Table S1 – Issues analysed and impacts (positive and negative) of digitalization in agricultural sector according to selected literature review.

Title	Issues analysed	Digital tools	Effect reported	Outcomes in
Barnes, A.P.; Soto, I.; Eory, V.; Beck, B.; Balafoutis, A.; Sánchez, B.; Vangeyte, J.; Fountas, S.; van der Wal, T.; Gómez-Barbero, M. Exploring the adoption of precision agricultural technologies: A cross regional study of EU farmers. *Land Use Policy* **2019**, *80*, 163–174, doi:10.1016/j.landusepol.2018.10.004.	Barriers and effects in adopting precision agricultural technologies to preserve natural capital and increase agricultural productivity and farms income. Analysis of 971 arable crop growers in five European countries. Subsidy and taxation emerged as positive drivers for the adoption, and indirect interventions are relevant (i.e., informational support to counteract industry bias, and demonstration to prove the viability of economic return, policy expectations).	Autonomous system Connectivity Local and remote sensing	(+) farm management (+) ecological footprint (+) natural resources (+) production / income (-) labour market (-) skills	Autonomy, Equity, Food quality, Gender gap, Incomes. Learning, Plant health, Privacy, Proactivity, Resources, Responsibility, Security, Skills
Bayer, J.; Ed. *Harnessing the Chances of Digitalisation for Rural Development. Lessons-Learnt in German-Funded Rural Development Projects*; GIZ: Brussels, Belgium, 2018.	The potential of digital solutions for African countries based on German technical cooperation experiences. It is stressed that digital tools can be useful to promotes innovation related to sustainable agricultural practices and to other cross-cutting issues (increasing incomes, employment of young people & women, enhanced food and nutrition security, environmental protection, reduces soil degradation, reducing the information gap between smallholder farmers and financial institutions, access to adequate financial services). Education and communication are stressed as relevant factors in digitalization process.	Cloud Connectivity Data analytics Distributed ledger Social media Platforms Smartphone Sensors on vehicles	(+) farm management (+) income / job opportunities (+) nutrition of food products (+) ecological footprint / soil (+) gender & information gap (+) financial services (-) connectivity (-) policies (-) socio-political stability (-) stakeholder participation	Autonomy, Bargaining power, Biodiversity, Clime, Cooperation, equity, Financial risk, Gender gap, health, Inclusion, Incomes, Prediction, Prevention, Proactivity, Productivity, Resilience Resources, Responsibility, Security, Skills
Belaud, J.-P.; Prioux, N.; Vialle, C.; Sablayrolles, C. Big data for agri-food 4.0: Application to sustainability management for by-products supply chain. *Comput. Ind.* **2019**, *111*, 41–50, doi:10.1016/j.compind.2019.06.006.	The article presents a study concerning big data used to improve the sustainability management in supply chain design. The aim of the study is to valorise agricultural waste. The study presents the main steps and issues related to "Agriculture 4.0".	Big data Autonomous Systems Automation Connectivity Local and remote sensing	(+) Life cycle assessment (+) Sustainability (+) Food Waste (-) Natural resources (-) Food Waste	Autonomy, Biodiversity, Resources, Responsibility, Clime, Energy, Resource Efficiency
Bronson, K.; Knezevic, I. Big data in food and agriculture. *Big Data Soc.*	The article presents an illustration about digitalization in agriculture especially in relation to big data collection and utilization. Digitalization in agriculture is represented as a key factor	Big data Precision agriculture Automation	(+) Environment protection (+) Natural resources better utilization	Biodiversity, Clime, Energy, Autonomy, Financial Risk, Incomes, Productivi-

2016, *3*, 205395171664817, doi:10.1177/2053951716648 174.	to address present and future food security issues worldwide. Socio-ethical challenges that innovation brings are considered and discussed.	Cloud Local and remote sensing Connectivity Autonomous Systems Artificial Intelligence	(+) Agricultural risks prediction (+) Better productivity (+) Food security (+) Supply chain efficiency (+) Soil management (+) Food waste reduction (+) Footprint reduction (-) Job positions losses (-) Data ownership and transparency (-) Food systems inequalities (-) Biodiversity	ty, Resilience, Transparency, Bargaining Power, Equal opportunities, Prices, Stability, Cooperation, Administrative Burdens, Responsibility, Privacy, Security, Inclusion
Chui, M.; Harrysson, M.; Manyika, J.; Roberts, R.; Chung, R.; van Heteren, A.; Nel, P. Notes from the AI frontier: Applying AI for social good. *Discuss. Pap.* Mckinsey Glob. Inst., 2018.	The document provides an overview about the application of Artificial Intelligence in different sectors that are expected to produce social impacts. It provides a broader overview applied to diverse sectors, including also agriculture.	Artificial Intelligence	(+) Protect and endanger animals (+) Forecast agriculture production (+) Biodiversity protection (+) Climate conditions improvement (-) Work management	Animal Health, Animal welfare, Plant Health, Prevention, Skills, Autonomy, Incomes, Financial Risks, Resilience, Productivity
Deloitte (2019)	Digital technologies applications for the achievement of the SDGs	Digital access Cloud Sensing Distributed ledger IoT Digital Reality Connectivity Augmented and Automate Data and analytics	(+) Traceability (+) Climate conditions (+) Energy optimization (+) Water management (+) Water quality (+) Financial inclusion (+) Education improvement (+) Hunger and poverty reduction (+) Food security improvement (+) Energy management (+) Food waste reduction (+) Costs reduction (+) Markets places access (+) Markets efficiency (+) Economic activities transparency (+) Environmental problems prediction (+) Water access improvement (+) Unregular fishing identification (+) Deforestation control	Transparency, Resilience, Productivity, Resource Efficiency, Transaction Costs, Bargaining Power, Equal opportunities, Biodiversity, Clime, Soil, Water, Health, Responsibility, Cohesion, Identity, Inclusion, Participation, Privacy, Energy, Inclusion, Concentration, Plant Health.

			(-) E-waste (-) Emissions increase (-) Misinformation (-) Access inequalities (-) Technology access (-) Job displacement (-) Cyber attacks	
Dlodlo, N.; Kalezhi, J. The Internet of things in agriculture for sustainable rural development, *2015 International Conference on Emerging Trends in Networks and Computer Communications (ETNCC).* **2015**, 13-18, doi: 10.1109/ETNCC.2015.7184801.	The article focuses on the contribution of Internet of Things to reduce poverty in South Africa and Zambia rural areas.	Internet of Things	(+) Animal control (+) Water management (+) Water quality control (+) Fires prevention (+) Natural resources management (+) Fraud fight	Animal Health, Animal Welfare, Biodiversity, Water, Soil, Clime, Prevention, Responsibility, Financial Risk, Law Enforcement, Cooperation.
Dury, S.; Bendjebbar, P.; Hainzelin, E.; Giordano, T.; Bricas, N. (Eds.) *Food Systems at Risk. New Trends and Challenges*; FAO—CIRAD: Rome, Italy, 2019; doi:10.19182/agritrop/00080.	It analyses trends in the food system and digital technologies. It shows that digital solutions could promote socioeconomic prosperity and socio-political stability in many countries. Digital tools can enable farmers to improve their agricultural production, food safety and marketing, enhancing their ability to make decisions to foster food production, reducing costs (production and environmental ones). It can also facilitate access to financial services reducing transaction costs. At the same time, the work stress that current trends are threatening countries and social groups' ability to meet this potential. Inequalities between actors within food systems actors or stakeholders (e.g., women, minorities, etc.) and between territories can exclude many people from the benefits of digital technology, which may trigger further civil conflicts and food crises.	Cloud Connectivity Distributed ledger Local and remote sensing Positioning systems Robots Satellite	(+) farm management / decision-making (+) marketing (+) ecological footprint (+) financial services (+) food safety (-) social exclusion (-) accessibility (-) social tension	Autonomy, Bargaining, power, Biodiversity, Equity, Financial risk, Food quality, Incomes, Learning, Marketing, Nutrients, Participation, Prevention, Privacy, Proactivity, Productivity, Resilience, Resource efficiency, Responsibility, Security, Skills, Surveillance, Transaction costs, Trust
EU Declaration on 'A Smart and Sustainable Digital Future for European Agriculture and Rural Areas', 2019. Available online: https://ec.europa.eu/digital-single-market/en/news/eu-member-states-join-forces-digitalisation-european-agriculture-and-rural-areas	The declaration has been signed by the EU member states to achieve a smart and sustainable future concerning agriculture and rural areas in Europe. It indicates the potential achievements.	Connectivity Internet of Things High performance computing Blockchain Robotics Artificial Intelligence	(+) Farm management (+) Natural resources utilization (+) Farming sustainability (+) Decision making process (+) Workers quality of life	Autonomy, Bargaining power, Biodiversity, Clime, Cooperation, equity, Financial risk, Gender gap, Health, Inclusion, Incomes, Prediction, Prevention, Proactivity, Productivity, Resilience Resources, Responsibility, Security, Skills

(accessed on 5 January 2021).				
Kirova, M.; Montanari, F.; Ferreira, I.; Pesce, M.; Albuquerque, J.D.; Montfort, C.; Neirynck, R.; Moroni, J.; Traon, D.; Perrin, M.; et al. *Megatrends in the Agri-Food Sector*; European Parliament: Policy Department for Structural and Cohesion Policies: Brussels, Belgium, 2019.	The study aims at providing an overall scenario about future needs that are going to be addressed concerning food production, consumption and distribution, proving four possible solutions.	Biotechnology Synthetic biology Internet of Things Automation and Robotization Artificial Intelligence Big data Global Navigation Satellite System Drones Blockchain Augmented Reality	(+) Food production increase (+) Ecological efficiency (+) Efficient business models (+) Natural resources management (+) Environment protection (+) Farm management (+) Crops resistance (+) Information diffusion and sharing (+) Predictive analytics (+) Decision making process	Autonomy, incomes, Financial Risk, Resilience, Food Quality, Resource Efficiency, Stability, Biodiversity, Energy, Plant Health, Prevention, Proactivity, Participation, Health, Responsibility, Information, ICT, Resources, Autonomy, Power, Cohesion, Inclusion, Participation, Control
Floridi, L.; Cowls, J.; Beltrametti, M.; Chatila, R.; Chazerand, P.; Dignum, V.; Luetge, C.; Madelin, R.; Pagallo, U.; Rossi, F.; et al. AI4People. An ethical framework for a good AI society: Opportunities, risks, principles, and recommendations. *Minds Mach.* **2018**, *28*, 689–707, doi:10.1007/s11023-018-9482-5.	The document represents an ethical framework considering the utilization of Artificial Intelligence and the risks and opportunities arising for the society.	Artificial Intelligence Internet of Things Connectivity	(+) Self realization (+) Societal capabilities (+) Improve climate conditions (+) Societal cohesion (+) Traceability (+) Water management (+) Water quality (+) Sustainable fish stocks (+) Financial inclusion (+) Education improvement (+) Food waste reduction (-) Devaluation of human skills (-) Reduction of human responsibility (-) Reduction of human control (-) Erosion of human self determination (-) E-waste (-) Misinformation (-) Job displacement (-) Technology access	Resource Efficiency, Financial Risk, Responsibility, Equal Opportunities, Animal Health, Biodiversity, Clime, Energy, Water, Prevention, Cooperation, Participation, Skills, Wellbeing, Information, Responsibility, Autonomy, Equity, Power, Resilience, Cohesion, Inclusion, ICT
Deutsche Gesellschaff fur Internationale Zusammenarbeit (GIZ) GmbH. *Harnessing the Chances of Digitalization for Rural Development*;	The study concerns the ICT contribution to rural development in the SDGs framework is considered to be pivotal. In particular, it focuses on the role played by digitalization when considering specific aspects such as gender balance and young generation access to the agriculture sector; how to implement digital solutions to have rural areas benefit; recommendations on sustaina-	ICT Connectivity Internet of Things	(+) Access (+) Gender gap (+) Participation (+) Education (+) Societal cohesion (+) Farm management	Resource Efficiency, Financial Risk, Equal Opportunities, Clime, Energy, Water, Cooperation, Participation, Skills, Wellbeing, Information, Respon-

Germany, Bonn, 2018.	ble business models implementations. The information is gathered from different experiences.		(+) Financial access (+) Environment protection (-) Data protection (-) Costs	sibility, Autonomy, Equity, Power, Resilience, Cohesion, ICT
Kamilaris, A.; Kartakoullis, A.; Prenafeta-Boldú, F.X. A review on the practice of big data analysis in agriculture. *Comput. Electron. Agric.* **2017**, *143*, 23–37, doi:10.1016/j.compag.2017.09.037.	Literature review about big data in agriculture.	Big data	(+) Supply chain access (+) Farm management (+) Fertilizers use optimization (+) Food safety (+) Food traceability (+) Productivity measurement (+) Environmental sustainability (+) Decision making (+) Environmental qualitative control (+) Farm management (+) Circular economy implementation (+) Productivity	Autonomy, Cooperation, Financial Risk, Incomes, Resilience, Bargaining Power, Food Quality, Resource Efficiency, Transparency, Equal Opportunities, Stability, Biodiversity, Clime, Energy, Cooperation, Administrative Burdens, Participation
Kirova, M.; Montanari, F.; Ferreira, I.; Pesce, M.; Albuquerque, J.D.; Montfort, C.; Neirynck, R.; Moroni, J.; Traon, D.; Perrin, M.; et al. *Megatrends in the Agri-Food Sector*; European Parliament: Policy Department for Structural and Cohesion Policies: Brussels, Belgium, 2019.	The study aims at providing an overall scenario about future needs that are going to be addressed concerning food production, consumption and distribution, proving four possible solutions.	Biotechnology Synthetic biology Internet of Things Automation and Robotization Artificial Intelligence Big data Global Navigation Satellite System Drones Blockchain Augmented Reality	(+) Food production increase (+) Ecological efficiency (+) Efficient business models (+) Natural resources management (+) Environment protection (+) Farm management (+) Crops resistance (+) Information diffusion and sharing (+) Predictive analytics (+) Decision making process	Autonomy, Cooperation, Financial Risk, Incomes, Productivity, Resilience, Resource efficiency, Food Security Transparency, Equal Opportunities, Stability, Biodiversity, Clime, Prevention, Cooperation, Law Enforcement, Skills, Resilience, Cohesion, Inclusion, Prediction
Klerkx, L.; Jakku, E.; P.; Labarthe, P. A review of social science on digital agriculture, smart farming and agriculture 4.0: New contributions and a future research agenda. *NJAS Wagening. J. Life Sci.* **2019**, *90*, 100315, doi:10.1016/j.njas.2019.100315.	A literature review of digitalization in agriculture in relation to production systems, value chains and food systems.	Blockchain Internet of Things Connectivity Artificial Intelligence	(+) Agriculture crisis prevention (+) Environment protection (+) Decision making process (+) Job skills improvement (-) Privacy issues (-) Digital divide (-) Group marginalization	Financial Risk, Bargaining Power, Resource efficiency, Prevention, Biodiversity, Cooperation, Learning, Cohesion, Equity, ICT, Information, Resources, Privacy

Maru, A.; Berne, D.; Beer, J.D.; Ballantyne, P.; Pesce, V.; Kalyesubula, S.; Nicolene, F.; Addison, C.; Anneliza, C.; Chaves, J. *Digital and Data-Driven Agriculture: Harnessing the Power of Data for Smallholders*; GFAR: Rome, Italy, 2018; doi:10.7490/F1000RESEARCH.1115402.1.	The white paper analyses the opportunities and the combined risks arising from ICTs (particularly data collection and utilization) for small farmers.	Cloud Local and remote sensing Data and analytics Connectivity	(+) Decision making process and farm management (+) Risk management (+) Administrative burdens reduction (+) Value to data collected (+) Rational use of water (+) Automatization (+) Negotiating and market access (+) Transparency in value chains (-) Misuse (-) Monetization (-) Unfair competition	Autonomy, Product/Process Security, Responsibility, Bargaining Power, Transparency (Market), Administrative burdens
Mehrabi, Z.; McDowell, M.J.; Ricciardi, V.; Levers, C.; Martinez, J.D.; Mehrabi, N.; Wittman, H.; Ramankutty, N.; Jarvis, A. The global divide in data-driven farming. *Nature Sustainability* **2020**, *4*, 154-160, doi:10.1038/s41893-020-00631-0	The paper discusses about big data and mobile technology in relation to small scale farmers potential benefits. Starting from the assumption that data-driven interventions are considered as a disruptive force in global food systems. It emerges how Internet access is limited and also the cost of data is not affordable. The analysis leads to recommendations concerning how governments could intervene to implement digital inclusion.	Big data Mobile technology	(+) Crop yields (+) Nutrition (+) Diseases (+) Climate adaptation (+) Decision making process (+) Food security (+) Environmental sustainability (-) Footprints (-) Digital divide (-) Education (-) Equity (-) Health (-) Wellbeing	Autonomy, Cooperation, Financial Risk, Incomes, Productivity, Resilience, Resource efficiency, Food Security Transparency, Equal Opportunities, Stability, Biodiversity, Clime, Prevention, Cooperation, Law Enforcement, Skills, Resilience, Cohesion, Inclusion, Prediction
Kitikos, M. *Precision agriculture in Europe. Legal, social and ethical considerations*. Study –Science and Technology Options Assessment. European Parliamentary Research Service (EPRS): Brussels, Belgium, 2017.	The study examines precision agriculture providing legal social and ethical considerations while also considering the actual European legislation and possible future challenges and eventual needed changes.	Cloud Local and remote sensing Data and analytics Connectivity	(+) Water use efficiency (+) Administrative burdens reduction (+) Fair remuneration (+) Economic farming efficiency (+) Agriculture management (+) Food quality and transparency (+) Information dissemination (+) Natural resources management (+) Livestock monitoring (+) Food fraud management	Financial Risk, Bargaining Power, Resource efficiency, Prevention, Biodiversity, Cooperation, Learning, Cohesion, Equity, ICT, Information, Resources, Privacy

			(+) Unfair competition (+) Sustainable productions (+) Climate conditions (+) Food security (-) Biodiversity loss (-) Need to reshape legislations (-) Need to introduce codes of conduct (-) Privacy (-) High costs (-) Accessibility (-) Employment issues (-) Affordability for small farmers (-) Food security (-) Communication transparency (-) Properties value reduction (-) Small farmers independence (-) Data ownership issues (-) Digital divide	
Organisation for Economic Co-operation and Development (OECD). *Digital Opportunities for Better Agricultural Policies*; OECD: Paris, France, 2019; doi:10.1787/571a0812-en.	The document presents a framework for a discussion about digital technologies and agriculture in order to identify and utilize the benefits.	Platforms Sensors Internet of Things Robots Drones Big data Cloud computing Artificial Intelligence Blockchain	(+) Broader access to information and services (+) Soil quality preservation (+) Traceability (+) Environment protection (+) Productivity (+) Biodiversity (+) Food chain trust (+) Products value (+) Decision. Making process (-) Privacy (-) Liability issues	Cooperation, Financial Risk, Incomes, Product/Process Security, Resilience, Responsibility, Bargaining Power, Food Quality Transparency, Trust, Equal Opportunities, Prices, Stability, Animal Health, Biodiversity, Prevention, Administrative Burdens, Responsibility, Trust, Privacy
Pesce, M.; Kirova, M.; Soma, K.; Bogaardt, M-J.; Poppe, K.; Thurston, C.; Monfort Belles, C.; Wolfert, S.; Beers, G.; Urdu D. *Research for AGRI Committee – Impacts of the digital economy on the food-chain and the CAP*. European Parliament, Policy Department for	The study provides a representation of the current digital applications in agriculture and its related impacts.	Internet of Things Automation and Robotization Artificial Intelligence Big Data Blockchain Global Navigation Satellite System Virtual Reality	(+) Incomes (+) Food information system (+) Production system control (+) Economic system (+) Food safety (+) Supply chain transparency (+) Trust increase (+) Risk alert system acceleration (+) Audits and controls (+) Agriculture risks	Autonomy, Bargaining power, Biodiversity, Equal opportunities, Equity, Food quality, Health, Inclusion, Incomes, Market concentration, Monitoring, Power, Privacy, Resilience, Resource efficiency, Security, Skills, Transaction costs, Transparency, Trust, Well-

Structural and Cohesion Policies: Brussels, Belgium, 2019.			(+) Farm management (+) Market stability (+) Market transparency (+) Animal controls (-) Data Security (-) Data quality (-) Work forces decrease (-) Production costs	being
Popova, A.L.; Nuttunen, P.A.; Kanavtsev, M.V.; Serditov, V.A. The impact of the digital divide on the development of socio-economic systems. *IOP Conf. Ser. Earth Environ. Sci.* **2020**, *433*, 012022, doi:10.1088/1755-1315/433/1/012022.	The paper highlights the impact of digital inequality (technological, economic and social inequalities) on rural areas' development. They stress that difference in the levels of socio-economic development between rural areas and cities is increasing by the negative impact of digital transformations. Digitalization can deteriorate the quality of human resources; the concentration of innovative potential in cities and individual industries deplete rural areas, and unpredictable changes in agriculture can produce degradation of several resources. To solve this problem, policies need to consider the influence of territorial and sectoral factors of formation of resource potential of rural areas in the information society.	Autonomous systems Cloud Connectivity Data and analytics Distributed ledger Local and remote sensing Social Media	(+) production & income (+) ecological footprint (-) autonomy (-) power concentration (-) knowledge (-) education (-) skills	Incomes, Information, Market concentration, Monitoring, Nutrients, Participation, Power, Prevention, Product/process security, Productivity, Resource efficiency, Responsibility, Transaction costs, Transparency, Trust, Well-being
Räisänen, J.; Tuovinen, T. Digital innovations in rural micro-enterprises. *J. Rural Stud.* **2020**, *73*, 56–67, doi:10.1016/j.jrurstud.2019.09.010.	They analyse the issue of digitalization in rural areas. The focus is on micro-enterprises and new socioeconomic possibilities, specifically in supporting competitiveness. In this paper are highlighted challenges and digital competences needed to the digitalization. It is also developed a workshop concept to the innovation diffusion and adoption process. It can encourage a positive attitude towards digital innovations and for planning the use of innovations. Trust, communication, and changing the roles of agents and opinion leaders seem positive factors for the diffusion of digital tools.	3D printing Cloud services Connectivity Digital marketing Open data Social media	(+) trust (+) information (+) production & income (+) digital skills (-) digital divide (-) dependency	Autonomy, Biodiversity, Cohesion, Cooperation, Equal opportunities, Equity, Inclusion, Incomes, Learning, Market concentration, Monitoring, Participation, Productivity, Resilience, Resource efficiency, Trust, Wellbeing
Renda, A.; Reynolds, N.; Laurer, M.; Cohen, G. *Digitising Agrifood: Pathways and Challenges*; CEPS and BCFN: Brussels, Belgium, 2019.	This report looks at the digital opportunities and solutions to transform more sustainably the agri-food chain. Obstacles, challenges, gaps and possible policy recommendations are identified. A specific focus to the EU (as a relevant actor at the global level) stress policy dimensions to improve the digitalization process and reduce negative social impacts. Examples are: boosting connectivity, defining data governance, rebalancing small farmers' bargaining power, facilitating technology transfer, raising the skills and awareness of farmers and consumers, and attributing responsibility for negative externalities throughout the value chain providing incentives to shorten the supply chain, etc.	Artificial Intelligence Internet of Things Augmented reality Distributed ledger Local and remote sensing Social media	(+) ecological footprint (+) production & income (+) livestock & plant diseases (+) natural resources (+) farm management (-) market concentration (-) access to technology & networks (-) social asymmetries (-) energy consumption & e-waste	Animal welfare, Bargaining power, Food quality, Incomes, Plant health, Resource efficiency, Responsibility, Skills, Streamlining bureaucracy, Surveillance, Transparency

			(-) legal issues (-) information asymmetries	
Rose, D.C.; Wheeler, R.; Winter, M.; Lobley, M.; Chivers, C.-A. Agriculture 4.0: Making it work for people, production, and the planet. *Land Use Policy* **2021**, *100*, 104933, doi:10.1016/j.landusepol.2020.104933.	In this paper, the authors stress that narratives of agriculture 4.0 have been predominately framed in terms of benefits to productivity and the environment with little attention placed on social sustainability. However, digital innovation has significant social implications, both potentially positive and negative. For this reason, we should incorporate social sustainability into technological trajectories outlining a framework of multi-actor co-innovation to guide responsible socio-technical transitions. In this way, they argue, we can increase the likelihood of this technology revolution achieving social sustainability alongside benefiting production and the environment. It can also reduce resistance against the innovation processes.	ICT & digital solutions	(+) production & income (+) ecological footprint (+) food safety & quality (-) work & employment (-) legal issues (e.g., data ownership) (-) lack of social trust (-) power imbalances	Autonomy, Bargaining power, Biodiversity, Equal opportunities, Financial risk, Food quality, Inclusion, Incomes, Information, Market concentration, Power, Prices, Privacy, Proactivity, Productivity, Resilience, Resource efficiency, Security, Streamlining bureaucracy, Surveillance, Transaction costs, Transparency
Rotz, S.; Gravely, E.; Mosby, I.; Duncan, E.; Finnis, E.; Horgan, M.; LeBlanc, J.; Martin, R.; Neufeld, H.T.; Nixon, A.; et al. Automated pastures and the digital divide: How agricultural technologies are shaping labour and rural communities. *J. Rural Stud.* **2019**, *68*, 112–122, doi:10.1016/j.jrurstud.2019.01.023.	The potential impact of agricultural digitalization and automation on labour and rural communities in industrial agri-food context. Three key tensions are studied: rising land costs and automation; the development of a high-skill/low-skilled bifurcated labour market; and issues around the control of digital data. It stresses that new technologies may intensify exploitation and deepen both labour and spatial marginalization.	Cloud Local and remote sensing Distributed ledger Data and analytics Artificial intelligence Autonomous systems	(+) productivity & income (+) farmer quality of life (+) livestock well-being (+) ecological footprint (+) work opportunities (-) labour market (-) land cost / degradation (-) data control (-) unskilled labour-force (-) socioeconomic inequalities	Autonomy, Bargaining power, Cooperation, Equal opportunities, Equity, Inclusion, Incomes, Information, Law enforcement, Learning, Market concentration, Plant health, Productivity, Resilience, Resource efficiency, Responsibility, Security, Skills, Stability, Streamlining bureaucracy, Surveillance, Transparency
Small, B. Digital technology and agriculture: Foresight for rural enterprises and rural lives in New Zealand. *J. Agric. Environ. Sci.* **2017**, *6*, 54–77, doi:10.15640/jaes.v6n2a7.	Digital technologies and agriculture in relation to rural areas, in particular analysing a specific geographical area. Responsible technological development and business are considered to benefit of the digital agriculture potentials.	Internet of Things Cloud computing Artificial Intelligence Blockchain	(+) Food traceability (+) Biodiversity (+) Farm management (+) Climate change mitigation (+) Livestock control (+) Information traceability (+) Transparency (+) Data control	Autonomy, Equity, Food quality, Incomes. Learning, Plant health, Privacy, Proactivity, Resources, Responsibility, Security, Skills
Pesce, M.; Kirova, M.; Soma, K.; Bogaardt, M.-J.; Poppe, K.; Thurston, C.; Monfort Belles, C.; Wolfert, S.; Beers, G.; Urdu, D. *Impacts of the Digital*	The study provides a representation of the current digital applications in agriculture and its related impacts.	Internet of Things Automation and Robotization Artificial Intelligence Big Data Blockchain	(+) Incomes (+) Food information system (+) Production system control (+) Economic system (+) Food safety	Cooperation, Financial Risk, Incomes, Product/Process Security, Resilience, Responsibility, Bargaining Power, Food Qual-

Economy on the Food-Chain and the CAP; European Parliament, Policy Department for Structural and Cohesion Policies: Brussels, Belgium, 2019.			(+) Supply chain transparency (+) Trust increase (+) Risk alert system acceleration (+) Audits and controls (+) Agriculture risks (+) Farm management (+) Market stability (+) Market transparency (+) Animal controls (-) Data Security (-) Data quality (-) Work forces decrease (-) Production costs	ity Transparency, Trust, Equal Opportunities, Prices, Stability, Animal Health, Biodiversity, Prevention, Administrative Burdens, Responsibility, Trust, Privacy
Sparrow, R.; Howard, M. Robots in agriculture: Perspectives, impacts, ethics, and policy. *Precis. Agric.* **2020**, doi:10.1007/s11119-020-09757-9.	Authors propose a reflection on robotics in farming surveying the prospects for agricultural robotics, discusses its likely impacts, and examines the ethical and policy questions it may raise. In particular, the paper stresses key policy choices necessary to meet the ethical challenges to maximise the social, environmental, and economic benefits of robotics in agriculture.	Robots in agriculture AI Data	(+) environment (+) production / income (+) food security / quality (+) livestock well-being (-) job / unskilled labour forces (-) power / social asymmetries (-) socio-cultural changes (-) security / privacy	Animal control, Autonomy, Bargaining power, Energy, Equal opportunities, Equity, Food quality, Inclusion, Incomes, Market concentration, Plant health, Proactivity, Product/process security, Productivity, Resource efficiency, Responsibility, Security, Skills, Surveillance, Trust
van der Burg, S.; Bogaardt, M.-J.; Wolfert, S. Ethics of smart farming: Current questions and directions for responsible innovation towards the future. *NJAS Wagening. J. Life Sci.* **2019**, *90*, 100289, doi:10.1016/j.njas.2019.01.001.	Ethical challenges of smart farming are discussed around three themes: (1) data ownership and access, (2) distribution of power and (3) impacts on human life and society. The pros and cons should be discussed, focusing first on the content of societal and commercial goals and whether they can be combined in differing contexts. It could allow developing appropriate guidelines and codes of conduct for farming digitalization trajectories.	Artificial intelligence Augmented reality Autonomous systems Connectivity Data and analytics Distributed ledger Local and remote sensing	(+) ecological footprint (+) food security, traceability and transparency (+) farm management (+) natural resource (+) production / income (-) dependency to digital companies / service providers (-) decisional autonomy (-) data ownership and control (-) farming skills	Biodiversity, Clime, Cohesion, Cooperation, Equal opportunities, Equity, Food quality, Identity, Inclusion, Power, Privacy, Productivity, Resilience, Resource efficiency, Responsibility, Security, Surveillance, Transparency, Trust
Verdouw, C.; Wolfert, S.; Tekinerdogan, B. Internet of Things in agriculture. *CAB Rev. Perspect. Agric. Vet. Sci. Nutr. Nat. Resour.*	The literature review concerns the Internet of Things in agriculture and food, facing future challenges.	Internet of Things	(+) Production traceability (+) Efficiency of farm resources (+) Food quality (+) Efficient use of chemical products	Autonomy, Cooperation, Financial Risk, Incomes, Marketing, Productivity, Resource efficiency, Responsibility, Food

2016, *11*, doi:10.1079/PAVSNNR2016 11035.			(+) Consumer awareness (-) Technology dependence (-) Data control	quality, Transparency, Trust, Biodiversity, Clime, Energy, Water, Wellbeing, Health,
Vinuesa, R.; Azizpour, H.; Leite, I.; Balaam, M.; Dignum, V.; Domisch, S.; Felländer, A.; Langhans, S.D.; Tegmark, M.; Fuso Nerini, F. The role of artificial intelligence in achieving the Sustainable Development Goals. *Nat. Commun.* **2020**, *11*, 233, doi:10.1038/s41467-019-14108-y	The progressive implementation of artificial intelligence (AI) is changing many sectors, contributing to the achievement of the Sustainable Development Goals. In the agriculture sector, it can contribute to sustainable and cost-efficient production. Simultaneously, AI development needs to be coupled with regulatory and policy oversight to reduce gaps and unexpected adverse outcomes in transparency, safety, and ethical standards. For example, in the implementation of AI, users lack information on the type of analysed data and its consequences on their lives. Moreover, AI technology is unevenly distributed, and it may not be accessible to small farmers and thus produce an increased gap to larger producers.	Artificial Intelligence	(+) ecological footprint (+) natural resources (+) climate change (+) energy & water management (-) social inequalities (-) privacy & legal issues (-) accessibility (-) power & market concentration	Autonomy, bargaining power, Clime, Equity, Financial risk, Food quality, Learning, Market concentration, Power, Prevention, Privacy, Productivity, Resilience, Responsibility, Security, Skills, Surveillance, Transparency, Trust
Wolfert, S.; Ge, L.; Verdouw, C.; Bogaardt, M.-J. Big data in smart farming—A review. *Agric. Syst.* **2017**, *153*, 69–80, doi:10.1016/j.agsy.2017.01.0 23.	The review is about big data applications in smart farming and the socio-economics aspects that should be addressed in the future.	Internet of Things Cloud computing	(+) Farmers empowerment (+) Fair share between different stakeholders (-) Privacy issues (-) Security issues	Autonomy, Cooperation, Financial risk, Incomes, Productivity, Bargaining power, Food quality, Resource efficiency, Equal opportunities, Transparency, Participation, Information, Privacy, Security.
World Economic Forum (WEF). *Innovation with a purpose: the role of technology innovation in accelerating food systems transformation*; WEF: Geneva, Switzerland, 2018.	The report identifies emerging technology innovations that can drive rapid progress in the sustainability, inclusivity, efficiency, and health impacts of food systems to achieve the Sustainable Development Goals by 2050. It highlights the significant economic, environmental and health benefits that could be realized through the broad adoption of specific technologies and enabling actions/policies that can support and scale those solutions for rural actor and communities.	Artificial intelligence Augmented reality Autonomous systems Data and analytics Distributed ledger Internet of Things Robots	(+) GHG emissions (+) natural resources (+) food waste & loss (+) production & income (+) ecological footprint (+) nutrition of food products (-) access to technology & networks (-) digital skills (-) social asymmetries	Autonomy, Bargaining power, Biodiversity, Clime, Energy, Equal opportunities, Equity, Food quality, Health, Inclusion, Incomes, Market concentration, Monitoring, Power, Privacy, Resilience, Resource efficiency, Security, Skills, Transaction costs, Transparency, Trust, Wellbeing
Zarra, A.; Simonelli, F.; Lenaerts, K.; Luo, M.; Baiocco, S.; Ben, S.; Li, W.; Echikson, W.; Kilhoffer, Z. *Sustainability in the Age of Platforms*; CEPS Special	The report aims at examining the economic, social and environmental impacts of platforms and he key issues to improve their sustainability.	Platforms	(+) Job positions (+) Climate conditions (+) Energy management (+) Natural resources management (+) Economic opportunities	Inclusion, Gender Gap, Autonomy, Wellbeing, Skills, Transaction Costs, Cooperation, Water, Energy, Equal opportunities, Transparency, Productivi-

Report: Brussels, Belgium, 2019.			(+) Incomes (+) Workers autonomy (+) Jobs creation (+) Poverty reduction (+) Financial inclusion (-) Environmental issues (-) E-waste (-) Power consumption (-) Market volatility (-) Unfair competition (-) Employment conditions (-) Job displacement (-) Uneven benefit distribution	ty, Marketing, Autonomy
Zhao, G.; Liu, S.; Lopez, C.; Lu, H.; Elgueta, S.; Chen, H.; Boshkoska, B.M. Blockchain technology in agri-food value chain management: A synthesis of applications, challenges, and future research directions. *Comput. Ind.* **2019**, *109*, 83–99, doi:10.1016/j.compind.2019.04.00.	Blockchain in agri-food value chain collection of data and product information that are validated along the agri-food steps (production, transformation, distribution, consumption) with the possibility of accurate verification.	Blockchain	(+) Food transparency, traceability and security (+) Rational use of natural resources (+) Consumer awareness (-) Privacy (-) Legality	Resource efficiency Responsibility Resource efficiency Trust Product/Process Security

Source: elaboration of research data.