DIGITISATION: ECONOMIC AND SOCIAL IMPACTS IN RURAL AREAS

DELIVERABLE 2.4

SECOND SET OF PRACTICE ABSTRACTS

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INTRODUCTION

This document provides the second set of 22 practice abstracts (PAs). Those have been compiled building on the collected digital tools and projects in WP2 activities, task 2.2 “Needs, Expectations and Impact appraisal”. Each PA describes the context, the focal question chosen by each Living Lab, and highlights the distinctive key needs and expectations for the future. The aim is in providing descriptions on how digitalization is understood and reflected by rural actors in different contexts. The Living Labs cover a wide range of themes and application scenarios related to agriculture, forestry, and rural development.

LIVING LABS' FOCAL QUESTIONS

Living Labs	Focal questions
1. Flevoland, the Netherlands	How can digital systems/platforms contribute to the exchange of knowledge of short food supply chains?
2. Central Osthrobotnia. Finland	How can digital systems contribute to advancing bioeconomy and circular economy in Central Ostrobothnia in 2030?
3. Rhineland-Palatinate, Germany	How the local administration can cope with internal and external challenges of the digital transformation and integrate citizens as well as other local actors into this process?
4. Poland	How to enhance participation in rural planning? And how can digitalisation improve the involvement of local communities in spatial planning processes?
5. Latvia	To develop an innovative support system with the use of digitals tools for the recognition and traceability of beef cattle meat in order to improve and extend markets (e.g. digital marketing strategy aimed at communicating the characteristics of Latvia's beef to consumers and farmers).
6. Lake of Constance, Germany	How can digitalisation contribute to the sustainability of fruit production in the Lake of Constance region?
7. Austria	How can digitalisation support and enforce the adoption of the European Timber Regulation (EUTR) concerning imported round wood in Austria?
8. North Great Plain, Hungary	• What factors influence the spread of precision technologies? • What role does the spread of digitalisation have in the labour retention capacity of rural areas?
9. Switzerland	How to control weeds effectively and efficiently in Swiss organic vegetable farming?
10. Northern Greece	• How to develop new digital services and functionalities for rural communities based on utilization of existing agricultural / data infrastructures and tools? • How can these infrastructures be used to further support the economy and farmers' / citizens' income in rural communities?
11. Trikala, Greece	How to better manage water resources for the benefit of both, farming purposes and the everyday needs of the citizens?
12. Croatian Adriatic Region	• How can digitisation contribute to availability of local products, recognition, flexibility and standardization of local traditional small-scale products and services? • How can digitisation contribute to strengthening the connections between farmers and tourists, and create a better position of the small family farms in the value chain?
13. Programme for the Endorsement of Forest Certification schemes, Italy	How to strengthen the adoption of digital tools to support the wood-energy traceability over the whole supply chain in conformity to the compulsory EU Timber Regulation (995/2010) in Italian forests
14. Toscana Nord, Italy	How can a better communication among citizens, farmers, public administration and other stakeholders make ordinary land management in marginal rural areas more effective? And how can digitalization facilitate the information flows between actors/tools involved in this process?
15. Andalucia, Spain	How can digitalisation contribute to reduce the damage caused by wildfires and to make more effective firefighting and degraded land restoration by 2030?
16. Aragon, Spain	How can digitalisation contribute to enhance the global attractiveness of the territory of Maestrazgo and Gúdar-Javalambre?

17. Inno'vin, France	What is the current state of the level of digitalisation within the wine sector's value chain and how these technologies can help achieve the agro-ecological transition of the wine sector while strengthening its competitiveness?
18. AgrOnov, France	How does digital technology contribute to the emergence of innovations in favour of agro-ecological transition in agriculture?
19. Scotland	How can digital technologies promote opportunities for crofting communities in Wester Ross?
20. West Flanders, Belgium	What is the impact of individual farm based airborne monitoring of emissions of ammonia, particulate matter, and odour, in the intensive livestock sector for agriculture, policy, and society in Flanders?
21. Cultivate, Ireland	How can digitalisation support local livelihoods that contribute to rural regeneration and assist in the transition to a low carbon society?
22. Végépolys Valley, France	• How can digital technology enable horticultural companies to increase their productivity and reduce costs, while reducing their environmental impact? • How can digital technology enable horticultural companies to have a better knowledge of the offer, to better appreciate the market and the real needs of end consumers, but also to diversify the sales methods?

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OOSTERWORLD, THE NETHERLANDS

Jan Eelco Jansma, Wageningen University and Research

Living Lab
Oosterwold (NL)
Key Digital Technologies
Apps
Keywords
Urban Agriculture, Short Food Supply Chains, Community Building
More info:
https://www.youtube.com/watch?v=bEn6-82ZMX4

Oosterwold is a new and unique peri-urban area (of 45,000 future residents) situated at the fringe of the city of Almere (215,000 residents). 50% of Oosterwold spatial room is earmarked to urban agriculture. Oosterwold should provide 10% of the food basket of the Almere city region in the near future. However, due an unbalanced future vision of urban agriculture in the area, the lack of a critical mass of experienced practitioners as well as the lack of an appealing focal route, the current vibrancy around urban agriculture in Oosterwold could easily fade.

Establishing short food supply chains in Oosterwold is considered a means to organise and unite the food production in Oosterwold, and is concomitantly supportive in strengthening the ties between peri-urban Oosterwold and the Almere city region. Hence the focal question of the Desira Living Lab Oosterwold is: could digital systems be supportive in establishing vibrant social communities around short food supply chains that unite Oosterwold and the Almere city-region?

Central to the Socio-Cyber-Physical System of Oosterwold are the urban agriculture initiatives in the area that, in various ways, produce (surplus) food and try to develop food communities. The environmental and social impact of short food supply chains (communities) in Oosterwold is most likely positively affected by the use of digital technologies. Digital technologies optimise logistics, share knowledge, and create a social exchange between producers and consumers, and most likely will support the inclusion of more local and regional residents in supply chains that deliver healthy and affordable local food. However, these are all anticipated effects as the different food initiatives in Oosterwold are still developing, and so are their digital means.

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In 2021 Living Lab Oosterwold organised 5 workshops with local stakeholders/residents in which it co-explored the needs, possible directions, and future visions of urban agriculture in the area. Two lessons can be obtained from these workshops. Firstly, that the area -its residents as well as the authorities- (still) lacks a shared future vision and agenda on urban agriculture and food communities. A next step is to co-organise incentives which elicits local debate and community building on urban agriculture. Secondly, that the focus of Living lab Oosterwold should be on digital technologies that support the creation of a vibrant and committed community around short food supply chains. The essential need is to build communities around the digital systems. In the sphere of living lab Oosterwold, three potential communities emerge, i.e. a consumers cooperative -VoKo Oosterwold- (https://www.voko-oosterwold.nl/), a local CSA-alike farm -Burgerboerderij Oosterwold- and a cooperative of local producers -Cooperatie Stadslandbouw Oosterwold- (https://www.coopoosterwold.nl/). A next step is to explore with these initiatives potential (digital) systems that facilitate their needs.

May, 2022

BIOVALLEY FINLAND: CIRCULAR ECONOMY IN CENTRAL OSTROBOTHNIA

Jouni Kaipainen (University of Jyväskylä, Kokkola University Consortium Chydenius)

Biovalley Finland (BF) Living Lab is based on the focal question "How can digital technologies contribute to advancing bioeconomy and circular economy in Central Ostrobothnia in 2030?".

Usually, people see that rural areas are homogeneous and change very slowly. Central Ostrobothnia (CO) does not fit the framework as it is in the middle of energy transformation (from using peat into renewable energy). Local biogas is used to make carbon neutral hydrogen and highly valued active carbon (material for batteries). Wind power creates cheap electricity that can be used to advance digitalisation.

Living Lab
Biovalley Finland
Key Digital Technologies
Match-making tools, videoconferences, platforms
Keywords
Bioeconomy, circular economy, managing large networks
More info: https://desira2020.eu/central-ostrobothnia-finland/

CO is full of paradoxes. CO is the smallest region in mainland Finland, but we are – with a high margin - the biggest exporter of goods per capita. We have multinational companies in Kokkola Industrial Park (KIP) that are connected to global value chains. KIP will take into use private 5G network that helps sharing information in the factory area. In the zinc factory, robots (that are equipped with computer vision) are now automatically cleaning all the 38 000 anode plates that are used in the electrolysis process. We also have remote rural areas that are suitable for forestry and nature tourism. In-between is agricultural zone, which is highly specialised in dairy farming. We have manure to make biogas and bio-based fertilizers, but milk and manure robots are needed to make farm systems sustainable.

Scientists talk about social-cyber-physical systems (SCPs). Basically, they mean that cyber connects social actors (humans) with physical entities. BF is a system of systems which makes it even more difficult to understand. BF connects RDI actors, companies, SMEs, farms, regulators, and education institutes. Digital technologies (like videoconferencing) make working together easier and more efficient. Common efforts (like yearly hybrid conference Kokkola Material Week) showcase, how digital technologies can used to enhance the local face-to-face meeting tradition into next level. Internationalisation and interregional connections open opportunities for new ideas to enrich the local doing.

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BF is a network and a concept that organises the experiences of different actors and the resources of the region into a common reality. All the parts of BF are known before but only putting them together makes the process to start to create something useful. BF is a catalyst that makes things happen. Keeping things apart leads either to regional path dependency or to scientific silos. Combining different knowledge bases (analytical, synthetic, and symbolic) is usually advantageous even if in practise new ideas are found by experimenting. Random events or infrequent formal meeting are not enough to make disruptive breakthroughs as development efforts also need commitment from stakeholders. Absorptive capacity develops slowly.

Circular economy (CE) is the future way of doing things. The main barriers to CE are related to informational problems. Actors rarely have good knowledge of the quantity and quality of the biomasses, side streams and second-hand materials that are available. Digitalisation helps to remove informational barriers by using programs and platforms that do matchmaking for actors and materials.

June, 2021

DIGITALISATION AND LOCAL ADMINISTRATIONS IN RHINELAND-PALATINATE, GERMANY

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Fraunhofer Institute for Experimental Software Engineering IESE

Betzdorf-Gebhardshain, where the Rhineland-Palatinate Living Lab (LL) is located, is confronted with typical challenges for many rural areas in Germany: rural exodus, lacking job opportunities, adequate provision of services and more.

Local administrations are central actors in overcoming these challenges and grasp the potential opportunities of digitalisation. With the law establishing the Online Access Act in Germany, they are called to offer their services digitally via administrative portals by the end of 2022.

Besides the **external challenge** posed by this legal act, local administrations must also face **internal challenges**, such as mobilising resources (budget, skills) or designing effective solutions (adaptability, interoperability).

The focal question is **how can local administrations cope with the internal and external challenges of digitalisation, and what are the main impacts on the local actors involved in this process?.**

Living Lab
Rhineland-Palatinate
Key Digital Technologies
Smartphone apps, websites, online collaborative tools, social media, broadband & mobile connectivity
Keywords:
e-governance, e-services, information flows in rural areas
More info: Fraunhofer IESE; Digital Villages; Smart Rural Areas

DESIRA analysed **the main needs and impacts** of digitalisation identified by the LL Rhineland-Palatinate. Main positive effects of digitalisation are **faster services, higher convenience, and more interactions and flexibility,** which are already experienced by end users. Thus, accessibility to digital services can make **local administration more effective**.

Negative effects refer to the **reduction of personal contacts with local administrators and higher risks of discords**, as well as to the **unequal distribution of the advantages** of digital tools and services across all target groups due to age, affinity, socio-economic status and digital connectivity.

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Context and main needs related to the Living Lab's focal question

The municipality of Betzdorf-Gebhardshain is an area characterised by a **decreasing population** between 2008-2018, especially for the age group <20 years (-15.0% compared to -6.3% observed in the region). **Manufacturing and services** are the major employment and economic sectors (98,8% of GDP).

Copyright: Verbandsgemeinde Betzdorf-Gebhardshain

In terms of digital infrastructure, statistical data shows that the City of Betzdorf provides broadband connectivity 50 Mbit/s to 100%, and 200Mbit/s to 80% of households. The city itself has six towers with 5G mobile data network and free Wi-Fi spots in public spaces. In Gebhardshain, this situation is slightly different: 93% of the households have 50 Mbit/s, 47% have 200 Mbit/s.

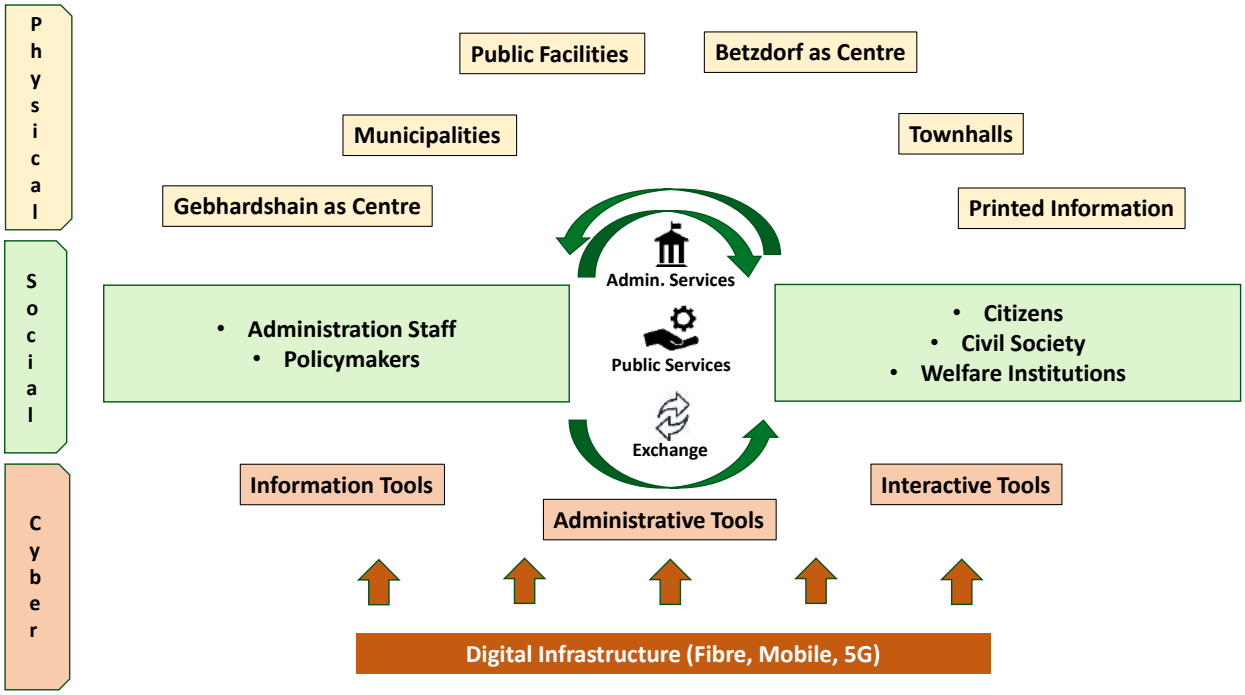
In terms of digitalisation of the local administration, the municipality has been active during the last years. Since 2015, it has piloted the project 'Digital Villages' (*Digitale Dörfer*) for the development of digital services in rural areas. Some of the project outputs were the creation of a web platform 'DorfNews' (*village news*) and a smartphone app 'DorfFunk' (*village radio*). These tools provide regional news, information on events and interactive messaging. In 2019, the platforms were extended with the 'LösBar' (*solvable*) app, a digital tool enabling interactions between the local administration and citizens.

Based on SWOT analysis, the following needs are identified in relation to the Living Lab's focal question.

- The local administration needs adequate provision of human (staff) and material (technology) resources to face the requirements of digitalisation.
- The administration staff needs organisational development and human resource development need to be improved (e.g. training through seminars).
- Citizens and civil society must be motivated and be given the opportunity to participate in decision-making concerning the digital transformation.
- Citizens need an easy start with digital tools because not everyone can use them intuitively. An ongoing offer of educational measures should be provided to empower citizens to make use of digital tools.
- Fears must be faced, i.e. prejudices against digital technologies by indicating the potentials of digital technologies need to be reduced, especially for young and elderly citizens.
- Positive user experience of digital services must be ensured, in particular the demands of users from all backgrounds so that the services are attractive and convenient to use.

The Socio-Cyber-Physical System (SCPS) in Betzdorf-Gebhardshain

To understand the implications of digital transformation in Betzdorf-Gebhardshain from the perspectives of the local administration as well as citizens and civil society, the Living Lab mapped and visualised the **entities, relationships, and activities** in three specific domains: social, cyber, and physical. The dark green arrows represent interactions between social entities. Note, that in the cyber domain this process is predominantly unidirectional (e.g. information flows mainly in one way so far).



Among the listed **social entities**, the so-called 'registered associations' (*Eingetragener Verein*) are the dominating organisational form through which civil society realises a vast amount of sports, cultural life and other leisure activities, as well as the representation of particular interests. **Physical entities** include the places and facilities where the aforementioned social entities meet and interact. A great number of interactions occur through the physical domain (official journal of Betzdorf-Gebhardshain, official letters, posters and public notices). **Cyber entities** hold a vast ensemble of digital media and services based on the digital infrastructure (local fibre-optic network, mobile, 5G).

- **Information tools** include mainly websites offered by various institutions for informational and representative purposes (e.g. municipalities' official websites).
- **Administrative tools** mainly refer to the digital and networked applications used by the administration staff internally to do their work and realise services.
- **Interactive tools** allow for an exchange between the local administration, policy-makers, citizens and other interest groups. These tools are neither restricted to one-way information flows, nor are they used exclusively for internal purposes. An example is 'DorfFunk' (www.dorf.app), a smartphone app intended to foster communication between citizens and put them in contact with the local administration to bring suggestions forward. 'LösBar' is a web tool used by the local administration to handle these suggestions and give official feedback.

These entities interact and perform activities like **administrative services** (e.g. demanding and transferring registration certificates or permits for public events), **public services** (e.g. managing public transports, schools, events), and **exchanges of information on a general level**.

The impacts of digitalisation in Betzdorf-Gebhardshain

What has been digitalised?		Main impacts (i.e. effects/consequences)	Sustainable Development Goals
Local administrative services via information tools (websites or internally used working tools like e-clouds, databases, e-mails).	Direct	• Media breaks (processes are only partially digitised, e.g. signatures and identification must be provided analogously)	SDG 11: Sustainable Cities and Communities SDG 16: Peace, Justice and Strong Institutions
		• The provision of administrative services has become faster	
		• Services are more convenient (independent of time/place)	
		• More and easier accessible information has been created	
	Indirect	• Unequal distribution of advantages among different target groups	
		• Reduction of personal contact to the administration ("faces")	
		• Reduced paper consumption for ordinary administration	
Public services, such as public transports, via information and interactive tools.	Direct	• Faster provision of services	
		• Services are more convenient (independent of time/place)	
	Indirect	• Unequal distribution of advantages among different target groups	
		• Reduction of personal contact to the administration ("faces")	
General exchanges between public and private entities, through the project "Digital Villages" with its interactive tools like DorfFunk and LösBar plays a crucial role.	Direct	• Digital interaction increases likelihood of discords	
		• Multiple digital channels yield inconsistent information	
		• Acceleration of information flows	
		• More inputs are exchanged (suggestions, reported damages)	
		• Exchange is more convenient (independent of time/place)	
	Indirect	• Transparency of administrative action	
		• Collaboration of public and private actors	

Positive Negative

The identified positive and negative impacts brought by digitalisation can be explained by:

- **Design of digital technologies:** positive effects emerged thanks to the participatory development of digital tools; attention to the user-friendliness for target groups; and the level of simplification presented at the front-end to cover the complex architecture behind the digital tools.
- **Access:** positive effects can be achieved by means of a good digital infrastructure (quality and quantity of connectivity); educational and capacity building activities; information policy and marketing have proven to be important aspects of local digitalisation.
- **System complexity:** negative or modest impacts might emerge from the availability of multiple overlapping tools. The platform Digital Villages acts as 'modular service kit' and allows for context sensitive selection of tools. COVID-19 restrictions accelerated the digitalisation of communication (among citizens), administrative services, and economy (e-commerce) in Betzdorf-Gebhardshain.

Main conclusions and recommendations

Digitalisation was assessed as having two sides: on the one hand, new communication channels offer benefits to almost all social groups. These were identified as winners because they facilitate exchanges and information flows.

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On the other hand, not everybody can participate and ends up being marginalised. The main reason is that these groups do not have access to digital products or do not yet have the means to make use of them in a positive way, as for example occurs with the print media.

Interestingly, some groups of people appear repeatedly: people with disabilities, for example, were mentioned as both winners and losers of digitalisation. In a way, they can benefit from flexibly accessible and easy to use services. Contrarily, they might not be able to participate in the case digital solutions are not designed according to their needs (e.g. in terms of accessibility). Elderly people are not participating in digitalisation in the same way as younger people do. However, the elderly people were seen as winners, losers and opponents of digitalisation. As an explanation, some participants stressed that participation in digitalisation is not a matter of *age* but rather a matter of *willingness* to learn and adopt a new tool.

Finally, the following aspects are of key importance in the ongoing process of the digital transformation in Betzdorf-Gebhardshain:

1. **Inclusion of all relevant social entities**. For example, all generations must be addressed – the elderly as well as teenagers. This means, for example, integrating schools and adult education institutions.
2. **The advantages of digital technologies need to be adequately explained** to overcome resistance or scepticism in local administrations and beyond. Furthermore, it is important that any administrative service provided digitally in the local administration should also be provided in an analogous way. This ensures trustworthiness, until everyone is used to it.
3. **Digitalisation should be designed based on transparency and participatory principles**. The most affected target groups should be effectively consulted when a public service or activities become digitalised. On the other hand, transparency also involves data trustworthiness in a data usage sense. Citizens need to understand the purpose for which their data is processed digitally, why data security is guaranteed and why the processing systems are therefore credible.

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GEODESIGN IN RURAL POLAND

Patrycja Grzyś, University of Lodz

Geodesign in Rural Poland Living Lab's focal questions are: how to enhance participation in rural planning and how can digitalisation improve the involvement of local communities in spatial planning processes in the Lodz region.

This Living Lab (LL) is focused on dynamic changes that recently have taken place in spatial planning, involving digitalisation with high potential to enhance participation and transparency of these processes.

Living Lab
Geodesign in Rural Poland
Key Digital Technologies
GIS (software, datasets, web services), social media, communal web platforms
Keywords
Geodesign, GIS, spatial planning, community participation enhancement, rural areas
More info: https://desira2020.eu/geodesign-rural-poland/

The main entities involved in our LL are divided in three domains: social (those are local communities, investors and entrepreneurships, local authorities, planners, specialists and advisors within the field of spatial planning plus formal and informal organisations like NGOs, local action groups etc.), **physical** ("the place" – that is besides typical physical elements, the value of the landscape, planned new development, and local plans) **and cyber** (Geographic Information System [GIS data, web GIS service], social media and official communal websites). The main interrelations within our Socio-Cyber-Physical (SCP) system focus on information flows between the system's entities. The digitalisation of spatial planning affects the way spatial information is displayed (digital image) and accessed by individuals but also enables their participation in planning procedures as they can easily respond to the current or planned development of local communities' neighbourhoods.

GeoDesign opens up new possibilities for spatial planning on the local scale. However, success in its implementation depends on a high level of digital skills by the stakeholders and awareness of local authorities, who should seek to cross the barriers beyond which a community can become a partner in the planning process.

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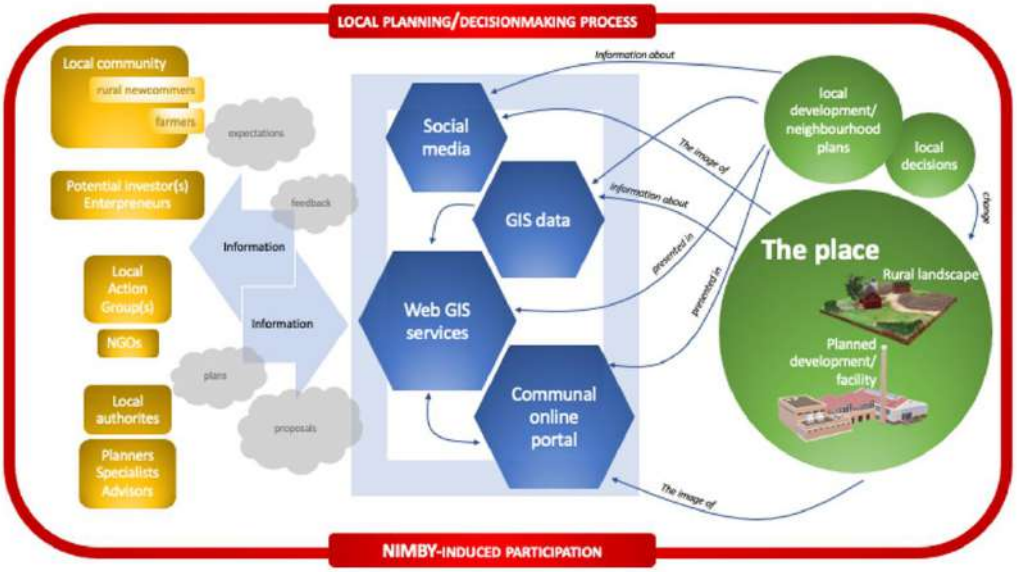

Fig. 1. Visualisation of SCP system related to the impact of digitalisation on the participation's enhancement in rural planning

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DIGITAL MARKETING STRATEGY IN LATVIA

Mikelis Grivins, Baltic Studies Centre

Living Lab
Digital marketing strategy for beef cattle production sector, Latvia
Key Digital Technologies
Social media, web pages
Keywords
Digital marketing, Beef cattle, High quality beef
More info: www.bscresearch.lv, www.zemniekusaeima.lv, https://desira2020.eu/digital-marketing-strategy-latvia/

Latvian beef cattle farmers can ensure high animal welfare standards and produce high-quality beef. Despite the apparent advantages, the sector has failed so far to communicate the characteristics of Latvia's beef cattle to local consumers. Consequently, beef farmers have failed to translate these characteristics into a higher product price.

Farmers have very good access to the internet. However, they might lack digital skills, limiting their ability to use the internet to enhance their communication with consumers and to strengthen their access to outlet markets. Thus, the Living Lab from Latvia aims to develop an innovative support system with the use of digitals tools for the recognition and traceability of beef cattle meat in order to improve and extend markets (e.g. digital marketing strategy aimed at communicating the characteristics of Latvia's beef to consumers and farmers).

The Living Lab (LL) is aimed at harvesting, targeting and upscaling the potential and skill of the beef cattle farmers to use digital tools to communicate with the broader public. Digital solutions will help beef farmers to communicate its social and environmental performance and the high quality of beef produced by Latvia's farmers. It will target consumers willing to pay extra for high quality meat: there is a niche market of consumers that are willing to pay for products of high quality with low environmental impacts. It is difficult to reach this group using traditional forms of marketing. The digital marketing strategy is focusing on the following:

- Using digital tools and technologies to inform consumers.
- Communicating the reasons for the high price of high-quality beef meat.
- Develop new high-quality grass-fed meat related narrative (new arguments).

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SOCIO-CYBER-PHYSICAL SYSTEM OF THE LAKE OF CONSTANCE, GERMANY

Kirsten Gaber and Christine Rösch, KIT-ITAS

Living Lab
Lake of Constance, Germany
Key Digital Technologies
Farm management information systems, automated orchard machinery, consumer-producer communication apps
Keywords
Digitalised fruit production, environmental sustainability, consumer behaviour, conditions of access
More info: https:/desira2020.eu/lake-constance-germany/

The focal question researched by the Lake Constance Living Lab is: How can digitalisation contribute to the sustainability of fruit production in the Lake of Constance region? Digitalisation in this sector is not widely implemented, but stakeholder groups along the value chain have high expectations for digital solutions and appreciate the potential that these tools can bring into the sector. A large variety of socio-economic and environmental challenges are facing the fruit production sector in the Lake Constance region and have become more prominent during recent years. Regulations regarding pesticide reduction, the need for increased biodiversity, changing consumer behaviours, increasing weather extremes because of climate change, and a dependence on foreign seasonal workers challenge the sustainability of fruit production. Current activities between entities in the SCP are automated field and orchard work, automated or partially-automated produce sorting and packing, controlled optimisation of controlled atmosphere (CA) storage of fruit, digital communication between farmers and along the value chain to the end consumer, and digital marketing systems such as organic produce boxes and on-farm store finders via smartphone apps. Overall, stakeholders perceive digitalisation to have a positive impact in fruit production, particularly in the environmental sustainability of fruit farming systems. 83% of stakeholders believe the energy efficiency of fruit farming can be increased, 75 % believe agricultural input efficiency can be improved, and 67 % believe greenhouse gas emissions can be reduced through digitalisation. However, these potential impacts are directly connected to the conditions of access: if access in terms of digital infrastructure, digital knowledge and skills, costs, and data security are not ensured at equal levels throughout the region, the positive impacts cannot be reached or evenly distributed across all stakeholder groups and demographics.

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ROUND WOOD TRACEABILITY IN AUSTRIA

Clemens Rendl, SISTEMA GmbH

Living Lab
Timber Regulation Round Wood Traceability in Austria
Key Digital Technologies
Internet based technologies for information sharing, e.g. documents, databases, websites
Keywords
Traceability, EUTR, illegal forestry
More info: https://desira2020.eu/timber-regulation-austria/

Austria has a strict, long-existing forest law guaranteeing sustainability: the word sustainability originates from the domain forestry itself and is defined as guaranteeing more growth than felling. Nevertheless, to fulfil the yearly demand of roundwood, timber is acquired from the European and international market. This poses the threat of placing illegal deforested products on the European market, which is what the EUTR is tackling; illegality is not only defined as cutting down endangered tree species, but also breaching national forestry laws. The focal question dealt within this living lab is phrased the following way: "*How can digitalisation support and enforce the adoption of the European Timber Regulation (EUTR) concerning imported round wood in Austria?"*

The main entities involved can be divided into three domains, socio, physical and cyber. Interactions amongst the domains are dictated by interests and the availability of information. The socio domain consists of foreign countries exporting round wood, the Austrian operators and traders placing wood on the European market, the Competent Authority (CA) responsible for the implementation of the EUTR in Austria, the Federal Forest Office (BFW) and the European market as the destination for round wood. The physical domain comprises all relevant factors surrounding the physical forest. The cyber domain represents the digital technologies utilised to prove compliance with the regulation. To verify and confirm legality of wood and wood products, operators and traders are obliged to set up and maintain a due diligence system (DDS). The level of digitalisation as part of operating a DDS is rather low, the procedures of the EUTR heavily rely on paperwork. Here, the internet serves as a medium for communication and is used as a source of information. The main two reasons for the overall low level of digitisation are the lack of standards amongst EUTR member states, and the lack of incentives or policies in place, to motivate operators to utilise more technologies.

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The effects of digitalisation concern the availability of information and the way information is exchanged and communicated. Digitalisation allows information to travel faster; generally speaking, transparency counters clandestine activities. Contrarily, an abundance of information needs efficient data filtering, storage and distribution. Forestry is a domain which is experiencing a high degree of technological advancement, only, the institutional circumstances are not there yet, for technological innovation to gain importance when tackling illegal logging.

May, 2022

DIGITALISATION IN THE NORTH GREAT PLAIN REGION, HUNGARY

Gábor G. Szabó, János Szenderák, Dániel Fróna & Mónika Harangi-Rákos,
University of Debrecen

Living Lab
North Great Plain Region, Hungary
Key Digital Technologies
precision technologies
Keywords
precision agriculture, agriculture workforce
More info: https://desira2020.eu/north-great-plain-region-hungary/

The North Great Plain Region, where the Living Lab is located, is facing with significant economic and social disparities compared to the Western regions of Hungary. The research of this Living Lab revolves around two **focal question: 1) what factors influence the spread of precision technologies? and 2) What role does the spread of digitalisation have in the labour retention capacity of rural areas?**

These questions reflect the need of the Living Lab members and the stakeholders in the North Great Plain region in general. Precision technologies are still expensive, while most farmers do not feel the necessity of these tools and find them too complicated to use. A common reason is that the farm size is too small to take advantage of the precision tools. However, **climate contributions require a more efficient resource use and monitoring in agriculture in order to lower the environmental pressure, in which precision farming could play a significant role.**

The spread of precision technologies could be greatly improved if farmers **familiarised themselves** with the possibilities provided by precision technologies and were able to **translate this knowledge** into practice. On the other hand, there must be a close relationship between farmers' low qualification levels and their lack of necessary knowledge and skills and the fact that they **fail to recognise the potential of technology**. One of the main problems is the **shift of age composition** of producers towards older age groups, which hinders the spread of digitalisation. At the same time, the spread of digitalisation is expected to **have a complex effect on the labour capacity of rural areas**, while farmers in the region are also **facing with the lack of workforce** with suitable digital skills. **An effective solution could be to integrate higher education, vocational training and the stakeholders of the value chain in order to increase the knowledge base.**

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May, 2022

DIGITALISED WEED CONTROL IN SWITZERLAND

Sylvain Quiédeville & Olivier Ejderyan, FiBL

Living Lab
Weed control in Swiss organic vegetable growing
Key Digital Technologies
Robots, GPS, cameras, sensors, smartphone, tablet
Keywords
Digitalisation, robots, organic vegetables, impacts
More info: https://desira2020.eu/organic-farming-switzerland/

The Swiss organic vegetable production is increasingly affected by the on-going digitalisation of society as a whole. In the frame of the EU DESIRA project, the Swiss Research Institute of Organic Agriculture (FiBL) is facilitating a Living Lab involving stakeholders around the following question: "**How can weeds in Swiss organic vegetable production be controlled effectively and efficiently?**"

In organic farming, weeds are usually controlled mechanically and by hand, but digitalisation may bring substantial changes as it allows automation. Fully automatic systems for weed management are not yet used in Swiss vegetable production, apart from a few pioneers and at experimental level. Weeding robots are currently in a testing phase. In practice, semi-autonomous hoeing modules (pulled by tractors) are widespread.

The impacts of using digital tools for weed management are diverse. It reduces the need for manual work (and associated costs) and possibly improves working conditions and increases labour productivity. However, farmers are becoming more dependent on technologies, tech companies and advisory services. In addition, the entry and maintenance costs are high and the cost of the technology is limiting their adoption and increasing disparity between larger and smaller farms. One practical way to reduce these costs, though, is to develop sharing systems among farmers.

Another possible challenge is the time needed for farmers to parameterise and use digital tools. This is especially relevant in vegetable growing where the work is generally tightly scheduled due to the high variety of crops to be dealt with. At the same time, the use of GPS-controlled guidance systems can save time when the user has the required skills as they allow areas to be mapped and thus managed more efficiently. Despite the current shortage of skilled workers, digital technologies could attract new skilled

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workers in agriculture. The time saved is not reflected in the form of increased free time, but in shifting the freed-up working time to other areas.

Moreover, fully autonomous robots are not yet well adapted to the Swiss conditions. Such robots should be able to deal with (even slight) slopes, heterogeneous soils as well as changes in the weather in order to enable 24-hours operation and to reduce technical failures.

Having said that, more and more digital tools are being used in Swiss organic vegetable growing, especially in the areas of administration, organisation and communication. The advanced test series on weed control suggest that relevant digital technologies will soon be ready for large-scale use in that area.

May, 2022

DIGITAL SERVICES FOR RURAL AND FARMER COMMUNITIES IN NORTHERN GREECE

Christos Marinos-Kouris, ATHENA Research Centre

This Living Lab operates geographically in the area of Trilofos, a village and community belonging to the municipality of Katerini, located in Northern Greece.

This region of Greece has a long tradition with tobacco cultivation. In the recent years, the position of the local farmers in the supply chain has been weakened, mainly due to the production limitation system EU has applied to tobacco and the suspension of any subsidies to tobacco growers. At the same time the economic risk and dependency from the local tobacco distributors-retailers is being increased.

The Living Lab delves into the identification of digital services and functionalities and proposes digital solutions and ways to implement them to a group of local farmers that are gradually transitioning from tobacco to leek cultivation.

Living Lab
Digital Services for Rural and Farmer Communities
Key Digital Technologies
Lora Wan network, On field precision agriculture sensors, data sharing platforms
Keywords
Digital Agriculture, Smart Transition, Capacity Building
More info: https://desira2020.eu/northern-greece-greece/

Outline of the main needs that were identified during the course of the Living Lab workshop:

- Strengthen the position of farmers in the supply chain
- Explore digital solutions that will benefit the agricultural process and attract more-younger individuals in the agricultural business
- Train the farmers operating inside the scope of this LL to fully utilise the technologic solutions and ensure a self-sustainable use of the introduced solutions in the future.

The Socio-Cyber-Physical system is mainly characterised from the interacting elements of Farmers group-American Farming School (innovation facilitator and technology advisors) – adopted agricultural Digital tools – and existing agricultural land and equipment. The digital transformation actions led to the adoption of smart agriculture digital tools and establishment of a LoRa Wan network in the region. The introduction of these digital interventions has reshaped the interactions among the entities of the LL's

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SCP system and introduced new agricultural processes that entail agricultural data gathering and data driven information sharing routines, all administrated and coordinated by the American Farming School. The LL farmers who embraced digital solutions in their agricultural practices have quickly benefited from the daily monitoring and regular feedback on their crop status as well as the timely weather and temperature warnings that helped them protect their crop from sudden physical hazards. The acquisition and circulation of information and data have enhanced the overall climatic resilience of the crops and yield. Furthermore, the data-driven decision-making has enabled a better utilisation of land in the region that translates also in better seasonal and spatial exploitation of the agricultural fields and adoption of optimised land preservation practices.

May, 2022

SUSTAINABLE WATER MANAGEMENT IN TRIKALA, GREECE

Christos Marinos-Kouris, ATHENA Research Centre

Living Lab
Sustainable Water Management
Key Digital Technologies
Smart Water Metering Systems, Remote Sensors
Keywords
Water, sustainability, smart, rural
More info: https://desira2020.eu/trikala-greece/

The Sustainable Water Management Living Lab operates in a region with no water scarcity issues in most parts of it. The amplitude of water resources in the region can cover the agricultural and everyday needs of citizens. However, local authority representatives have realised that the current water management practices are sub-optimal and inadequate to ensure a mid-long term sustainable use of water resources for the region. Therefore, *'How to better manage water resources for the benefit of both, farming purposes and the everyday needs of the citizens?'* was jointly approved as the focal question for the purpose of this Living Lab.

The workshops conducted in the scope of this Living Lab engulfed a diverse group of stakeholders representing regional water management agencies and local administrative units, facilitated the identification of the main water management problems and the assessment of primary needs to ensure better management practices of water resources.

The most prevalent needs highlighted:

- Increase of the collaboration between the regional water management authorities
- Reduce the fragmentation of roles and responsibilities in monitoring and management of water supplies
- Need for a revised regional/national regulatory framework
- Increase the level of public awareness for sustainable water management practices
- Emphasise on the adoption of digital tools to increase administrative coordination and raise public awareness.

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Water is a resource of high importance for the region of Trikala, as water streams directly affect both the primary sector (agriculture, animal husbandry) and the tertiary sector (tourism) as well as the recreational activities and the overall wellbeing and sanitation of the citizens in the prefecture. The Social-Cyber-Physical system examined inside the scope of this Living Lab engulfs the main water related natural and physical entities (irrigation network, main rivers, water streams, farming & livestock related entities) of the region, and examines their interplay with the societal actors and administrative institutions. It also tries to identify the impact of the adopted digital tools and services (water measurement sensors, data gathering repositories, data exchange platforms) for best water management practices. To date, a small magnitude of impacts has been generated from digitalisation in relation with improving the management of water resources in the region in respect of both agricultural needs at farm level and public authority and local community levels. The Municipality of Trikala has managed to keep a steady progress over the past years towards the adoption of smart services for the improvement of daily life of citizens, water management in the region however is still an area where the local authorities should put greater focus on.

May, 2022

SOCIO-ECONOMIC IMPACTS OF DIGITISATION OF CROATIAN AGRICULTURE AND RURAL AREAS

Ozren Hrsto & Silvio Šimon, MofA

Living Lab
DIGIFARMTOUR
Keywords
Locally produced, agricultural products, short supply chains, direct sale, internet platforms, agricultural and tourism sectors, digital connection
More info: https:/desira2020.eu/digifarmtour-croatia/

The focal question researched by Croatian Living Lab is: **How can digitisation contribute to strengthening the connections between farmers and tourists, and create a better position of the small family farms in the value chain?** Small producers sell their products on their farm and the best business results are achieved if they sell directly *at the farm* door. Online sales of agricultural products are becoming more and more frequent. However, the direct effects (consequences) generated by digitalisation on Socio-economic-environmental dimensions of the focal question are: small number of users, both farmers and customers; maintenance and updates of internet platform; creation of local product offer; recognition of local product and service; direct selling without intermediaries (better position in value chain) and easier communication among stakeholders. Challenges and other indirect effects can be considered: high delivery costs; difficult agricultural product representation (lack of feel, appearance and smell); changes in customers behaviour (buying local not in whole stores), and low-marketing cost.

The access to market even when using digital technologies requires a certain level of standards, identification and recognition of the actual suppliers of local products and services, internet access and computer literacy, close cooperation between tourist service providers, and the use of knowledge and innovative practices in digital marketing. Also, all other supportive services should be included in digital system, such as ICT companies, delivery services and others.

As the key constraints in the further development and connection of agriculture and tourism, the Living Lab identified digital inequality in terms of knowledge and interest of farms in the use of digital technologies, lack of delivery services, and the high cost of individual delivery.

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Positive effects refer to better recognition of local products and services, highlighting the importance of linkages of small scale farmers' community, and the lower costs of marketing. Digital technologies also affect interactions and relationships, mostly depending on the type of users and the benefits they get from the digitalisation as such.

Digitalisation will improve farmer position in value chain and development of agritourism in rural areas increasing market with standardised and recognised products, and enlarge it with tourists who have the largest impact on GDP in Croatia. As a result of expanding market using low cost marketing opportunities, it will result as economic growth for all stakeholders.

May, 2022

TIMBER REGULATION
WOOD-ENERGY TRACEABILITY IN ITALY

Stefano Ciliberti (University of Pisa) and Angelo Frascarelli (University of Perugia)
Antonio Brunori and Eleonora Mariano (PEFC Italia)

The Apennine Region Living Lab works around the following focal question: "How to strengthen the adoption of digital tools to support the **wood-energy traceability over the whole supply chain** in conformity to the compulsory EU Timber Regulation (995/2010) in Italian forests?".

Every year tons of **timber without a clear traceability** are imported in Italy. In order to foster production of wood from legal sources, the EU has enacted the **European Timber Regulation** (EUTR – Reg. n. 995/2010), prohibiting illegal timber from being placed on the European market. Such a system strongly relies on data flows allowing both risk assessment and mitigation.

Living Lab
EU Timber Regulation wood-energy traceability in Italy
Key Digital Technologies
Tools for digital payments (electronic invoice and point of sale), IT portals and digital platforms, social media
Keywords
Traceability, wood-energy, certification, EUTR
More info: https://desira2020.eu/firewood-traceability-italy/

The Living Lab elaborated a socio-cyber-physical (SCP) system able to identify entities, relationships and activities related to their focal question. Entities refer to three domains: **social** (forestry entrepreneurs, forestry managers and their associations; EUTR managing and supervisory authorities; civil society and local communities; European, national, regional and local public institutions; consultants and advisory services; consumers and end-users), **physical** (inputs and machinery; mountain areas with their forests and their physical infrastructures such as roads, electricity, etc.; collected and processed timber; hard copy documents) and **cyber** (tools for digital payments such as electronic invoice and point of sale; IT portals and digital platforms; social media). In more details, the SCP system revolved around the entity of the **forestry entrepreneur**, being the one able to catalyse main relations and activities in the wood-energy sector under analysis.

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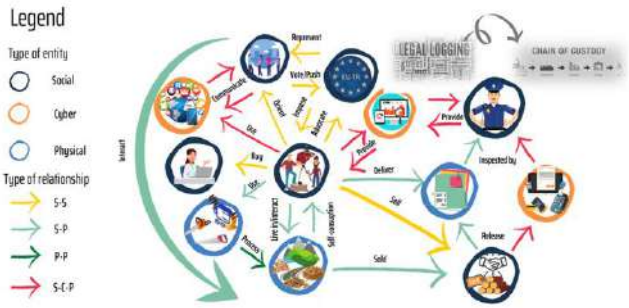
The Living Lab identified some relevant impacts of the digitalisation process on traceability of biomasses for energy purposes, which are here listed:



a) an **increasing transparency** and **traceability** due to the increase of digital payments to buy woody biomasses for energy purposes;

b) an acceleration of **communications** between EUTR managing authorities, public administrations and forest companies involved in the production of biomass for energy uses thanks to the presence of digital platforms with data and information;

c) the positive influence of these digital platforms in the **speed up of documentary checks** in compliance with EUTR requirements.

May, 2022

DIGITAL TECHNOLOGIES TO REDUCE HYDROGEOLOGICAL RISKS IN ITALY

Livia Ortolani, AMIGO s.r.l. & Fabio Lepore, UNIPI

Living Lab
Living Lab "Toscana Nord"
Key Digital Technologies
Messaging apps/email, platforms, software, databases, sensor/drones
Keywords
Marginal rural areas, ordinary land management, land monitoring, farmers/citizens participation, e-governance, rapid intervention
More info: https://desira2020.eu/tuscany-italy/

The Living Lab Toscana Nord focuses on the **use of digital technologies for ordinary land management in rural areas with the mountain landscape.** The area identified is classified for the 70% with a **high hydro-geological risk.** The structural fragility of the area, characterised by distance to essential services, has determined a long-term process of **depopulation**, **ageing of population** and loss of key functions. **Agriculture** is a key economic activity.

A constant monitoring of water streams can contribute to reduce hydro-geological risk. The Reclamation Consortium "Toscana Nord" gives an **important and active role of farmers and citizens** in the alert system and involves farmers in the maintenance works of water streams. Small farms in mountain areas consider this activity relevant to complement their income. The main aim of the Living Lab is to **identify opportunities to use digital technologies** to improve this process and enlarge the group of farmers involved in ordinary land management.

There are several actors involved in this process (*Reclamation Consortium, Tuscany Region, Public institutes, Municipalities, Farmers, Citizens and Associations*) who with the help of technology are oriented to pay attention to the main physical entity: *the territory*. Digital tools are today largely used by the Reclamation Consortium to facilitate the work of ordinary land management, including *WhatsApp/email, platform, software, databases, sensors/drones*. **Four main functions** have been identified clustering the technologies mentioned by local actors during interviews and workshops of the DESIRA projects: **Communication**, **Mapping and Planning**, **Integration of data and data management**, **monitoring and study of the territory.**

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The main impact of digital technologies in ordinary land management is the possibility **to reduce the time to transfer information from the land to the public authorities to allow a more rapid intervention when needed**. In particular, the communication function can improve the quality of the alert system and the data management function can facilitate the interaction among actors at different levels.

January, 2022

THE FUTURE OF FOREST FIREFIGHTING IN ANDALUCIA, SPAIN

Mª del Mar Delgado-Serrano, María Alonso-Roldán, UCO

Living Lab
Forest Fires in Andalusia
Key Digital Technologies
Remotely Piloted Aircraft System, geolocation, communication systems, cloud-based database
Keywords
Interoperability, coordination, resilient forests, public engagement
More info: Living Lab of Andalucia, Spain

The Andalusian Living Lab (LL) focuses on *How can digitalisation contribute to reduce the damage caused by wildfires and to make more effective firefighting and degraded land restoration by 2030?*

Forest fires are an increasingly recurrent phenomenon with an everchanging and more unpredictable behaviour. They require a significant amount of effort, resources, and coordination from all the organisations and communities involved to minimise their impact. The current context is complex and increases the risk to suffer highly impactful forest fires. Rural depopulation and agriculture land abandonment have increased forest surface in Spain, but many of these areas are not managed, and the local knowledge and values are not passed on. Private-forest owners -accounting for 75% of the Andalusian forests-, see their land profitability reduced due to the high costs of fire preventions measures. They are also affected by unfair competition of resources from public-owned forests (e.g., wood), increasing possibilities to land abandonment. Also, the limits between urban and forests have faded as new communities settle within or in the vicinity of forest areas, changing the way in which fires are managed. Finally, the sector is demanding professional profiles trained on forest management and digital and technological tools that Academia is not yet able to provide.

Whereas technologies have significantly evolved and contributed to faster and better manage forest fires (e.g., use of the use of Remotely Piloted Aircraft System -RPAS- for monitoring, smartphone devices and networks for immediate communication and geolocation), there are still some issues to be addressed for a better performance. Technological advances require a more responsive public administration to provide regulation updates and to establish data protocols and data interoperability mechanisms. Also, technologies could support a better coordination of the public administration with the communities and the private sector for early warning, monitoring and recovery systems.

The LL participants had a valuable chance to interact, which is not always enabled, and to provide hints about the future of digitalisation in forest fires management.

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Context and main needs related to the Living Lab's focal question

The current context is shaped by key socio-economic factors: agriculture land abandonment, increase of forest land and depopulation processes in the rural areas. These factors combined with climate change and the natural dynamic of Mediterranean forest ecosystems to accumulate fuel (especially during the summer draught) increase the possibilities to suffer more severe and impactful forest fires. Moreover, ageing processes and lack of generational shift in traditional farming activities playing a key role in forest fires prevention, such as cattle grazing, contribute to create less resilient forest ecosystem.

Yet the forest fires sector has seen a dramatic technological adoption in the past decade (e.g., fire evolution modelling, use of geographical big data) and it is expecting to incorporate further developments. In return, the rigidity of the public administration hinders regulation updates and the provision of open, interoperable, and up-to-date data protocols and databases. Technology can facilitate public engagement and citizen science for early warning, monitoring and recovery mechanisms. Also, faster, and more accurate technologies -like the High Altitude Pseudo Satellites, HAPS- are expected to significantly control and reduce the impact of forest fires. The main threat is how climate change will impact forest ecosystems and whether the access to future technologies will be granted.

Main digitalisation needs

- *Increased general awareness about forest fires. Awareness campaigns about prevention, risks, and impact of forest fires. Procedures in case of forest fire events, early warning, and monitoring mechanisms for citizens. Technologies to support prevention measures in private forest properties.*
- *Updated and real-time data. Protocols and tools to make updated forests information available including vegetation fuel maps, firebreaks status, accessibility of roads and routes, etc. Protocols and tools to provide real-time information about forest fires evolution and behaviour.*
- *Improved data accessibility. Centralised, organised, easy-to-access and public data in relation to vegetation status, location of water supplies, new roads and routes, private owners fire prevention plans, and previous forest fires episodes.*
- *Frequent regulation updates. Need to accommodate technology developments in regulation faster. Regulation to coordinate RPAS and piloted aircrafts.*
- *Better collaboration and coordination among stakeholders. Communication channels to enable information exchange, collaborations and to share technological innovations. Early warning systems and use of social media.*
- *Interoperable systems to transfer data among stakeholders.*
- *More reliable communication systems, especially in rural and remote areas. Internet connectivity must also be affordable, reliable, stable, possess low latency, and have redundancy.*[1]

[1] Council of Canadian Academies, "Waiting to Connect: The Expert Panel on High-Throughput Networks for Rural and Remote Communities in Canada" (Ottawa, October 2021), https://cca-reports.ca/wp-content/uploads/2021/10/Waiting-to-Connect_FINAL-EN_digital.pdf.

The Socio-Cyber-Physical (SCP) system

Several interactions occur in a complex SCP system due to the population increase within or in the vicinity of forest areas, the shared competencies in land management and the development of strategies for prevention, extinction, and restoration of burnt areas. All these are, at the same time, impacted by progress in research, development, and innovation.

The **social** component of the SCP system comprises citizens, the public administration, and the private sector. Forest owners, people living in forests and forest areas, forest visitors, occasional users and society at large are beneficiaries of the forest ecosystem services. Therefore, they should be involved in the forest maintenance and valorisation to the extent possible, which is not always facilitated. The competencies in forest firefighting and forest management are shared among different areas and levels of the public administration, which can cause overlapping and coordination issues, as well as information flows deficiencies. The staff and technologies required for forest firefighting belong to both the public (firefighters) and the private sectors (piloted aircrafts and their sensors). This may lead to clashes in terms of regulations and standards, slowing down or even preventing the use of certain -unregulated- technologies or the deployment of forest fire brigades. The visions and strategies of the stakeholders within the social dimension of the SCP system differ and can lead to conflicts and coordination issues.

The **physical** aspect of the SCP system shows a great variability and complexity throughout Andalusian forests in terms of vegetation, topography, climate, infrastructure layout, etc. Forests vulnerability to suffer severe wildfires is increased by the existence of patches of homogenous species, the lack of management in many forests (especially in pine forests) and wrong approaches to forest ecology (considering thinning and clearance activities as deforestation). Therefore, modelling techniques based on artificial intelligence could support to design more resilient landscapes.

The **cyber** domain has undergone significant development in the past decade. Remote sensing and spatial techniques provide updated information about the forest and fire status; fast telecommunication systems enable onsite and offsite coordination; and the capacity to quickly process large volumes of information allows to predict forest fires behaviour. The challenge is to establish collaboration and communication protocols among stakeholders and to the increase systems interoperability.

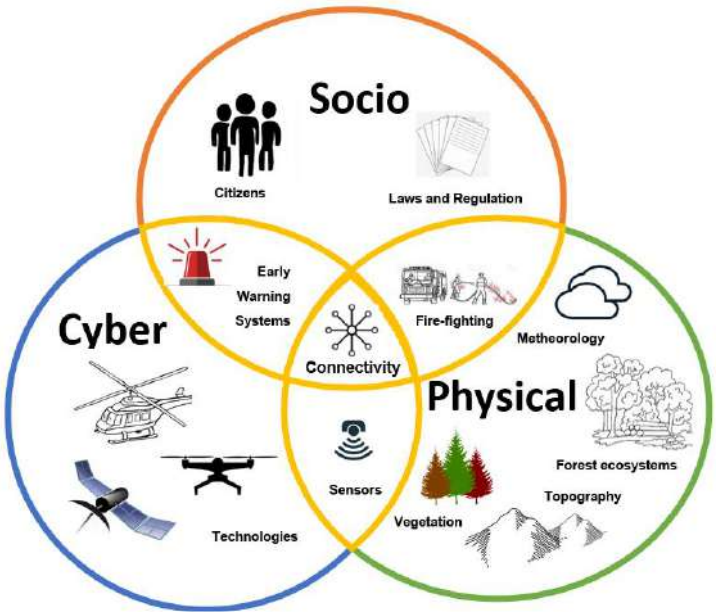

Figure 1 Visualisation of SCP system for forest fires in Andalusia

Impacts of digitalisation

What has been digitalised?	Main impacts (i.e. effects/consequences)		Sustainable Development Goals
• The data acquisition and data processing, thanks to sensors, remote sensing, telecommunication systems and powerful software and hardware.	Direct	• Difficulties in sorting and organising all the data and evidence gathered during wildfires	SDG 9: Build resilient infrastructure, promote sustainable industrialisation and foster innovation SDG 13: Climate action SDG15: Life on land
		• Difficult to find qualified staff	
		• Faster and more informed decision making, in prevention, firefighting and recovery	
		• Increased security for the firefighting brigades (geolocation, faster assistance)	
		• More accurate response and forest recovery thanks to modelling techniques	
	Indirect	• Potential unethical use of the data	
		• Better forest and ecosystem management, reducing fire possibilities	
		• Enhanced transparency in operations	

- **Design of digital technologies:**

Data processing has enabled to make information from different sources accessible. Also, availability of devices, such as smartphones or tablets, and the capacity to process and to consult high volumes of information quickly, have accelerated and improved the response on the field. New technologies pose the challenges of integrating them in a time-sensitive operation and to find the qualified profiles required. Finally, proprietary software and limited interoperability might prevent the use of relevant data.

- **Access:**

Reliable, stable, and fast internet connection is not always available in rural areas, making the firefighting response more difficult, especially in remote places. Besides, the fire often damages infrastructures which are the only source of communications. New technologies require significant investments for their development, testing and full adoption, which is conditioned as well by a general reluctance to change by the public administration and the staff involved in firefighting. Yet access to digital technologies is not limited to availability, but usage. Sometimes the staff lacks the technical skills and abilities to use specific or cutting-edge technologies. The ageing of the rural population restricts the capacity to engage with the local communities via new technologies (e.g. social media).

- **System complexity**:

The fast evolution of technologies has generated a complex system in which standardised training and requirements for staff are missing. This is worsened by the work seasonality for a high percentage of professionals working in forest fires. In general, communication channels, data acquisition and processing during wildfire fighting are not uniform and difficult early warning systems.

Main conclusions and recommendations

The impact of digitalisation in forest fires has been of special relevance in relation to data and communications. New technologies have significantly increased the capacity for data acquisition and processing. Nowadays, it is easier, cheaper, and faster to gather data with remote sensing technologies, cameras, sensors, GPS devices, etc., providing a detailed picture of all the forest fires stages. The capacity to process, integrate, and analyse data has undergone rapid improvements, enabling faster and more informed decision-making processes. Geolocation systems and portable GPS devices allow to track assets and to improve people safety. Progress in communications systems have also contributed to enhance the response capacity during a forest fire episode. Advanced technologies (satellite broadband, digital radio communications networks, etc.) facilitate onsite and offsite communications through a variety of devices, even in challenging conditions and complex topography.

To summarise, digitalisation has improved the analysis, modelling and usability of forest fire scenarios; it has improved the capacity of reaction; it has managed to reduce the impact of forest fires in the whole system -including casualties, ecological and economic losses-; and it has contributed to save time and money.

Some of the recommendations for the future of digitalisation in forest fires are:

- To use the new technologies to design collaborative platforms and to create a framework that facilitates knowledge transference between all stakeholders (public administration, rural communities, academia, and private sector).
- To systematise the experiences with technological advances for efficient and effective learning and implementation processes.
- To boost transversal development, fostering new opportunities for rural development.
- The public administration should adopt these new technologies with the views to:
    - Create more fluid and efficient administrative procedures.
    - Open direct communication channels with the citizens.
    - Develop and improve regulation, e.g. permits required for specific activities in forests, such as camping or bonfires, could be granted based on a risk index calculated from real-time data and not based on a fixed calendar.
    - Design a system to turn administrative process into an opportunity to contribute and to update a centralised database.
    - Ensure the standardisation of data to be easily integrated in different platforms and to be accessed by different stakeholders.

May, 2022

MAESTRAZGO AND GÚDAR-JAVALAMBRE DIGILAB

Javier Sancho & Ruth Aguarod (SARGA)

Living Lab
Maestrazgo and Gúdar-Javalambre Digilab
Key Digital Technologies
Technology involving websites, apps, social networks
Keywords
Digitalisation, natural resources, environment, depopulation
More info: https://desira2020.eu/aragon-spain/

This Living Lab is placed in the territories of Maestrazgo and Gúdar-Javalambre, located in Teruel, in the southeast of Aragón (Spain). Both areas are known for having a great territorial dispersion among their villages with a low population density.

The focal question this Living Lab is trying to answer is: "**how can digitalisation contribute to enhance the global attractiveness of the territory of Maestrazgo and Gúdar-Javalambre while taking care of their natural resources and environment?**"

The main challenge of this Living Lab has been to talk about digitalisation in an environment with lots of digital restrictions, so the activities performed try to analyse the past and current use of digital technologies associated to the focal question, the causes that have make that digitalisation difficult so far and the opportunities that it entitles.

The Socio-Cyber-Physical context of this Living Lab is complex, being **an extensive and depopulated territory with a great natural and cultural richness and with a deficient infrastructure from the technological point of view**. **Social** entities include: citizens, entrepreneurs, farmers, local associations and the different levels of public administrations involved. **Cyber** tools include: smartphones, laptops, PCs, websites, social media, APPs and related everyday digital devices. **Physical** context could be described as being located in high altitude (in the Iberian Mountain System), with hard climate conditions and a complex landscape that prevent from improving infrastructures.

The state of digitalisation in this LL could be classified as low, as in many rural areas of the rest of Aragón. Digital infrastructures should be improved, as well as the telephone coverage. COVID-19 has helped accelerated some changes (smart work, online market places, collaborative platforms) but it is also clear that the territory suffers from a severe infrastructure problem and lots of expectations rely on its improvement. The deficient broadband coverage in mountain areas and communications need to be solved in order to work on the further subsequent steps of digitalisation of administrations, industry and education.

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The most significant impacts of digitalisation of this LL are linked to the needs assessment: **to digitalise the industrial network of the territory**, to **improve and increase the basic services offered by local administrations** by strengthening the digital capabilities of public administrations; to **improve the digital skills** of all citizens; to **attract investors, companies and workers of the future** and to **turn the territory into a digital rural territory**.

Steps have been given in the last 10 years. Still, great expectations are placed on the possibility of really achieving the expected infrastructure and so the socio part of the system should be prepared to really take the change of improve the living conditions of the territory.

April, 2022

INNO'VIN USING DIGITAL FOR AGRO-ECOLOGICAL TRANSITION AND COMPTITIVENESS

Maryline Filippi, INRAE France

Living Lab
Insert name of Living Lab (LL)
Key Digital Technologies
Smart Transition, sensor, robot,
Keywords
Digital Agriculture, Smart Transition, sensor, robot, whole value chain
More info: https://innovin.fr/en/

Inno'vin is the wine cluster of New-Aquitaine Region in the South–West of France which now brings together nearly 180 industry players in the wine ecosystem.

The focal question refers to the wine sector's digitalisation and aims to understand the stakes of digitalisation throughout the wine value chain, as well as its impacts: After a current state of the level of digitalisation within the wine sector value chain, *how can these technologies help achieve the agro-ecological transition of the wine sector while strengthening its competitiveness?* It is divided into two sub-questions concerning the upstream and downstream value chain because the agro-ecological transition leads to the improved competitiveness of wine on the markets.

The upstream of the wine value chain is characterised by the focus on agro-ecological transition with concentration of vineyards which has led to an increase in size. **The downstream of the wine value chain involves** actors focused on competitiveness.

Inno'Vin Socio-Cyber-Physical system shows digital technologies being used to move towards a more virtuous form of viticulture ('precision viticulture', thanks to the data collected by sensors) while meeting both legislative requirements and consumer expectations alike. The characterization of purchasing behaviors allows to adapt the different modes of production, marketing and sale of products accordingly.

Digital technologies, far from being a simple bundle of innovations, constitute a real transformation of the entire winegrowing system, one which redefines the interactions between its entities. Digitalisation helps improve winegrowing practices and the techniques for moving toward more sustainability in response to regulations and consumer expectations, reconnecting both up- and down-stream of the wine value chain. But digitalisation also intensifies inequality between bigger and smaller vineyards (size and/or value). This poses certain difficulties for improving value enhancement and data sharing in order to develop knowledge over the entire wine value chain.

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Context and main needs related to the Living Lab's focal question

INNO'VIN supports companies in their innovation projects (more than 100 projects successfully supported since 2010). It contributes to meeting the challenges of the sector through innovation by helping to germinate solutions: promotes the competitiveness of companies in the wine industry and contributes to maintaining its leadership position. Based on SWOT analysis, the following needs are identified in relation to the Living Lab's focal question.

The main digitalization challenges of INNO'VIN are related to (1) **Digital conditions**: Lack of connectivity of some territories, lack of cooperation between actors on interoperability and data exchange issues and the cost of certain digital tools that remains high and constitutes too substantial an investment for small vineyards (in volume or value), and (2) **Sector conditions**: wine sector is a particularly atomised and complex niche market, where the creation and adaption of specific digital tools for each farm implies greater costs. However, the competitiveness with the poor valorisation of winegrowing or distribution data prevents both improvement in digital practices and better characterisation of stakeholder purchasing behaviour. Finally, the existence of a plethora of solution providers reduces the visibility of the tools available on the market, making it difficult for users to identify which one would best meet their needs

Consequently, the main digitalisation needs of INNO'VIN whole value chain

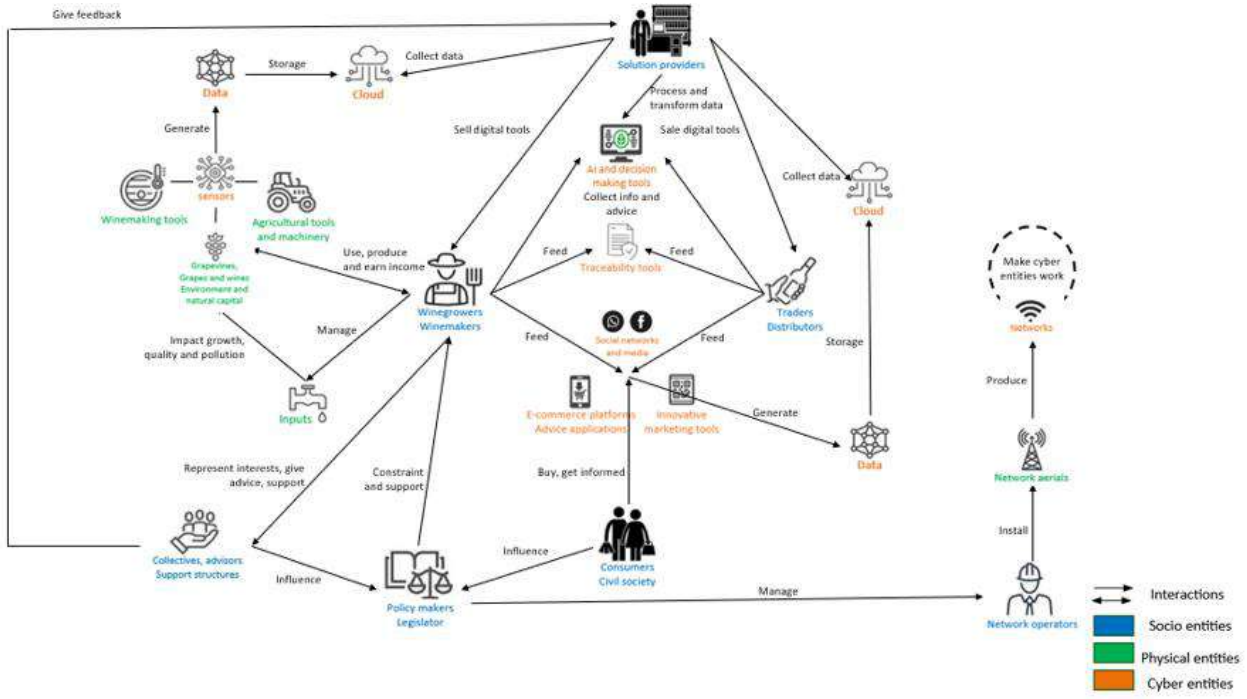
- Developing practical, user-friendly and adaptable tools
- Developing marketing strategies using digital tools and diversifying distribution channels
- Strengthening the role of the collective to support producer organization and innovation
- Ensuring the emergence of forms of support to help develop skills and enhance job value
- Promoting stakeholder collaboration to ensure data sharing and develop an inclusive business model
- Solving connectivity problems in order to enhance digital solutions

Main Strengths

- Arrival of a new generation familiar with both digital technologies and new marketing strategies or sales methods
- Prospects offered by technological progress such as robotics, AI and augmented reality + improvements to existing tools
- The mobilization of Inter-professional collective organizations and advisory services to support the digital transition projects of various sectorial actors
- The rapid spread of basic digital technologies within the wine sector is a first step towards digitalisation

The Socio-Cyber-Physical (SCP) system of INNO'VIN

The diagram below provides a representation of the INNO'VIN cluster and illustrates the interactions between the SCP entities and especially how digital technologies impact them translated into a system. Social entities (in blue) correspond to types of actors and other elements of the social field (e.g. regulations). Physical entities (in green) are the tangible elements used by social entities in the course of their activities. Cyber entities (in orange) refer to digital technologies.



Winegrowers and winemakers are using connected tools, DMT and AI in vineyards and cellars to achieve more virtuous viticulture and wine fabrication by managing inputs more efficiently. They are also using traceability tools to record all their interventions. These tools can be categorized according to their uses (Ex. Meteorology and pest risk management with weather stations being often associated with a DMT, to optimize the choice of treatment period; Proxi-detection for disease detection; drones and tractor; …).

Consumers' purchasing behaviour and civil society expectations simultaneously influence wine-growing and wine-making practices (winegrowers and winemakers), marketing strategy and ways of selling wine (traders, distributors), legislation (legislator). Policy makers and the legislator constrain winegrowing practices but also support winegrowers in the sector's evolutions via financial support, training, infrastructures, etc.

Solution providers sell digital tools to winegrowers, winemakers, traders and distributors. They also capture the data collected through the connected object they provide, and process these data to transform them into information or knowledge thanks to artificial intelligence to resell them through services to other actors of the wine value chain (e.g. DMT cartography, etc.). Collectives, advisors and support structures furnish feedback to solution providers about the needs in the field to enable them to adapt their tools and services. Most of the time, the data are captured by solution providers, who process them as services for resale. This is why cooperatives and support structures are important social-entities for supporting the digital transition.

Impacts of digitalisation

What has been digitalised?	Main impacts (i.e. effects/consequences)		Sustainable Development Goals
Producing grapevine: **IOT** and **AI** technology; **Captors** **Data** collected by **AI** via **decision support tools** **Agricultural connected tools and machinery** **winemaking connected tools**	Direct	• Data are captured by solution providers, so that winegrowers are deprived of the potential benefits	SDG 1: No Poverty SDG 3: Good Health and Well-being SDG 6: Clean Water and Sanitation SDG 7: Affordable and Clean Energy SDG 13: Climate Action
		• Improved knowledge about grapevine and wine production	
		• The use of output is reduced, thereby lessening environmental pollution and sanitary risks	
	Indirect	• Digital tools are expensive, so farms have to incur debt. This increases the risk of inequality and the loss of competitivity for small farms, which cannot invest in digital technologies	
		• Winegrowers' and winemakers' skills are developed, farms modernised and the profession made more attractive for young people	
Marketing and selling wine: **e-commerce platforms** **traceability tools** **Innovative marketing tools** **Social networks and media** **Data** on purchasing behaviour	Direct	• Seizing new market opportunities and capturing new consumers	SDG 9: Industry, Innovation and Infrastructure SDG 8: Decent Work and Economic Growth SDG 10: Reduced Inequality SDG 12: Responsible Consumption and Production
		• Valorised products, ways of production and reinforced competitiveness	
		• **Data are captured by solution providers with, farmers being deprived of the potential benefits**	
		• Better characterised purchasing behavior and consumer needs	
		• Producers who are not selling their wine online or not using social networks to promote their product risk losing market share and competitivity	
	Indirect	• **Producers are developing new skills, thereby making their profession more diversified and attractive**	

. The identified positive and negative impacts brought by digitalisation can be explained by:

- **Design of digital technologies:** precision and adaptability of digital tools improve 'precision viticulture' in diverse vineyards and cellars; materials used to manufacture digital tools, their functionalities and performance determine their price; non-adoption can increase exclusion risk.
- **Access to digitalisation**: use digital tools to promote, sell or buy products; crise covid-19 accelerates changes; no connectivity = no digital tools or at a more expensive price)
- **System complexity:** determinant Tool facility for adoption; greater the skills required in using it. System complexity can increase their price and needs training for both producers and traders

Main conclusions and recommendations

The changes brought about by digital technology can become either opportunities or obstacles to development for the actors in the sector.

Main impacts generated by digitalisation in the Inno'Vin focal question:

The use of digital technology in viticulture is driven by the preservation of resources (precision agriculture, biocontrol), the traceability of practices, but also the search for competitiveness of the sector throughout the value chain. Issues and risks have been identified with some of them being of paramount importance:

- Data is a source of value that is still insufficiently exploited, because the wine growers and wine distributors who own the data do not know what to do with them.
- The plethora of solution providers makes it difficult for users to navigate and know how to find the solution that will best meet their needs.
- The digital challenge could allow the links with consumers to be recreated, whether by (1) ensuring traceability over the entire value chain so as to have direct contact with the consumer; (2) to seize digitalisation as a means of "reinventing the wine product" and "reinventing itself" as a company: in other words, finding new sources of value.

Analysis of the digitization of the value chain highlights that:

- The two-speed viticulture that has been observed constitutes a source of brakes on digital adoption, and even presents significant risks of exclusion.
- Support for change, the development of professions for both winegrowers, advisers and supervisors (management, marketing) are essential issues for developing inclusive digitalisation, allowing both the agro-ecological transition and the improvement of value chain competitiveness.

System complexity, technology design, and access role:

The sector reveals different levels of maturity. Wine sector heterogeneity explains the obstacles to the implementation of a collective strategy. The digitization of the cluster is characterised by the weakness of any comprehensive digitization strategy within the sector. The development of strategic governance of the entire value chain would seem to be an achievable objective.

Main recommendations are:

Accelerating agro-ecological and digital transitions, training and support for changes are crucial. This requires converging the strategic framework and the digital tools that are deployed at the various links in the value chain, from upstream to the consumer, in order to try to build a real collective strategy.

Promoting interoperability by sharing a common language, education and developing trusted third parties across the entire value chain to pool data, associating producers and digital players for creating and sharing value in the whole system, for the benefit of actors.

Co-building public policy measures to promote digital tool use, reducing the costs of individual equipment (at the operational level) and at a collective level (equipment, network connections,...), developing new supports for adoption (e.g. securing the business model of sharing and improving data) and modifying regulations to legislate on data sharing.

April, 2022

INNOVATIONS IN FAVOR OF AGRO-ECOLOGICAL TRANSITION IN AGRICULTURE

André Torre, INRAE, France

Living Lab
Agronov
Key Digital Technologies
Insert short list of the technologies assessed in the SCPS
Keywords
Insert keywords of the report
More info: https://agronov.com/

Agronov is an agricultural cluster (LL) localized in the Burgundy Franche-Comté Region (BFC) in the East of France, characterized by great culture diversification (animal and vegetal) and two main parts (plains versus mountains), high quality with many labelling products and an important urban area (Dijon).

The activity of Agronov is dedicated to agro-ecological transition. Its focal question is: How does digital technology contribute to the emergence of innovations in favor of agro-ecological transition in agriculture?, declined into three sub-questions dedicated to data, new solutions and innovations.

The SCP system of Agronov shows that digital technologies are using for reinforcing agricultural transition (precision agricultural thanks to data collected by captors, robots…) and for responding at the same time to both legislation pressures and consumers' expectations. The use of digital technologies is not new due to the regulation pressures like CAP registration or precision farming but for another uses adoption is low and variable. The other factors influencing adoption, are in particular, both types of crops (plants / livestock) and of farms (small / large). The analysis underlines the needs for practical and simple tools, for concrete investment return for farmers and an economic inclusive data model (sharing, property and valorization of data more sustainable). Digitalization adoption is more related to human than technological brakes. So a collective strategy needs to be consolidated at regional level.

The analysis of the impacts of digitization leads to distinguish three topics: (1) uses and their specificities according to the characteristics of farms (including digital culture, financial farm sustainability…); (2) the obstacles to the adoption of digital technologies (weaknesses in interoperability, "white areas", …) and (3) factors accelerating the digital transition to serve agro-ecological transition.

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Context and main needs related to the Living Lab's focal question

Burgundy Franche-Comté is an agricultural region characterized by great culture diversification (animal versus vegetal), two main parts (plains versus mountains), high quality with many labeling products and an important urban area. Agro-ecological transition is the main driver for all supply chains.

The regional agricultural performances are rather good with five dominant technico-economic orientations: field crops, meat cattle, milk cattle, viticulture, polyculture livestock farms. A substantial part of production is very well known and benefits from geographical indications, particularly in viticulture and cheese production.

Strengths: commitment to the agro-ecological transition, quality of the regional agricultural and agri-food industry, dynamic early adopters, positive strategies of cooperatives and collective organizations, fall in price of certain equipment.

Weaknesses: weakness of data sharing, lack of digital culture and skills, transition to the industrial phase in progress, digital tools not always adapted to the reality on the ground.

Opportunities: concentration of farms and lack of labor, open data as an opportunity to boost exchanges and create new services, incentives towards the adoption of new practices, use of already existing techniques, opportunities to reduce the arduousness of agricultural professions.

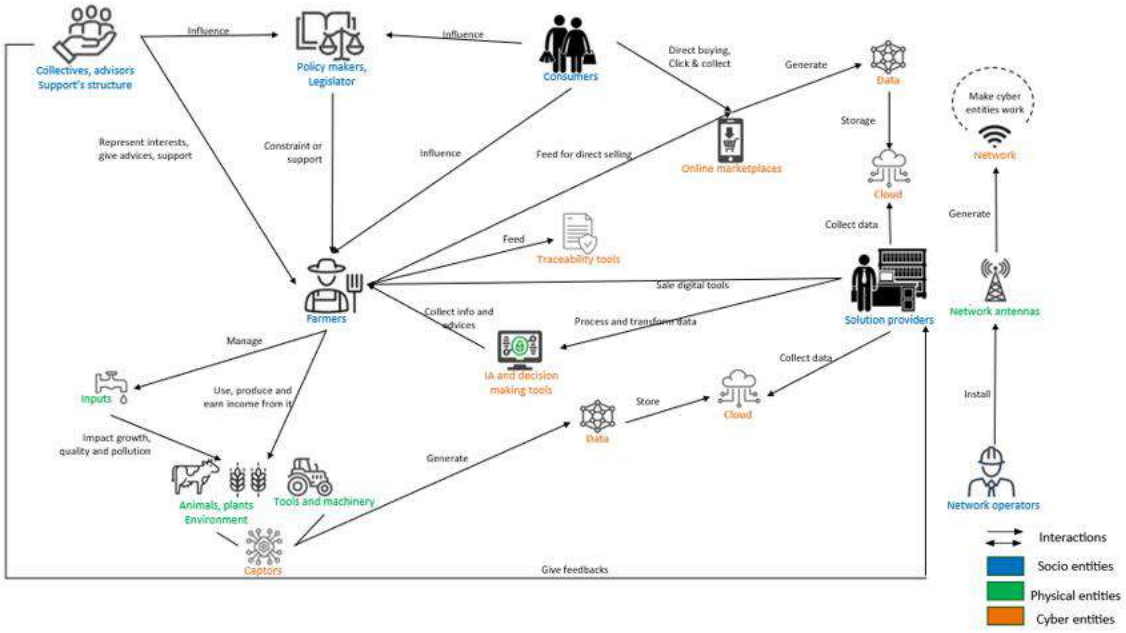
Threats: heterogeneity of players and strategies between various territories, need to secure sustainable solutions, lack of robust data economic models, lack of interoperability standards, energy-consuming digital technologies.

Main digitalization needs

- *Struggle against white areas which prevent the deployment of digital tools by lack of connectivity, with the deployment of fiber, 4 and 5 G, and satellites.*
- *Strengthen the interoperability of systems, develop a common language and data exchange standards allowing communication between digital objects.*
- *Secure solutions and promote interoperability of systems, in order to guaranteeing farmers a lifespan of connected objects allowing at least amortization of the investment.*
- *Need to find robust business models for data sharing, in order to guaranteeing a return on investment from data sharing and de-privatizing dataflows, and to move towards more collective actions*
- *Need to meet consumer expectations, particularly in terms of product durability and traceability, with the development of reliable traceability tools strengthening the link between producer and consumer.*

The Socio-Cyber-Physical (SCP) system

The diagram is a representation of the Agronov cluster translated into a system with three types of entities: social entities (blue), physical entities (green) and cyber entities (orange). Social entities correspond to types of actors and other elements (e.g. regulations). Physical entities are the tangible elements used by social entities in the course of their activities. Cyber activities refer to digital technologies. This representation materializes the interactions and how digital technologies impact them.



Interactions developed between each system entities (intra and inter-domain)

- *Socio- socio: Public policies and regulations impacts influence of consumer's needs, services to the farmers, cooperatives helping farmers in changes of practices, influence of farmers unions on policies.*
- *Cyber-cyber: sensors generating data in the cloud, internet and mobile networks allowing other cyber entities to operate, data used to feel the blockchains and online platforms.*
- *Physical-physical: Agricultural tools and machinery allowing cultivation of plants and breeding of animals, inputs which impact the growth of plants and animals + pollute the air and soil.*
- *Cyber-physical: Agricultural tools, machinery, plants and animals supports for sensors, probes, etc., Cell towers easing mobile network and the internet, smartphones, tablets and computers supports for platforms and marketplaces, DMTs, artificial intelligence, blockchain, etc.*
- *Socio-physical: farmers handling agricultural tools, growing plants and raising animals, providers selling agricultural tools, smartphones, etc., network operators installing cell towers.*
- *Socio-cyber: farmers feeding traceability tools + receiving information, suppliers providing sensors, collecting and processing data, consumers using platforms and marketplace and generating data.*

Impacts of digitalisation

What has been digitalised?	Main impacts (i.e. effects/consequences)		Sustainable Development Goals
• Agricultural, plant and animal production systems have been digitalized • Sensors, robots, software for precision farming, and broadband network (smartphones, Internet) are the most popular tools • AI, drones, and blockchain are less used	Direct	• Strengthening of dependence on solution providers and issues related to data ownership and consent to use	SDG XX: Name of SDG SDG XX: Name of SDG
		• Increase in pollution emitted by the use of digital technologies (CO2 emissions, use of scarce resources, etc.)	
		• Reduction of environmental impacts and health risks associated with agricultural practices	
		• Contribution to the agro-ecological transition by improving knowledge and skills	
	Indirect	• Widening of the gap between the most dynamic farms that adopt digital technologies and those that remain in the background. Risk of negative impact on the number of farmers	
		• Increase of the competitiveness and profitability of farms	
		• Strengthening of transparency on the evolution of agricultural practices aimed at actors in the value chain, local authorities and consumers	
		• Strengthening of the attractiveness of agricultural professions: reduced arduousness of tasks and technical skills	

Digitalisation generated impacts through the following mechanisms:

- **Design of digital technologies:** *Digital tools provide responses to the needs of the farmers, and improve agricultural practices for plant and animal production, towards greater sustainability. Materials used to manufacture tools, their functionalities and performance determine their price, so their adoption, and can increase the risk of exclusion. The way tools are interoperable or backwards compatible can increase their adoption, facilitate data collection and sharing, reduce user's workload and reinforce their trust.*

- **Access:** *Access to digitalization has made it possible to meet regulatory constraints in arable crops, in particular on phytosanitary products and water resources, and to increase farm size context. For breeders, digital technology provides solutions on the reliability of the information provided in order to facilitate the monitoring and management of animals.*

- **System complexity**: *The ease of tools is a determinant of their adoption, both by producers, actors of the supply chain and consumers: the more a system is complex, the higher are the skills to use it. Complexity of digital systems can create gaps between early adopters and opponents, creating exclusion processes. It can also increase their price, making the profitability of their adoption more uncertain.*

Main conclusions and recommendations

The main impacts generated by digitalization need to be analytically distinguish at farm, sector and territory levels.

- At the operating level (farm), digital technologies promote precision agriculture, facilitate the monitoring of the production, meet traceability requirements and offer a better information or a response for consumers (origin, quality…).
- At the sector level, they allow to identify the needs of the various actors of the value chain, to promote cooperation and the building of a strategy between them, and to share a common language between people and between tools.
- At regional and community levels (territory), they facilitate data sharing and promote support for farmers using them, help to build an inclusive model for the farmers primary producers of data, and promote the collection, processing and enhancement of data both within farms and at the level of the system as a whole through educational work, training of advisers and farmers.

Main recommendations are:

- to co-construct public policy measures to promote uses, to reduce individual equipment costs at the operating and collective levels (equipment, network connection, etc.), and to build new forms of help in supporting change and adoption (e.g. participating in securing the economic model of sharing and enhancing data;
- to promote interoperability by sharing a common language;
- to promote training and information for users in order to reduce the costs of equipment changes, data loss and to improve the return on investment of equipment (milking robots, sensors, etc.);
- to develop trusted third parties to share and enhance data in a system and for the benefit of an actor (e.g. GAFA, John Deer or Casioland for tractor equipment); to modify the regulations to legislate on the sharing of data;
- to work on projects at the regional level, with the goal to pool the different sectors, associate producers, digital players and consumers, to create value and share it in order to avoid capture for the benefit for a small number.

May, 2022

DIGITALISATION IMPACTS FOR A CROFTING COMMUNITY IN SCOTLAND

Leanne Townsend and Dominic Duckett, James Hutton Institute

Living Lab
Scottish Crofting Community
Key Digital Technologies
Digital connectivity, digital platforms
Keywords
Digitalisation; rural; crofting; community
More info: https://www.coigach-assynt.org/, https://desira2020.eu/rural-scotland-united-kingdom/

The Scottish Living Lab works with a crofting community on the West Coast of Scotland.

The focal question is: **How can digital technologies promote opportunities for crofting communities in Wester Ross?**

The Living Lab is situated in a remote rural region of Scotland. Crofting is a form of small-scale agriculture typical in Scottish Highland and Island communities. Crofters are pluri-active – they have multiple economic roles, because crofting itself is not a viable means of making a living for a household. The **needs assessment** considered diverse community needs, not only those relating to crofting. The needs identified were: fast broadband for all and access to digital tools to empower local community actions and economic activities. Participants highlighted a need for support to enable more inclusive digital participation.

Social entities of the Living Lab include crofters and members of the wider community, as well as structures including community groups and a local development trust. **Cyber** entities include smartphones, laptops, PCs and other everyday digital devices. **Physical** entities relate to remoteness; environmental aspects (mountains, local wildlife); crofting aspects such as livestock; and human-made elements such as sparse local housing, roads and other infrastructures.

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Digitalisation impacts relate mostly to using "low-tech" tools including digital platforms that allow social connectivity. The community are at an early stage of "digital readiness". The installation of reliable broadband arrived just before Covid-19 struck. This motivated the community to embrace digital tools for connecting at a relatively fast pace. The ability to access digital tools and services has been transformational for some, enabling community networking and action, empowering local businesses, and giving residents access to e-health services. The benefits of this rapid digital transition have not reached all members – the older members of the community are most likely to be marginalised from these services and opportunities.

May, 2022

DIGITALISATION AND AMMONIA EMISSIONS IN FLANDERS, BELGIUM

Daniel van der Velden, ILVO

Living Lab
Flanders (Belgium)
Key Digital Technologies
Individualised monitoring of ammonia emissions on livestock farms, E-government services
Keywords
Ammonia emissions, livestock, e-government, data sharing, data ownership
More info:
https://desira2020.eu/west-flanders-belgium/

In the livestock farming sector in Flanders there are several issues that need to be addressed. This followed from research that sought to understand the main research question: "**What is the impact of individual farm based monitoring of emissions in the intensive livestock sector for agriculture, policy, and society?"**

As of right now, the livestock sector is anticipating regulation that seeks to curtail the emissions of ammonia from livestock farms. This regulation is expected to have a large impact on livestock farms and farmers. Equally, the livestock sector is suffering from poor economic performance, with low incomes for livestock farmers. This creates a space where stakeholders ask for dependable regulatory frameworks that create space to farm as well as asking for fair prices.

As a social-cyber-physical system this can be represented as social actors such as consumers, retail, governments and farmers that have influence on another as well as on physical infrastructures such as emissions, environment & nature and digital infrastructure in rural areas. This is connected to a slowly developing cyber element consisting of sensors & data sharing tools for livestock farms as well as e-government services provided by the Flemish government.

At the moment, the livestock sector is slowly digitalising and presents a mix of digital and analogue elements. Currently, sensor technologies to monitor airborne emissions are in development. However, because they are not yet ready for market there are currently no direct impacts of this technology. Stakeholders are mainly concerned with the ownership of data collected in farming.

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Potential misuse of this data is a concern and stakeholders describe the need to ensure that farmers own the data produced on their farms. Regulatory complexity and the readiness of government actors to adopt digital technologies in agricultural regulation are named as a concern by ag-tech companies. This is also vital in relation to e-government services and the further development of digital technologies for agri-environmental governance.

May, 2022

DIGITALISATION & RESILIENT RURAL LIVELIHOODS IN CLOUGHJORDAN ECOVILLAGE, IRELAND

Mel White, Cultivate (Sustainable Ireland Co-operative)

cultivate
living and learning

Living Lab
Scottish Crofting Community
Key Digital Technologies
Digital connectivity, digital platforms
Keywords
Digitalisation; rural; crofting; community
More info: https://www.coigach-assynt.org/, https://desira2020.eu/rural-scotland-united-kingdom/

Cloughjordan Ecovillage was developed 10 years ago, bringing an influx of residents with high levels of skills, capability and education, and a subsequent increase of enterprise and remote working to an area with low population density and few employment opportunities. The Living Lab spotlights a community enterprise centre within the Ecovillage, with the focal question: how can digitalisation support local livelihoods that contribute to rural regeneration and assist in the transition to a low carbon society?

Stakeholders recognise threats to global supply chains due to shocks caused by environmental, economic, and political factors, and have identified the need to strengthen local supply chains. This would support livelihoods for local producers, artisans, and service providers, reinvigorate the local economy and support regional resilience. They also recognise the need to reduce travel, in line with the global need to cut fossil fuel emissions, and aim to work remotely where possible.

The enterprise centre houses a community owned digital fabrication studio, a new digital farmers market, a digital media studio, and a large event space, and functions as a co-working hub, while supporting the incubation and development of innovative projects. As well as the physical users of the building, many

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other stakeholders are connected via digital platforms and peer to peer global networks which share information and skills.

The most significant impacts of digitalisation on the system relate to these innovative projects, that are at the core of the centre's activities. A number of past and present projects would have been inconceivable without digitalisation. Digitalisation has also created global peer to peer networks that share information and skills, which has led to an increase in citizen-led innovation, and allowed regional start-ups to benefit from global experience. This has created a change to the nature of many local livelihoods. Other impacts relate to a reduction in travel to work, which was enabled by the advent of collaborative platforms, and amplified by the pandemic response. This contributes to a reduction in carbon emissions, rural repopulation, and strengthening of local economies, as well as improved quality of life.

PRACTICE ABSTRACT

Digitalisation: Needs and Impacts

May, 2022

VEGEPOLYS VALLEY

Frederic Wallet, INRAE, France

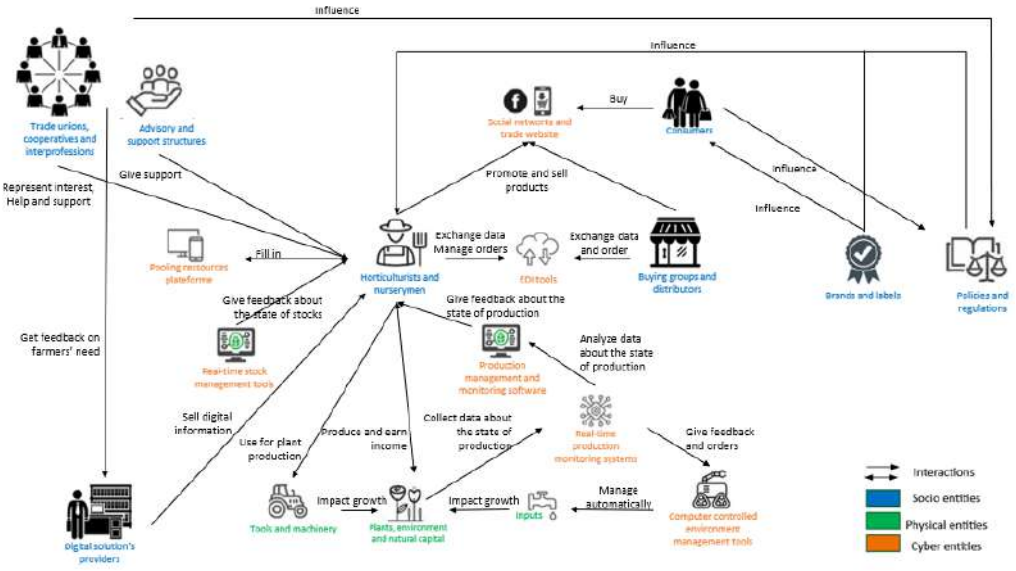
Living Lab
Vegepolis Valley
Key Digital Technologies
Insert short list of the technologies assessed in the SCPS
Keywords
Insert keywords of the report
More info: Insert the link

Vegepolys Valley is a French vegetal cluster localized in the regions of Brittany, Pays de la Loire, Centre Val de Loire and Auvergne-Rhône-Alpes, dedicated to the competitiveness of the vegetal sector. Due to the diversity of the vegetal sector, we focused on its horticultural branch in order to deepen understanding of the digital impacts. **Its focal question** is *how can the digital transition allow companies in the French horticultural sector to remain competitive on the international market?* It is declined into two sub-questions regarding the supply chain challenges. The first concerns the upstream side of the value chain: *how can digital technology enable horticultural companies to increase their productivity and reduce costs, while reducing their environmental impact?* The second concerns the downstream side of the value chain: *how can digital technology enable horticultural companies to have a better knowledge of the offer, to better appreciate the market and the real needs of end consumers, but also to diversify the sales methods?*

Context and main need assessments of the Living Lab

The **digital needs** are related to the specificities of horticulture, which is characterized by continuing deterioration of its competitiveness compared to other European countries, particularly the Netherlands, where processes are strongly specialized and industrialized. Another aspect is that in the horticultural sector, perhaps more than agriculture in general, there is an ageing of farm managers who are rarely replaced when they retire and a workforce shortage, which creates a need for process automatization and mechanization, resulting in great heterogeneity between farms. Finally, those horticultural farms already in financial difficulties have been further weakened by the Codiv-19 crisis, which stops them from investing in digitalisation, even though doing so has been identified as a necessity by the sector's stakeholders. Several needs to achieve this digital transition, to allow the sector to gain in competitiveness, have been identified : raising awareness of the horticultural sector to attract workforce, carrying out training and support for the digital transition of producers; trying to remove technical barriers to the digital transition through R&D; creating added value around horticultural products through digital technology; strengthening the profitability of companies to create margins for investment in new tools, including for e-commence; developing stakeholder cooperation and mutualisation between upstream and downstream.

Synthesis of the SCP system



Consumer's behaviour and civil society's expectations influence horticultural production practices (more respectful of health and the environment), ways of selling and promoting products (development of e-commerce and short supply chains, greater use of social networks and media, etc.), but also restrictive legislation (reduction in the use of plant protection products). Labels influence consumers' purchasing behaviour by affecting their awareness of the origin of plants and the processes used for their production. But **labels** also influence horticultural practices to a certain extent, because to obtain them, horticulturists will have to adapt their practices to comply with very precise specifications. The labels allow the horticultural production and the efforts made by the producers to be valued by the consumers.
Solution providers equip horticulturists for the production, farm management and marketing of plants, but also distributors for the ordering, business management and marketing of plants.
Moreover, they must constantly innovate in order to remove the obstacles (social, technical, economic) to adopting the tools they offer. In this sense, the **horticulturists' collectives and representatives, as well as the advisory and support structures**, inform the solution providers of the needs in the field and the difficulties they face. Support structures can also influence public policies by lobbying for more support or by trying to limit constraints.
Monitoring, management and production tracking systems produce data that will allow the best possible adaptation of input use and optimisation of plant production processes. This will have repercussions in terms of public health and farm. The data collected by stock management tools will enable practically instantaneous interfaces between feed merchant sites, platforms for pooling available products or producer/shop interfaces.

Impacts of digitalisation

The main activities of the system are the production and marketing of plants. Thanks to digitalisation, the main outputs are horticultural products that are more respectful of the environment and health and more market competitive. Data are also outputs produced by means of digital tools, which allow system actors to adapt and evolve their practices (production, marketing, purchasing), and to make inter-actor exchanges more fluid.
The outcomes are that (1) practices throughout the value chain are more virtuous and less impactful on the environment; (2) that exchanges are more fluid and trust is strengthened between the actors in the system and that products; and (3) practices are better valorised. It remains to be seen whether increased digitalisation will also result in greater competitiveness and profitability for companies and increased attractiveness of the profession, as is also expected.

The digitalisation of the horticultural sector has an impact on several sustainable development objectives:
• By improving the competitiveness of enterprises and their profitability, this will increase the producers' income (SDG1, SDG 8).
• Real-time measurement of plant needs will allow better management of inputs, a reduction in pollution and thus a reduction in public health risks (SDG3, SDG 6, SDG 7, SGD 12, SDG 13).
• Mechanisation and automation will improve the working conditions of horticulturists and thus their well-being (SDG2, SDG 8).
• The arrival of digital technology will diversify and broaden the skills of horticulturists as soon as training and other educational tools are put in place. In the same way, the use of digital technology in training centres (initial or continuing education) can improve student learning**,** and also make the profession more attractive, by giving it an image of an innovative and modern sector (SDG 4).
• **Digitalisation of the horticultural sector** will allow for the industrialisation of production processes, and will push solution providers to innovate further in order to offer tools that are increasingly efficient and capable of accomplishing more and more varied tasks, while removing technical obstacles. It will also push public authorities to develop infrastructures in the territory, especially network infrastructures (SDG 9)

Impact on the upstream of the value chain

What has been digitalised?	Main impacts (i.e. effects/consequences)		Sustainable Development Goals
Plant production process (upstream) • Real-time production monitoring systems • Computer-controlled climate management and watering systems • Production management and monitoring software or applications	Direct	• Strengthening of dependence on solution providers and issues related to data ownership and consent to use	SDG XX: Name of SDG SDG XX: Name of SDG
		• Increase in pollution emitted by the use of digital technologies (CO2 emissions, use of scarce resources, etc.)	
		• Reduction of environmental impacts and health risks associated with agricultural practices	
		• Contribution to the agro-ecological transition by improving knowledge and skills	
	Indirect	• The increased stress and mental tension of being constantly connected	
		• The rupture of the privileged link between horticulturists and nature	
		• Greater attractivity of the horticultural work because it gives a more modern image of the profession that is more likely to appeal to young people	
		• Decrease in the drudgery of work for horticulturists and a better quality of life	
		• Improved vision of the production processes by consumers, increasingly attentive to the preservation of resources	

Impact on the downstream of the value chain

What has been digitalised?	Main impacts (i.e. effects/consequences)		Sustainable Development Goals
Plant marketing (downstream) • Digital producer/store interfaces and EDI tools • Platforms for pooling available resources • Real-time stock management tools • Trade websites • Social networks and showcase websites	Direct	• The increase in inequality between companies which can be digitalised and those that cannot	SDG XX: Name of SDG SDG XX: Name of SDG
		• Producers are more able to evaluate their stock so they can better adapt their production to demand	
		• Producers are more able to pool their stock on dedicated platforms, and consequently respond to bigger orders in cooperation with other producers	
		• A decrease in product loss. Because plants are perishable products, if stock are not well managed and plants are not quickly sold, they are thrown away, so that income is lost. Thanks to digitalisation, stock can be better managed, so production can be adapted according to market trends	
		• Relationship and data exchanges between producers and distributors are easier, more fluid and more efficient	
	Indirect	• Diversification and eventual increase in producers' income	
		• Reinforcement of relationships and trust between producers and consumers	

Main conclusions and recommendations

Although digitalisation is not currently the focus of attention in the Vegepolys Valley cluster and in the horticultural sector, it is seen by actors as an effective engine to improve their competitiveness.
The impacts generated depend on the structure of the farms**,** and are linked to the strong heterogeneity of the actors. Those horticultural farms already in financial difficulty have been further weakened by the Covid-19 crisis, which prevents them from investing in digital technologies, even though sector players have identified such investment as essential.
The main impacts generated by digitalisation are: (1) at the level of the upstream value chain**;** and (2) at the level of the downstream value chain. Several requirements for the successful digital transition of the sector to gain in competitiveness have been identified: (1) raising awareness of the horticultural sector to attract labour, particularly young people**;** (2) carrying out educational projects and supporting the digital transition of producers; (3) attempting to raise the technical barriers of the digital transition through R&D; (4) create added value around horticultural products thanks to digital technologies; (5) strengthen the profitability of companies to create a margin for investment in new tools; and (6) develop cooperation and pooling upstream.
The role played by the complexity of the systems, the design of the technology and the access is really significant on these impacts. The Vegepolys Valley SCP system shows that digital technologies are being used to improve resource conservation, better manage the production process, and to improve stocks and sales. Digitalisation has increased the complexity of the system embodied by the cluster**,** because it has disrupted the existing links between certain elements (for example, producers are emancipating themselves from distribution and strengthening their links with consumers, but they are becoming more and more dependent on providers of solutions and lose their privileged relationship with nature).

Digitalisation has also made the system more complex by integrating all the considerations related to the increasing amount of data and its governance.

The main recommendations can be expressed along two main lines:

Develop policy support for investment strategies: digitalisation reinforces inequalities between companies that have the resources to initiate their digital transition and take advantage of it to improve their situation (virtuous circle) *versus* companies that do not have enough economic and competency resources and are, thus, unable to compete on markets and consequently have their profitability decreasing (vicious circle). Consequently, policy supports have to take these problems into account to help the horticultural sector in both skill and equipment perspectives.

Support digital communities: in order to increase the positive effects of the digitalisation of horticulture for the SDG transition, it seems important to strengthen trust and cooperation between upstream horticultural players, but also exchanges between producers and distribution, including solution providers and short supply chains. The advantages of digital technologies could be the improvement of competitiveness**,** with the conquest of new markets, as well as the agroecological transition