performed activities coagulate and become integrated in 'digitalised milieux'. Figure 3 illustrates everyday life places and ecosystems where digital technologies mediate and affect relationships between entities, performing a vast array of functionalities (e.g. matching, comparing, filtering, predicting). In a digitalised milieux, the boundaries between socio, cyber, and physical entities get progressively blurred.

Figure 3. Digitalised milieux in an agri-rural and forestry SCPS

Source: own elaboration

3. Development and digital needs of socio, cyber and physican systems

Living Labs assessed their main needs, categorised as development needs (those related to the broader social, economic and environmental context), and digital needs (strictly concerning digitalisation). Among the development needs, LLs reported the gaps between the current and desired state of SCPS such as those identified in reducing livestock emissions, increasing cost efficiency in weed control, raising societal awareness about climate change and wildfire, or creating conditions for accessible housing, among others. Digital needs were strictly connected to digitalisation, but highly connected to the development needs. Some examples of such needs were connectivity, data availability, data security, or digital skills.

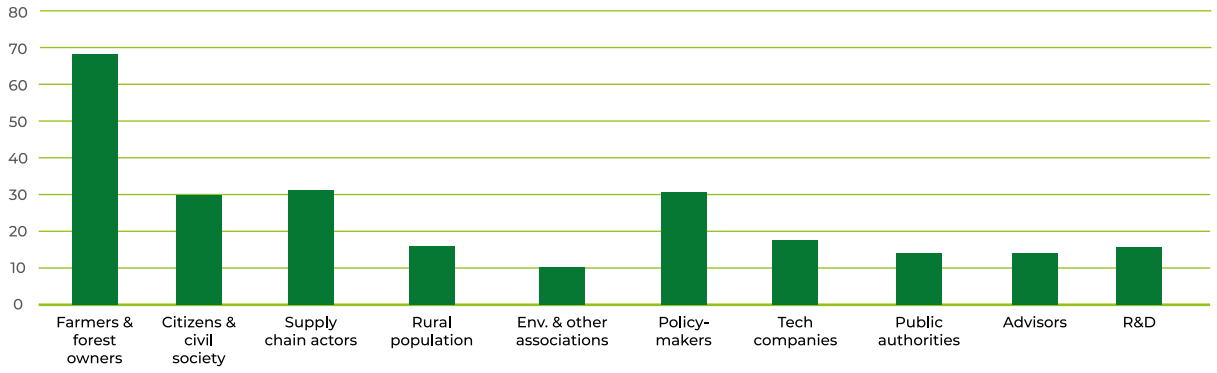
Fulfilling digital needs is one way to address development needs of socio-cyber-physical systems, but digitalisation is not necessarily the only way to go forward. For instance, to respect Good Agronomic and Environmental Conditions (GAEC) in agriculture, farmers need access to a variety of local seeds, social arrangements with other workers, and contextual knowledge to design and implement multiannual crop rotations. Digital skills or platforms can, however, help farmers to receive the results of public soil monitoring tests, and plan crop rotations according, for example, to the presence of nematodes or other pests.

Finally, the analysis of 'who needs what' shows that these needs are relevant for farmers and forest owners, policy-makers, supply chain actors, citizens and civil society, and technology companies. Figure 4 shows the distribution of the reported needs associated to various social entities.

Table 1. Examples of digital needs identified by the Living Labs

Digital needs	Living Lab	Example of need reported by the Living Lab
Access to information	Rhineland-Palatinate (DE)	Improving access to spatial data both through the website of local communities as well as through the official public information portal and with the use of uniform terms.
Connectivity	Scotland	Improving internet access for the entire community. A basic need for 12 MBPS and a shared feeling that it does not always need to be super-fast, but must be reliable. 30 MBPS preferable. The community broadband service is also very costly compared to Internet Service Providers in less remote regions.
Data availability	Andalucia (ES)	Improving data collection on the vegetation stage of crops, water deposit location, firebreak areas, perimetric strips, new roads, etc.
Data security	Switzerland	Setting up clear rules on data ownership and use. Farmers are reluctant to share their data as regulations on data use and ownership is not clear.
Digital services	Croatia	Developing (faster) service delivery to be more efficient and cheaper.
Interoperability	AgrOnov (FR)	Improved communication between digital objects to promote their uses and the exploitation of the data collected.
Skills	PEFC (IT)	Improved use of innovative tools aimed at ensuring traceability of wood and biomasses for energy purposes.

Figure 4. Distribution of needs across Living Labs' stakeholders (N=61)



Source: own elaboration

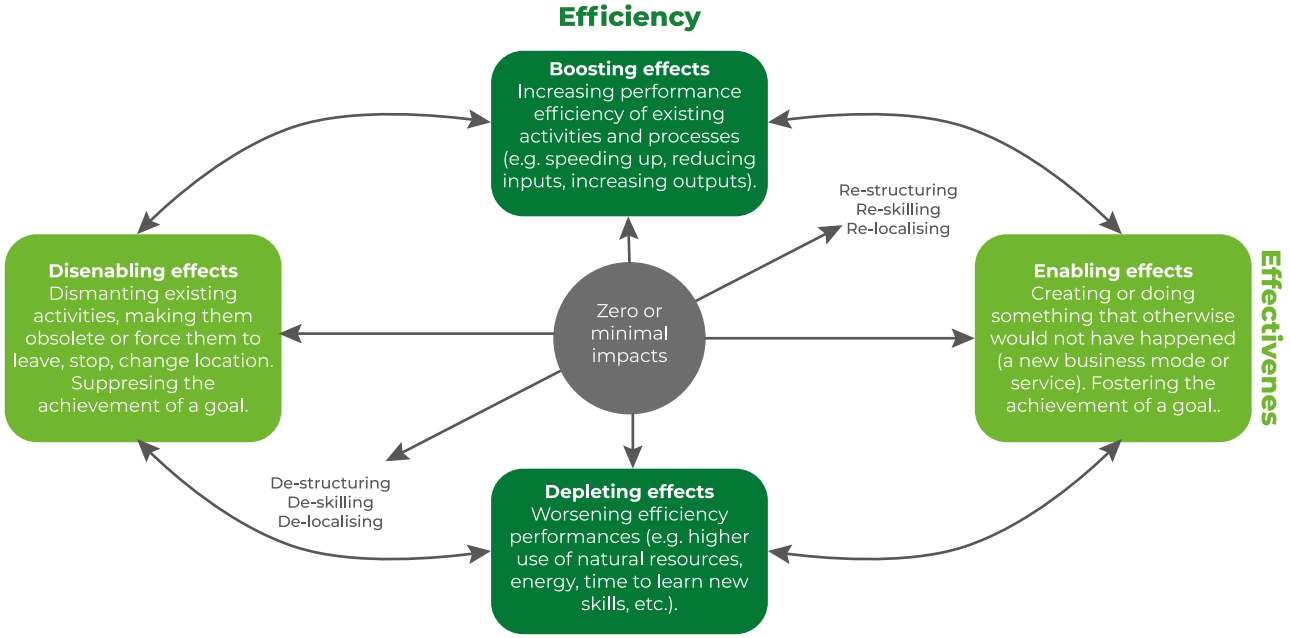
4. Digitalisation is impacting agricultural, forestry and rural activities and relationships

Living Labs identified the impacts of digitalisation on SCPS activities, clustered under enabling and disenabling (related to effectiveness) and boosting or depleting (related to efficiency).

In terms of enabling effects, digitalisation is found to be contributing to the creation of new activities, products and services, such as monitoring and analysing agri-environmental data, market stock pooling, on-farm and off-farm diversification activities, remote working, and real-time alerts in case of forest fires. On the other hand, it is generating disenabling effects, like displacing agricultural workers in rural areas, the loss of traditional skills and human knowledge, deteriorating autonomy, and diminishing in-person contacts and services in rural areas.

As part of boosting effects, digitalisation is reducing information asymmetry, lowering transaction costs, reduce risks of human errors and speeding up procedures, among others. However, depleting effects were observed on the ratio between input/outputs and other intangible aspects, for instance when considering negative externalities (digital pollution or information obesity), and investments and time for adopting new digital skills and practices, which add more stress on workers and increase tensions between individual private and professional lives.

Figure 5. Impacts of digitalisation on the SCPS activities in agriculture, forestry, and rural areas



Source: own elaboration

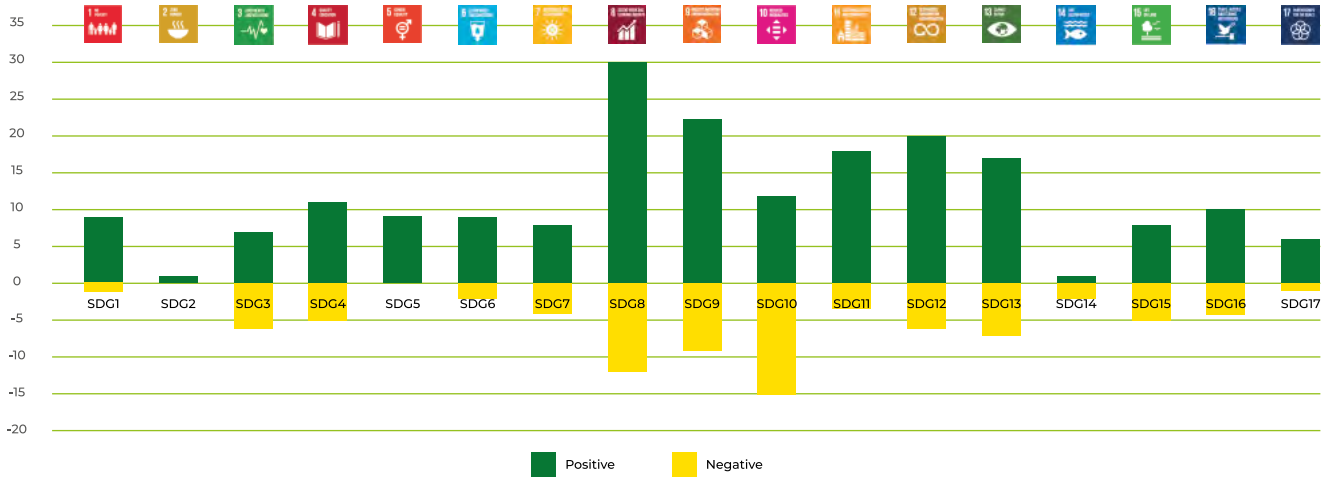
5. Contributions of digitalisation towards the United Nations' SDGs

Figure 6 shows the links identified between digitalisation and the 17 Sustainable Development Goals (SDGs), in terms of frequency of general perceptions expressed by Living Lab stakeholders in focus groups and interviews.

Most of the links found by the Living Labs between digitalisation and the SDGs were positive, especially for the 'productive' goals, like SDG 8 (Decent work and economic growth), SDG 9 (Industry, Innovation and Infrastructure), and SDG 12 (Responsible consumption and reproduction). Apart from climate action (SDG 13), less positive and negative links were identified between digitalisation and 'environmental' goals.

The achievement of the SDGs cannot be attributed only to design of digital technologies, skills, data infrastructures and flows. Access to digitalisation, as well as other socio-economic, environmental or cultural factors (System complexity) mediate the attainment of the SDGs.

Figure 6. Positive and negative links identified by Living Labs between digitalisation and SDGs



Source: own elaboration

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