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Robotics technology in agro-food SME clustering after the COVID-19 crisis in Europe: Legal aspects and socio-economic implications

Christos Andrikopoulos*

Abstract

The business clustering of small and medium-sized enterprises related to the agro-food supply chain (agro-food SME clusters) would be able to contribute significantly to addressing the economic consequences of the pandemic crisis in the European Union. Robotics technology can play a crucial role for this purpose, whereby it is important to identify innovative solutions to the legal and socio-economic challenges caused by using robots that have already begun to transform modern agriculture, food processing, and the food distribution systems. To that end, this article proposes a special legal status for robot applications in agro-food SME clusters in order to address the matter of liability, which faces various complexities that are associated with autonomous sophisticated devices entering the real world. Additionally, this article explores how the agro-food SME clustering can cope with the disruption in the labour market due to the advent of robots by supporting, through blockchain technology, a job guarantee that preserves the social aspects of work and strengthens the fundamental right to work for everyone.

Keywords: Agro-Food SME Clusters, Robotics Technology, EU Robot Law, Technological Unemployment, Regional Basic Dividend, Blockchain Technology.

Introduction

Today, in a period of transformation in Europe, robotics technology can play a crucial role in the business clustering of SMEs related to the agro-food supply chain (agro-food SME clusters) and contribute significantly to the socio-economic development of the 242 EU regions (NUTS-2).[1] The agro-food SME clusters are considered in this article as business

* PhD Candidate in the School of Law at the University of Nottingham, UK; Member of the University of Nottingham Commercial Law Centre (UNCLC). Email: ca3252@gmail.com; christos.andrikopoulos@nottingham.ac.uk; Proposed thesis title: 'Agro-food SME Clustering: Towards

clusters scattered across the EU. These business clusters consist of SMEs from the primary, secondary, and tertiary sector of the economy that network and participate in the process of production, processing, promotion, and selling of high quality agro-food products.[2] Due to the synergy effects of co-operative relationships, the concept of business clustering would assist SMEs, which are the backbone of the European economy,[3] to overcome their size limits and gain a comparative advantage over individual businesses.[4] To face the new challenges of global markets, however, the clustering of SMEs in the EU regions must be focused on economic sectors involved in the agro-food supply chain.[5] This is mainly because the EU has a leading position as a regulatory power worldwide in the policy domains of environmental protection, health and food safety,[6] which constitute the fundamental determinants to ensure a competitive position of high-quality European agro-food goods.

However, Europe is currently facing huge economic repercussions due to the unexpected and damaging event of the COVID-19 outbreak.[7] This pandemic has merely deepened and accelerated the consequences of the 2008 economic and financial crisis, which has reversed many years of Europe's development and uncovered structural disadvantages of

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a Reform of the EU Legal Framework for Achieving Growth'. The author worked as an entrepreneur in the entertainment industry and taught commercial law in Greece. Subsequently, he was appointed as a policy advisor in the Hellenic Organisation of SMEs and worked on research projects at the European Commission. The views expressed in this article are solely his own and do not represent the views of any of these organisations or groups. This article is a revised version of a paper originally presented at the University of Nottingham Commercial Law Centre (UNCLC), where participants provided valuable remarks. This article benefited greatly from Irit Mevorach, Jeff Kenner and Richard Hyde, who offered insightful comments and suggestions on earlier drafts. All uniform resource locators cited in footnotes were live on 15 August 2021.

[1] Nomenclature of territorial units for statistics - 2 (NUTS-2). The NUTS 2 classification is a hierarchical system for dividing up the economic territory of the EU and the UK for the purpose of framing of EU regional policies: Regulation (EC) No 1059/2003 of the European Parliament and of the Council of 26 May 2003 on the establishment of a common classification of territorial units for statistics (NUTS).

[2] This aspect is supported by the author's PhD research.

[3] SMEs represent 99% of all businesses in the EU, European Commission, 'Entrepreneurship and Small and medium-sized enterprises (SMEs)' <https://ec.europa.eu/growth/smes_en>.

[4] Michael Porter, *On Competition* (Harvard Business Press, 2008) 213-304.

[5] The agro-food industry is one of the largest in the EU and produces a vast array of products that emanate mainly from small businesses, which are located on the European territory, as this industry is directly dependent on the raw materials of the primary sector. As a result, all the businesses involved in the European agro-food industry cannot move away from the EU to other locations, where they could produce goods at lowest cost with the least interference, from regulatory bodies, on environmental rules, labour standards and standards in production process.

[6] Anu Bradford, *The Brussels Effect: How the European Union Rules the World*, (Oxford University Press, 2020) 171-234.

[7] The eurozone economy will shrink by 8 to 12 per cent this year, European Central Bank president Christine Lagarde has warned. ECB Youth Dialogue (27 May 2020) <https://www.ecb.europa.eu/ecb/educational/youth-initiatives/ecb-youth-dialogue/html/index.en.html>.

the European economy.[8] Against this backdrop, the development of agro-food SME clusters throughout the EU regions may be a sustainable project for a new model of prosperity that would contribute to the dynamic restart of the European economy after the pandemic crisis.[9] As part of the proposed project of agro-food SME clustering,[10] this article highlights the significance for the agro-food SME clusters to reap the benefits stemming from the recent technological developments throughout the agro-food supply chain. In addition, it identifies relevant concerns and, most importantly, provides innovative solutions to the legal and socio-economic challenges caused by the advent of robot applications that have already begun to transform modern agriculture, food processing, and food distribution systems. In this way, this article aims to address the existing lack of relevant sources and, through intra/inter-disciplinary research, make a substantial and original contribution to the literature concerning the emerging area of commercial law and robotics technology.

Robotics is becoming the driving technology that supports a novel generation of autonomous and cognitive devices which, via their learning capabilities, offer a strong connection between the physical and digital world. Given that 'there is still a lack of consensus among roboticists on how they define the object of their craft,'[11] this article considers robots in general as systems with different levels of autonomy, even the most sophisticated devices with embodied artificial intelligence. For instance, robots can be related with applications such as satellite-driven sensors, geo-positioning systems that detect water and nutrients in soil, and genome-scale tools with fitness trackers that monitor the health and welfare of farm animals. Additionally, there are industrial robots that are used from picking to processing, placing and packaging of agro-food goods, which are supplied through modern logistics operations that presently employ robot applications, such as drones and self-driving vehicles.

However, as robots can obtain a high degree of autonomy, the question of who is liable for any damage they may cause is complicated, especially in the current legal system that assumes linear causation while the actions of autonomous robotised systems will be nonlinear and unpredictable.[12] For this reason, the European Parliament (EP) report with recommendations to the Commission on Civil Law Rules on Robotics (EP report) considered the possibility of turning sophisticated robots into electronic persons with rights, thus creating a legal space for them when making autonomous decisions and interacting

[8] European Parliament, 'A decade on from the crisis: Main responses and remaining challenges' (European Parliamentary Research Service, October 2019).
[9] This aspect is supported by the author's PhD research.
[10] The consideration of the proposed project of agro-food SME clustering in the EU constitutes the main part of the author's PhD research.
[11] George Bekey 'Current trends in robotics: Technology and ethics' in Patrick Lin, Keith Abney, George Bekey, *Robot Ethics: The Ethical and Social Implications of Robotics* (The MIT Press, 2012) 17.
[12] Sidney Dekker, 'In the System View of Human Factors, who is Accountable for Failure and Success?' (Human Factors and Ergonomics Society Europe Chapter Annual Meeting in Linköping, Sweden, October 2009).

independently.[13] Therefore, this article considers that robot applications in the agro-food SME clusters could acquire a special legal status, designed according to a particular ethical framework, as a *third existence* that can be placed between subjects and objects.

Furthermore, robotics technology may have a substantial impact on employment in the agro-food SME clusters. Robots are already able to do numerous forms of manual labour and additionally perform several routine cognitive tasks, thereby demonstrating that recent advancements in machine learning will put a significant part of employment at risk in the years ahead.[14] In preceding waves of automation, technology was gradually creating more jobs than destroying them, and workers had the choice to move from one industry to another.[15] Nowadays, the initial reaction to the transition of the job market is the departure from the standard employer-worker relationship through the business model of the gig economy,[16] which is based on the casualisation of previous stable employment forms.[17] This proves that the institutions of the welfare state are at threat, particularly in the EU, where the European social model is currently experiencing one of the greatest challenges in its history. This model for a society that combines high living standards and good working conditions with economic growth is facing an important crisis of legitimacy, purpose, and regulation.[18] Accordingly, the EP report suggests the introduction of a general basic income as a response to the peril of a jobless future due to the advent of robots,[19] but its implementation may encounter practical difficulties related to complex levels of the amount, goals, and priorities.

Consequently, instead of supporting the idea of a general basic income, this article argues that it would be socially more efficient to focus on policies that promote a job guarantee, which preserves the social aspects of work and most prominently, strengthens the fundamental right to work for everyone. For this purpose, the agro-food SME clusters should examine available options to financially support the creation of new jobs with a decent living wage and strong labour rights in their geographical territories throughout the EU regions. The EP report discusses a tax on robots by introducing a corporate reporting system with regard to the range and percentage of the contribution of robotics to the business turnover.[20]

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[13] European Parliament, Report with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL) (Committee on Legal Affairs, 27 January 2017) 18 [hereinafter EP report].
[14] Carl Benedikt Frey and Michael Osborne, 'The future of employment: How susceptible are jobs to computerisation?' (2017) 114 Technological Forecasting and Social Change 254, 266.
[15] David Autor, 'Why Are There Still So Many Jobs? The History and Future of Workplace Automation' (2015) 29 Journal of Economic Perspectives 3, 5-9.
[16] The gig economy is about digitalisation of delivery of goods or services usually ordering via an application.
[17] See generally, Jeremias Prassl, *Humans as a Service* (Oxford University Press, 2018).
[18] Catherine Barnard has analysed the three crises of the European social model, in Catherine Barnard 'EU Employment Law and the European Social Model: The Past, the Present and the Future' (2014) University of Cambridge Paper No. 43/2014.
[19] EP report (n 13) 15.
[20] Ibid., 44.

By imposing a *robot tax*, however, it would be a problematic approach since, unlike the employee, the robot will receive no income and never negotiate a labour contract with the business. For this reason, this article proposes an alternative solution to a robot tax, which seems to be feasible in its implementation. This is the adoption of a *regional basic dividend* that would be financed from the returns of the agro-food SME clusters to create new social jobs needed in each EU region. A fixed share of equity issues could be directed into a regional public trust. This may be a decentralised autonomous organisation, which would generate via blockchain technology an income stream in order for a regional basic dividend to be paid. In this way, the automatic allocation of profits for new jobs will ensure more funds available to society, which becomes a shareholder in agro-food SME clustering through the growing socialisation of the production of capital in each decentralised autonomous organisation across the EU regions.

The central argument of this article is that there is a need to regulate robots and address the socio-economic implications stemming from their extensive use. The reason for this is so that the impact of robotics technology on the agro-food SME clustering can constitute the springboard for the creation of a new business and economic model which will lead to a more egalitarian European society in the post-pandemic era. The article proceeds as follows: Part I stresses the importance of robotics for the agro-food goods by outlining a number of recent technological applications that are effectively used in the key sectors of agro-food supply chain, such as agriculture, food processing and food distribution systems. Part II discusses legal issues related to the regulation of robots and subsequently deploys them in the context of EU robot law. In particular, it explores legal and ethical aspects for determining liability by exploring the ability of the legal system to address the allocation of risks and damaging consequences in a robotised world. By combining those legal and ethical aspects with EU proposed policies, this part also suggests specific techniques to designing robots in such a way that their behaviour will be legally and ethically compatible with the appropriate operation of agro-food SME clusters. Part III identifies potential socio-economic implications of robotics technology in agro-food SME clustering. It discusses the effects of automation on employment from an historical perspective and compares them with the current disruption in the labour market caused by the advent of robots. Afterwards, it explains how the European social model is experiencing a crisis of legitimacy, purpose of labour law and regulation, and promotes the option of a job guarantee by comparatively discussing standpoints related to the idea of a general basic income and the fundamental right to work. Part IV identifies an innovative way in order for agro-food SME clustering and new technologies to make a significant contribution to society. In particular, it justifies the effectiveness of the adoption of regional basic dividend, compared to robot tax, as a suitable means to finance new social jobs in the EU regions. This part considers the impact of blockchain technology on public trusts of agro-food SME clusters for the creation of a new economic and business model which would be based on decentralised autonomous organisations.

1. Technological developments in the agro-food supply chain

Technological innovation is of immense importance for the operation of the EU agro-food industry, which holds a leading role in ensuring food security and nutrition as well as reducing the negative impact on the economy in times of crisis, as clearly demonstrated

during the COVID-19 outbreak.[21] By extension, the agro-food SME clusters should exploit the advantages arising from new technologies throughout the agro-food supply chain, where robot applications have already begun to transform modern agriculture, food processing, and food distribution systems.

Regarding agriculture, which would normally be the first sector of agro-food SME clustering, innovative technologies have revolutionised farming and changed the way that farmers manage agricultural land and livestock. Satellite-driven sensors and geo-positioning systems are currently widely used to track weather patterns and geological changes in order to detect moisture and nutrients in the soil.[22] In addition, advanced robotised systems automatically plant, fertilise, irrigate, and harvest plants, as well as carrying out on-farm data collection that serves to increase crop yields.[23] Similarly, in livestock farming, fitness tracking and 5G collars enhance efficiency by accurately monitoring health conditions and welfare of farm animals, thus providing valuable information for appropriate nutrition to improve their health and increase their output.[24]

Technological developments in agricultural genetics have begun to affect processes in growing plants and raising animals. This is because advanced genomics-based tools offer precise and usable information on the field of genetic code evolution for the improvement of agricultural plant species and livestock.[25] Accordingly, genome-scale and farm technologies are able to increase efficiency and productivity of modern agriculture that is of enormous importance to feed a global population set to reach nearly ten billion by 2050.[26] Technology-driven agriculture is also looking ahead to face the growing global challenges by using the Internet of Things,[27] which is applied to plants and farm animals to build an Internet of Living Things. In this system, sophisticated sensors embedded in waterways, fields, irrigation structures, and tractors, are combined with data dashboards, genome-identifying devices, and machine-learning systems, in order to open the paths to

[21] European Commission, 'Supporting the agriculture and food sectors amid Coronavirus' <https://ec.europa.eu/info/food-farming-fisheries/farming/coronavirus-response_en>.
[22] Steven Schriber 'Smart Agriculture Sensors: Helping Small Farmers and Positively Impacting Global Issues, Too' (Mouser Electronics, 1 June 2019) <https://www.mouser.co.uk/applications/smart-agriculture-sensors/>.
[23] Impressive models of agricultural robots are: Harvest CROO; Fendt's Xaver; See & Spray; TerraSentia; Pellenc: Richard van Hooijdonk '4 Ways Robotics Will Affect Agriculture in 2019' (Robotics Business Review, 20 December 2018) <https://www.roboticsbusinessreview.com/agriculture/4-ways-robotics-change-agriculture-in-2019/>
[24] The 5G RuralFirst project is a representative experiment: 5G RuralFirst 'Agritech' <https://www.5gruralfirst.org/project/agritech/>.
[25] Matthieu De Clercq and others 'Agriculture 4.0: The Future of Farming Technology' (World Government Summit, February 2018) 15.
[26] World Bank, 'Population estimates and projections' <https://databank.worldbank.org/source/health-nutrition-and-population-statistics:-population-estimates-and-projections>.
[27] The Internet of Things is a network where physical objects are interconnected in order to collect and exchange data making them responsive. See Matt Burgess 'What is the Internet of Things? WIRED explains' (Wired, 16 February 2018) <https://www.wired.co.uk/article/internet-of-things-what-is-explained-iot>.

a new generation of smart agriculture.[28] This technological advancement has 'the capacity to sense and respond to its environment in a way that maximises production, while minimising negative impact.'[29]

New technologies have made a significant contribution to the development of food-processing, which would typically be the second sector of the supply chain of agro-food SME clusters in the EU. Pressing demands of increased productivity and advancements in various technological sectors over the last two decades have necessitated the deployment of industrial automation and the advent of robots.[30] Currently, industrial robots are broadly used in almost all food manufacturing plants to perform various tasks from picking and placing to palletising, packaging, and the labelling of agro-food products.[31] To achieve effective performance, however, each robot application should be based on suitable kinematic and dynamic models, which play an important role in predicting the actuator forces for the end-effector tasks and also setting the actuator torques needed to create the desired trajectory.[32] Consequently, the dexterity of industrial robot manipulators can contribute to mitigating the effects of potential disturbances, thereby accomplishing tasks that require high levels of precision, repeatability, and reliability.[33]

Innovation in food processing is also indispensable for the preservation and manufacturing of the agro-food goods because it furthers non-thermal technologies and alternative thermal methods that exert a minimal impact on the nutritional properties.[34] Additionally, it promotes technological developments in food refrigeration and modified atmosphere packaging that are key preservation processes for the agro-food products.[35] Most

[28] Some examples of smart farming technology that uses the Internet of Things are: allMETEO, Smart Elements, Pycno, Arable, Semios, SCR by Allflex, Cowlar, FarmLogs, Cropio. See Alexey Chalimov 'IoT in Agriculture: 5 Technology Use Cases for Smart Farming' (Eastern Peak, 7 June 2018). <https://easternpeak.com/blog/iot-in-agriculture-5-technology-use-cases-for-smart-farming-and-4-challenges-to-consider/>.

[29] Evan Fraser and Sylvain Charlebois 'Automated farming: Good news for food security, bad news for job security' (ARELL Food Institute - University of Guelph, 2 April 2016) <https://arrellfoodinstitute.ca/automated-farming-good-news-for-food-security-bad-news-for-job-security/>.

[30] 422,000 installations of industrial robots in 2018 (an increase of 6% compared to 2017). The International Federation of Robotics (IFR) expects an average growth of 12% per year from 2020 to 2022: International Federation of Robotics (IFR), 'Industrial Robots: Robot Investment Reaches Record 16.5 billion USD' (IFR press release, 18 September 2019) <https://ifr.org/news/robot-investment-reaches-record-16.5-billion-usd>.

[31] Industrial robots for food manufacturing are mainly supplied by Kuka, Staubli, Kawasaki, Fanuc, ABB: Business Wire 'Insights into the Global Food Robotics Market - Analysis, Trends and Forecasts (2020 to 2025)' (16 March 2020) <https://www.businesswire.com/news/home/20200316005335/en/Insights-Global-Food-Robotics-Market---Analysis>.

[32] Jamshed Iqbal and others 'Prospects of robotics in food industry' (2017) 37 Food Science and Technology 159, 160.

[33] Ibid.

[34] Awsi Jan and others 'Non-thermal processing in food applications: A review' (2017) 2 International Journal of Food Science and Nutrition 171.

[35] Conference Series 'Emerging Food Technologies and Concepts'

importantly, advanced vision systems with multiple cameras are harnessed for inspecting and testing to identify defects and ensure quality control through robot learning.[36] Food safety constitutes an essential element for food-processing, and therefore robots should be used based on the strict requirements with hygienic design of their manipulators and end-effectors to avoid transmission of germs and bacteria.[37] Also, in a futuristic hybrid environment where the human-robot interaction is dominant, there is a vital need to standardise risk hazard by assessing hazard situations through the use of smart sensors and then isolating robot activities from human access.[38]

The recent technological developments have affected food distribution systems, which would be the third sector of the supply chain of agro-food SME clusters in the EU. In order to respond to burgeoning demand, food distributors have started to adopt advanced technologies that meet more efficient market needs and consumer expectations. Accordingly, they use modern transportation means and cooling facilities to supply fresh agro-food goods from the place of production to the markets where consumers enjoy them on a daily basis.[39] Moreover, match-making programmes and internet-based buying services contribute significantly to overcoming the marketing obstacle and linking producers with buyers. They also facilitate novel distribution management systems that can successfully track delivery trucks and plan delivery routes, thereby avoiding waste in distribution operations.[40] For instance, many applications of drones are currently able to meet consumer large-scale delivery needs by achieving to effectively deliver food products to extremely dense urban areas and overly remote rural locations.[41] Certainly, there is already a remarkable deployment of a plethora of self-driving vehicle technologies, from autonomous forklifts to driverless small plant trucks, pursuant to controllable testing environments offered by places, such as shipping yards of food distribution.[42]

To stay competitive, businesses in the logistics industry attempt to invest in promising robotic systems that can make their applications practically endless, mainly in e-commerce

<https://foodandnutrition.foodtechconferences.com/events-list/emerging-food-technologies-and-concepts>.

[36] Iqbal (n 32) 159.

[37] Ibid., 161-162.

[38] For example, ABB company produces applications in which robots work in a completely isolated and properly fenced working area: ABB 'Fencing systems' <https://new.abb.com/low-voltage/products/safety-products/fencing-systems>.

[39] Christian James, 'Food transportation and refrigeration technologies—Design and optimization'. In: Riccardo Accorsi and Riccardo Manzini (ed.) *Sustainable Food Supply Chains* (Academic Press, 2019) 185-199.

[40] For example, *entrée* software for food distributors: NECS 'entrée V4 SQL: Overview' <https://necs.com/entree_food_distribution_software/>.

[41] Flytrex launched drone food deliveries in 2017. Google, Amazon and Uber have also started doing testing drones for food deliveries: Alicia Kelso 'Food Delivery Via Drones May Be Closer Than You Think' Forbes (12 July 2019) <https://www.forbes.com/sites/aliciakelso/2019/07/12/food-delivery-via-drones-may-be-closer-than-you-think/#53da7a147438>.

[42] For example, the OTTO Material Handling Platform includes OTTO SDVs and OTTO Fleet Manager by the OTTO Motors are innovative solutions to move material within warehouses: Phil Britt '10 Robots That Can Speed Up Your Supply Chain' (Robotics Business Review, 9 May 2018).

which requires a high degree of velocity and efficiency to cope with the rapid growth of online shopping.[43] In general, automation that uses data-driven software to reduce errors and optimise scalability in logistics, helps in the improvement of customer service by offering a variety of solutions from progressing package labelling to streamlining warehouse management systems.[44] It is noteworthy that wearable technology is gradually becoming a standard element in the food logistics industry in order to increase speed and reduce hassle in picking, packing and shipping processes.[45] Cloud computing applications also offer efficient and flexible solutions in logistics by making non-digitised operations accessible on an online dashboard, thus cutting transaction costs, increasing transparency and satisfying consumer preferences for fast crowdsourced delivery.[46] Additionally, the Internet of Things, which turns physical objects to be connected to smart devices and systems, is used in diverse ways to manage the food distribution sector, such as monitoring supply chain quality control and detecting tampered packages.[47]

The agro-food SME clusters in the EU could benefit from the recent technological developments by utilising the capacity offered from the abovementioned innovations, which are successfully used throughout the agro-food supply chain. Farm and genome-scale technologies in agriculture, preservation systems and industrial automation in food processing, and modern logistics applications in food distribution could provide a great support for the effective operation of agro-food SME clustering in the EU regions. Those technological advancements converge to robotics technology, which is an interdisciplinary area that affects, to a large extent, many humans in their daily life. For this reason, it is of immense importance to examine the relevant legal aspects and socio-economic implications surrounding the use of robots in agro-food SME clusters across the EU.

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[43] Amazon uses in its warehouses the famous Kiva robots from 2012. Also, it introduced its new robotic models Xanthus and Pegasus: Brian Heater 'Amazon debuts a pair of new warehouse robots' (TechCrunch, 5 June 2019) <https://techcrunch.com/2019/06/05/amazon-debuts-a-pair-of-new-warehouse-robots/>. Recently, Amazon bought Whole Foods to convert more grocery consumers to online: April Berthene 'How Amazon's Whole Foods acquisition changed the grocery industry' (Digital Commerce 360, 21 Jun 2019).

[44] Port of Rotterdam is a good example related to the adoption of automation technology as it has become the smartest port in the world. It is the second largest export port in the world when it comes to perishables like vegetables and fruits: Loes Witschge 'Rotterdam is building the most automated port in the world' (Wired, 7 October 2019) <https://www.wired.co.uk/article/rotterdam-port-ships-automation>.

[45] For example, ProGlove is a startup that develops wireless gloves with built-in barcode scanners and gesture-sensing features: Kyle Wiggers 'ProGlove raises $40 million for barcode-scanning industrial gloves' (Venture Beat, 9 September 2019) <https://venturebeat.com/2019/09/09/proglove-raises-40-million-for-barcode-scanning-industrial-gloves/>.

[46] For example, Food Connex is an innovative cloud-based software for food distributors: Food Connex <https://www.foodconnex.com/>.

[47] AgTech company introduced Internet of Things technology into the post-harvest fresh food supply chain to improve food safety and reduce food waste: Mary Shacklett 'IoT Gains a Foothold in Food Supply Chains' (Food Logistics, 19 March 2018) < https://www.foodlogistics.com/technology/article/20993391/iot-gains-a-foothold-in-food-supply-chains>.

2. Legal aspects for robotics in agro-food SME clustering

2.1 Regulating robots

Given that new technologies affect to a large extent the agricultural, food-processing, and food-distribution sectors of the economy, the agro-food SME clusters should be in the position to reap the benefits stemming from the advent of robots in the post-pandemic era. However, due to the increasing sophistication of robotic systems and their widespread deployment, it is difficult to imagine how they will be used, and therefore, it is increasingly difficult to create comprehensive legislative and consumer protections for their use. As robots obtain a higher degree of autonomy, the matter of where liability lies in cases that something went wrong is complicated.[48] Robots that might cause serious bodily injury are currently designed in a manner that is analogous to rigid versions of *The Three Laws of Robotics*,[49] which constitute a key framework for human–robot interaction that respects the human values.[50] However, these abstract rule-based approaches that simply prescribe how robots should act around humans cannot take into consideration the complexities associated with highly sophisticated robotic devices entering the real world.[51]

Indeed, the matter of liability is more complicated because the damage caused by robots could be the result of a multitude of circumstances related to their actions, which may depend not only on software for self-learning and hardware, but also, on sensors that interact with unpredictable factors.[52] Essentially, *The Three Laws of Robotics* focus on functional morality, which presumes that robots have adequate cognition and agency to act morally correctly.[53] Nevertheless, functional morality ignores operational morality,[54] in which robot actions and inactions are associated with designers who create robots and users who handle them in operational contexts.[55] Additionally, robotic systems may be autonomous sometimes and teleoperated at different times with remote operators who although possibly seek to control robots in good faith, may otherwise possess inadequate

[48] Is the designer liable, the producer, the operator who provided a wrong instruction, or a combination of all of them?

[49] Isaac Asimov, *I, Robot* (Gnome Press, 1950). The Three Laws of Robotics developed by Isaac Asimov: (1) A robot may not injure a human being, or, through inaction, allow a human being to come to harm. (2) A robot must obey the orders given it by human beings except where such orders would conflict with the First Law. (3) A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

[50] Patrick F. Hubbard 'Sophisticated robots: Balancing liability, regulation, and innovation' (2014) 66 Florida Law Review1803, 1808.

[51] Noah J. Goodall 'Ethical decision making during automated vehicle crashes' (2014) 2424 Transportation Research Record 58.

[52] Ronald Leenes and others 'Robolaw D3. 1: Inventory of current state of robolaw' (Report - Robolaw consortium, 2012) 8.

[53] Robin Murphy and David Woods, 'Beyond Asimov: The Three Laws of Responsible Robotics' (Institute for Human and Machine Cognition 2009) 7.

[54] Ibid.

[55] David Woods and Erik Hollnagel, *Joint cognitive systems: Patterns in cognitive systems engineering* (CRC Press, 2006) 18.

sensory information.[56] This limited human ability to control robotics technology leads to legal uncertainty, which should be addressed by designing effective legislation that would be able to resolve issues related to liability for the actions of robots.

The legal system may be in the position to face the potential disturbances resulting from technological developments in the agro-food SME clusters, by addressing the allocation of risks, and assessing the damaging consequences of any relevant activity and private interaction. Tort is the enduring legal doctrine on which parties can invoke the protection of their rights and interests,[57] whereby it could be the appropriate instrument to be used to cope with the negative effects of the advent of robots. 'A tort is an act or omission that gives rise to injury or harm to another and amounts to a civil wrong for which courts impose liability,'[58] which is based on the balancing of conflicting interests that are not necessarily reflected in specific normative provisions.[59] This means that the legal system contains key internal mechanisms that would be able to address the possible risks in a robotised world, by ensuring a balance of competing interests between advocates of novel applications and ordinary people who are entitled to redress from injury or harm.[60]

However, there are insufficiencies in the present tort system that assumes linear causation,[61] while the actions of robots that are complex machines will be nonlinear and unpredictable.[62] Law currently distinguishes subjects and objects as two kinds of entities that could be essential elements with regard to research on robot liability. Legal subjects are beings 'to whom the law attributes a capacity of interests, rights, acts, and duties.'[63] Accordingly, they are recognised as having privileges, obligations and other capacities for legal relations, thereby obtaining legal personality, such as humans and corporations.[64] While legal subjects are entities that understand legal matters, objects that may have economic value, they do not possess legal rights and obligations, and cannot engage in any legal and financial transaction.[65] Thus, as long as robots are considered as objects, the

[56] Neil Richards and William Smart, 'How should the law think about robots?' in Ryan Calo, Michael Froomkin, and Ian Kerr (eds), *Robot law* (Edward Elgar Publishing, 2016) 11.
[57] See generally: Cees van Dam, *European tort law* (Oxford University Press 2013); Walter van Gerven, Pierre Larouche and Jeremy Lever, *Cases, Materials and Text on National, Supranational and International Tort Law* (Hart, 2000).
[58] Legal Information Institute, 'Tort' Cornell Law School <https://www.law.cornell.edu/wex/tort>.
[59] Thomas Wilhelmsson, Elina Paunio, and Annika Pohjolainen, *Private law and the many cultures of Europe* (Kluwer Law International 2007) 3-20.
[60] Hubbard (n 50) 25.
[61] David Owen, 'Figuring foreseeability' (2009) 44 Wake Forest Law Review 1277, 1277-1281.
[62] Dekker (n 12).
[63] John Salmond, *Jurisprudence* (5th ed. Stevens and Haynes, 1916) 253.
[64] Bryant Smith, 'Legal Personality' (1928) 37 The Yale Law Journal 283, 283-284; Jose Alvarez, 'Are Corporations Subjects of International Law?' (2011) 9 *Santa Clara Journal of International Law* 1; Andrew Clapham, *Human Rights Obligations of Non-State Actors* (OUP 2006); Jack Balkin, 'Understanding Legal Understanding: The Legal Subject and the Problem of Legal Coherence' (1993) 103 Yale Law Journal 105, 134; Michel Foucault, 'The Subject and Power' (1982) 8 Critical Inquiry 777, 781.
[65] Wendy Adams, 'Human Subjects and Animal Objects: Animals as Other in Law' (2009) 3 Journal of Animal Law and Ethics 29, 31-35.

matter is which legal entity, human or corporation is liable. Since automation makes unclear the lines between legal subjects and objects, this particular matter is a problematic one because the code may come from various sources that nobody can predict.[66]

For this reason, robot design may need to discover new ways to create robots whose actions would be constrained by *common sense*,[67] thus behaving in a manner that does not deviate too far from human expectations. In this way, sophisticated robots in the agro-food SME clusters would act more predictably and therefore the legal system, which already offers a balance of competing interests,[68] should make the relatively small changes required to face the upcoming challenges. As robots are designed to interact with humans and other machines, there is a need of a thoughtful dialogue between the technical and legal domains, in which developers and regulators must understand their interconnecting roles and recognise that robotic devices are part of a larger system.[69] Certainly, there are serious conceptual and terminological inconsistencies about robotic systems, and an appropriate way to avoid this unnecessary confusion, and any consequential damage to humans and other parties, is for engineers and lawyers to build a common language about robotics technology.[70]

Another crucial issue that raises important questions as regards robot liability in the acro-food SME clusters, is whether it would be ethically correct, or ethically compulsory, to depend on robots for several tasks rather than on humans. The rapid pace of deployment of robotic systems has caused an increasing level of ethical concerns among experts in various disciplines, such as lawyers, engineers, philosophers, and policymakers. In this interdisciplinary environment, there is an endeavour to put ethical values in the forefront of the technological progress by tackling enormous challenges that need to abolish disciplinary, international and most importantly, cultural boundaries.[71] As different cultures have different degrees of tolerance for robotic devices[72] the creation of a concept that could express the popular feeling and expectations in terms of behaviour in any given culture is necessary. This distillation of common perceptions would assist robot experts to effectively search for the identification of ethically suitable actions for robots.[73]

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[66] Anders Sandberg, 'Law-abiding robots? What should the legal status of robots be?' (Robohub 17 July 2016) <https://robohub.org/law-abiding-robots-what-should-the-legal-status-of-robots-be/>.
[67] Curtis Karnow 'The Application of Traditional Tort Theory to Embodied Machine Intelligence' in Ryan Calo, Michael Froomkin, and Ian Kerr (eds), *Robot law* (Edward Elgar Publishing, 2016) 51.
[68] See (n 59) above.
[69] Bryant Walker Smith 'Lawyers and engineers should speak the same robot language' in Ryan Calo, Michael Froomkin, and Ian Kerr (eds), *Robot law* (Edward Elgar Publishing, 2016) 101.
[70] Ibid, 83-89.
[71] Patrick Lin 'Introduction to Robot Ethics' in Patrick Lin, Keith Abney, George A. Bekey (eds) *Robot Ethics: The Ethical and Social Implications of Robotics* (MIT Press, 2012) 3-16; Gianmarco Veruggio, 'The Birth of Roboethics' IEEE International Conference on Robotics and Automation, Workshop on Robo-Ethics (Barcelona, April 2005) 1-4.
[72] Piotr Bołtuć, 'Church-Turing Lovers' in Patrick Lin, Keith Abney and Ryan Jenkins (eds), *Robot Ethics 2.0: From Autonomous Cars to Artificial Intelligence* (Oxford University Press, 2017) 214-228.
[73] AJung Moon and others, 'The Open Roboethics Initiative and the Elevator-Riding Robot' in Ryan Calo, Michael Froomkin, and Ian Kerr (eds), *Robot law* (Edward Elgar Publishing, 2016) 131.

In addition, the limited ability to restrict the use of new technologies in several downstream applications and operating environments causes significant difficulties for robot designers to minimise or eliminate the unethical use of their robotic devices.[74] This is because the inventions of the open model of robotics, which benefits from innovation and collaboration of end-users,[75] might find ethically doubtful uses downstream mainly due to the tumultuous forces of the global market that are more focused on profits than on ethics and human well-being.[76] A form of intervention through the adoption of an open licensing approach, however, could impose appropriate restrictions on downstream modifications for the ethical and nonharmful use of robots.[77] The challenge, therefore, is to identify an adequately open license for robotics technology in agro-food SME clustering, which is not too open to potential risks of use and not too closed to prevent innovation.

Consequently, regulating robots based on the above legal and ethical approaches may assist the agro-food SME clusters in the EU to exploit the benefits of robotics technology in the agricultural, food-processing, and food-distribution sectors of the economy. To this end, it would be useful to design robots in a manner that ensures that their behaviour would converge with human expectations, and hence be relatively compatible with the current legal system, as well as adopting a suitable licensing approach that should ensure their ethical use throughout interdisciplinary and multicultural environments. In this way, it could be feasible to face legal and ethical issues for determining liability when robots will make mistakes during their operation in the agro-food SME clusters across the EU regions.

2.2 Towards the formation of EU robot law

The EU institutions tend to design targeted policies for supporting the advancement of robotics technology in Europe.[78] This is one of the most important interdisciplinary areas to deal with the effects of the pandemic crisis[79] and is a helpful approach by the EU in order

[74] Diana Marina Cooper 'The Application of a "Sufficiently and Selectively Open License" to Limit Liability and Ethical Concerns Associated with Open Robotics' in Ryan Calo, Michael Froomkin, and Ian Kerr (eds), *Robot law* (Edward Elgar Publishing, 2016) 164; Ryan Calo, 'Open Robotics' (2011) 70 Maryland Law Review 571.

[75] Cooper (n 74) 163: For a comparative discussion of the open and closed software development and distribution models, see Eric Raymond, 'The Cathedral and the Bazaar' (Thyrsus Enterprises, 1997) <http://www.catb.org/~esr/writings/cathedral-bazaar/cathedral-bazaar/index.html#catbmain>.

[76] Gianmarco Veruggio and Keith Abney, 'Roboethics: The Applied Ethics for a New Science' in Patrick Lin, Keith Abney, George A. Bekey (eds) *Robot Ethics: The Ethical and Social Implications of Robotics* (MIT Press, 2012) 362.

[77] Cooper (n 74) 164-165.

[78] The development policies related to robotics technology is part of the EU's digital strategy (2019-2014). Commission, 'Shaping Europe's digital future' <https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/shaping-europe-digital-future_en>; European Parliament resolution of 12 February 2019 on a comprehensive European industrial policy on artificial intelligence and robotics (2018/2088(INI)).

[79] Ian Tucker, 'The five: robots helping to tackle coronavirus' (The Guardian, 31 May 2020) <https://www.theguardian.com/technology/2020/may/31/the-five-robots-helping-to-tackle-coronavirus>;
euRobotics, '10 ways robots fight against the COVID-19 pandemic' (30 April 2020) <https://www.eu-robotics.net/eurobotics/newsroom/press/robots-against-covid-19.html>.

for the widespread use of robots to positively influence the development of agro-food SME clusters in the EU regions. More specifically, in 2017, the European Parliament drafted the EP report, which considers the possibility of turning autonomous robots into electronic persons with specific rights and obligations.[80] According to this report, *The Three Laws of Robotics*[81] 'must be regarded as being directed at the designers, producers and operators of robots … since those laws cannot be converted into machine code.'[82] This is because those strict rules cannot ensure predictable behaviour for agents with learning and reasoning capabilities who are able to interact in a real-life context.[83] Therefore, humans seem to have the entire legal and ethical responsibility in the current time to create robots by embodying parts of their legal and ethical codes in the robot software, or at least making them compatible with their codes.[84]

The EP report proposes a new legislative instrument to address robot liability based on the assumption that when robots do something wrong, the types of compensation and damages that can be offered to the injured party should not be restricted in any way.[85] Accordingly, 'the future legislative instrument should be based on an in-depth evaluation … determining whether the strict liability or the risk management approach should be applied,'[86] where liability would be proportional to the level of instructions given to a robot by the identified responsible parties and of its autonomy.[87] In this manner, the responsibility due to harmful functioning of a robot in the agro-food SME clusters may be divided according to the degree of the causally related behaviour that it learned by analogy from the user, the designer, the manufacturer, and the robot itself.

To address the complexity of allocating responsibility for damage caused by robots, the EP report proposes as a possible solution the establishment of an obligatory insurance scheme and compensation fund.[88] This is so that the responsible parties can benefit from limited liability, which is an important element for the societal, economic, and business use of robotics technology. Nonetheless, transferring a large part of responsibility to the insurance industry would be a challenging issue as this industry is already concerned for the enormous risks related to autonomous cars and cyber-insurance.[89] For this reason, an in-depth interdisciplinary research in law, technology, and the insurance industry is necessary for the development of specific insurance products for the use of robots in the agro-food SME clusters. In particular, it is important to conduct extensive testing in a real

[80] See (n 13) above.
[81] See (n 49) above.
[82] EP report (n 13) 6.
[83] See (n 51) above; See generally, Dario Amodei and others 'Concrete problems in AI safety' (Cornell University, 2016) arXiv preprint arXiv:1606.06565.
[84] Sandberg (n 66).
[85] EP report (n 13) 16-17.
[86] Ibid., 17. Strict liability exists when there is a causal link between the injurious robot operation and the damage suffered by the aggrieved party, while the risk management approach focuses on the on the person who can reduce risks and address negative effects rather than on the person who acts negligently as liable individually.
[87] Ibid.
[88] Ibid., 17-18.
[89] Sandberg (n 66).

environment for a better understanding of the functioning of robotic systems and adopt sufficient risk assessment methods for evaluating new robots. Subsequently, the probable solutions adopted by courts based on existing regulation for hypothetical accidents of specific robotic devices should be considered, as well as identifying a desirable legislative reform in the area of liability rules for effective insurance products.[90]

In order for the insurance scheme and compensation fund to become an effective legal solution to allocating responsibility, the EP report proposes that 'at least the most sophisticated autonomous robots could be established as having the status of electronic persons responsible for making good any damage they may cause'.[91] In this way, it may apply electronic personality for various robotic devices, thereby creating a legal space for them where making autonomous decisions or otherwise interacting with third parties independently.[92] This new type of legal protection may offer a legal status to robots as a *third existence*, which would be different from the *first existence*, such as biological entities of humans, as well as contrasting with the *second existence*, such as non-biological entities of normal machines and property.[93] Consequently, in this *fuzzy boundary*, somewhere between personality and property, where certain technological applications can be neither humans nor exactly machines,[94] sophisticated robots in the agro-food SME clusters could acquire a special legal status, as a *third existence* that can be placed between subjects and objects.[95]

Humans already treat, to some extent, animals as entities between subjects and objects.[96] While animals do not possess, as objects, the fundamental freedoms and rights of legal subjects, it is widely recognised that they are able to act in a way that their owners cannot foresee.[97] Actions of wild animals are treated differently from actions of domesticated animals that are more foreseeable. Namely, there is strict liability for damage committed by wild animals, but not for damage done by domesticated ones, since the owner of wild animals must know that their actions are not foreseeable.[98] In a similar way, it could be considered that more transparent *domesticated robots* may be treated differently from

[90] Andrea Bertolini and others, 'On Robots and Insurance' (2016) 8 International Journal of Social Robotics 381, 388.
[91] EP report (n 13) 18.
[92] Ibid.
[93] Yueh-Hsuan Weng, Chien-Hsun Chen, and Chuen-Tsai Sun, 'Toward the Human-Robot Co-Existence Society: On Safety Intelligence for Next Generation Robots' (2009) 1 International Journal of Social Robotics 267, 275.
[94] Weng, Chen, and Sun (n 93) 275.
[95] See (n 66) above.
[96] Gary Francione, *Introduction to Animal Rights: Your Child or the Dog?* (Temple University Press, 2000) 50-80; 'As long as animals are regarded as property […] their basic rights . . . can be sacrificed as long as some socially recognised "benefit" is found to exist': Gary Francione, 'Animal rights and animal welfare' (1995) 48 Rutgers Law Review 397, 441–444.
[97] European Commission, Staff Working Document on liability for emerging digital technologies SWD (2018) 137 final 19.
[98] George Fletcher, 'Fairness and Utility in Tort Theory', (1972) 85 Harvard law review 537, 547-548.

wild robots, but there is much less experience and intuition concerning their behaviour compared with their fellow animals.[99]

Although robots lack legal subjectivity, and most notably moral patient-hood and agency, they could obtain a certain artificial personality. It is also important to develop a certain scope of action and decision-making by establishing a special legal category for them. In particular, the concept of electronic personality for sophisticated robots could be analogous to the successful model of legal personality of corporations, which reflects the bundling of material, capacities and financial responsibilities.[100] Likewise, the electronic personality may mean the bundling of all legal responsibilities of the parties involved, such as designers, manufacturers and users of robots.[101] As an electronic person, each sophisticated robot could be entered into a public register, similar to a corporate register, which would allow humans to be informed about the robot's characteristics and other information, such as the amount of liability, owners, areas of use, dangers, abilities and more.[102] For this reason, robots in agro-food SME clustering throughout the EU should be designed in a manner which ensures that their behaviour is compatible with human expectations and, therefore, largely amenable to the current legal system.[103] However, the potential tension between robot design and law-abidingness will lead to the creation of ethical mechanisms so that the robot designers can act appropriately, and principles for when unverifiable but useful autonomy is acceptable.

Though laws and regulations are able to legislate and control certain behaviour, as well as affecting moral beliefs and the development of ethical competence,[104] they cannot easily legislate in order for humans to be moral because morality is largely considered as being above the law.[105] Accordingly, it is difficult to identify what is the moral code for humans to follow due to the fact that the freedom of thought and belief is a fundamental right for everyone[106] and because morality encompasses extensive complexities and nuances, which are incompatible with the strict specifications of laws.[107] The EU promotes the construction of ethics-by-design principles in order to build a human-centric approach for the development of new technologies.[108] This ethical dimension would assist the adoption of a

[99] Sandberg (n 66).
[100] Reinier Kraakman and others, *The Anatomy of Corporate Law: A Comparative and Functional Approach* (3rd edn, Oxford University Press 2017) 5-8.
[101] Christophe Leroux and Roberto Labruto (eds.), 'Suggestion for a Green Paper on Legal Issues in Robotics' (euRobotics 2012) 62.
[102] Ibid., 60-62.
[103] See (n 67) above.
[104] Steven Shavell, 'Law Versus Morality as Regulators of Conduct American' (2002) 4 Law and Economics Review 227, 254.
[105] Joseph Raz, 'About Morality and the Nature of Law' (2003) 48 The American Journal of Jurisprudence 1, 13-15.
[106] Universal Declaration of Human Rights (adopted 10 December 1948 UNGA Res 217 A(III) (UDHR) art. 18.
[107] Joseph Raz, *Ethics in the Public Domain: Essays in the Morality of Law and Politics* (Clarendon Press 1995) 194–221; See generally, Ronald Dworkin, *Law's Empire* (Harvard University Press, 1986).
[108] European Commission, 'Building Trust in Human-Centric Artificial Intelligence' (Communication) COM(2019) 168 final, 9.

suitable licensing approach in the agro-food SME clusters that could ensure the ethical use of robots throughout interdisciplinary and multicultural environments in the EU.[109] To this end, it would be useful to take into account the recommendation of the EP report as regards a guiding ethical framework for robotic devices which would consist of 'a code of conduct for robotics engineers, of a code for research ethics committees when reviewing robotics protocols and of model licences for designers and users.'[110]

This ethical framework has to complement the current legal framework that needs to be updated in the light of the complexity of robotics technology and its social implications. In parallel, robots in the agro-food SME clusters should be designed in a manner that they would be relatively amenable to the law[111] and 'be equipped with a *black box*, which records data on every transaction carried out by the machine, including the logic that contributed to its decisions.'[112] This event recorder, which is proposed by the EP report, could provide important information on the circumstances when accidents occur, and thus contribute to the designing of robots with behaviour that can be legally and ethically verifiable.[113] In this sense, principles for the functioning of robots in the agro-food SME clusters may be embodied in an internal mechanism that would work as a *robot consciousness* by using sensor systems with law-enforcement algorithms.

The use of automated law enforcement could offer a number of advantages over human enforcement, such as more legal efficiency, lower costs, and reduction of the impact of human bias.[114] In order for the automated law-enforcement system to be successful, however, potential consequences of automation related to technological failures, administrative burdens, algorithmic encoding difficulties of the law, loss of discretion, threats to civil rights, and the social cost of perfect enforcement must be adequately addressed.[115] For this purpose, strong cooperation is needed between engineers and lawyers on robot law[116] in order for automated law enforcement to work in practice, whereby it could contribute significantly to the effective functioning of robots in the agro-food SME clusters across the EU. In particular, legal and technology experts should make laws more automation-friendly and figure out appropriate software engineering strategies for encoding these laws in a manner that they are sensitive in their interpretation and use.[117] In this way, the agro-food SME clusters could be aided by the substantial ability for robot innovation and law-making, and the potential capacity by the EU to codify the recommendations of the EP report into legal instruments that can address the crucial issues of robotics technology throughout the EU regions.

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[109] See (n 71) above.
[110] EP report (n 13).9-10.
[111] See (n 103) above.
[112] EP report (n 13) 10.
[113] Sandberg (n 66).
[114] Lisa Shay and others, 'Confronting automated law enforcement' in Ryan Calo, Michael Froomkin, and Ian Kerr (eds), *Robot law* (Edward Elgar Publishing, 2016) 272-273.
[115] Ibid., 272.
[116] See (n 70) above.
[117] Lisa Shay and others, 'Do robots dream of electric laws? An experiment in the law as algorithm' in Ryan Calo, Michael Froomkin, and Ian Kerr (eds), *Robot law* (Edward Elgar Publishing, 2016) 302-303.

3. Socio-economic implications of the use of robotics in agro-food SME clustering

3.1 Effects on employment of using robots

In order for the agro-food SME clusters to emerge and operate effectively in the EU, they should face the challenges stemming from the impact of robotics technology on employment, especially in times of crisis such as the period of COVID-19 outbreak and beyond. Robots are already able to do numerous forms of routine labour-intensive work and additionally perform several routine cognitive tasks.[118] This demonstrates that 'recent developments in machine learning will put a substantial share of employment, across a wide range of occupations, at risk in the near future.'[119] Technological innovation has already affected the phenomenon of *job polarisation*, which seems to cause the declining of the middle-skill jobs, thereby leading to the stagnation of middle income in many countries of the western world.[120] Accordingly, there is a strong threat of a *jobless future* and disruption in the labour market because most of the jobs can be allocated to a range of routine tasks that would be able to be done by robots.[121]

Instead of the previous waves of automation, where workers had the choice to move from one industry to another,[122] nowadays advanced techniques allow businesses to improve their operations by providing them large databases for training machine-learning systems to accomplish tasks in place of humans.[123] Therefore, in previous societies, where people were considered as potential producers, have now been replaced by a postmodern society, which tends to create people who are supernumerary and no longer useful for the function of the economy.[124] This redundant population of *human waste* constitutes the potentially unintentional and unplanned collateral losses of the current model of economic growth,[125] which is not consistent with the proposed model of prosperity of agro-food SME clustering in the EU.

Fears that technology would create redundant populations had been manifested before such as during the Industrial Revolution, when weavers and textile workers in England, known as Luddites, 'protested the automation of textile production by seeking to destroy some of the machines'.[126] Subsequent serious concerns emerged in the 1920s and 1930s,

[118] Martina Bisello and others, 'How computerisation is transforming jobs: Evidence from Eurofound's European Working Conditions Survey' (European Commission JRC117167, 2019).
[119] Frey and Osborn (n 14) 266.
[120] OECD, 'Job polarisation and the middle class' (Social, Employment and Migration WP 232, 2019) 43.
[121] Irmgard Nübler, 'New technologies: a jobless future or golden age of job creation?' (ILO Research Department WP 13, 2016) 4.
[122] David Autor, 'Why are there still so many jobs? The history and future of workplace automation' (2015) 29 Journal of economic perspectives 3, 5-6.
[123] Ibid., 24-26.
[124] Zygmunt Bauman, *Intimations of Postmodernity* (Routledge, 1991) 34.
[125] Zygmunt Bauman, *Postmodernity and its Discontents* (Polity Press, 1997) 59.
[126] Autor (n 122) 3.

when the term *technological unemployment* was coined.[127] Also, in the 1960s, as robots began to appear on factory floors and computers in offices, there were alerts about 'a new era of production […] which requires progressively less human labour,'[128] thereby threatening to create a society divided into an unskilled underclass and a skilled elite.[129] Unquestionably, the appearance of personal computers in the early 1980s caused an extensive display of distress regarding potential job losses.[130]

Historically, however, technology was creating more jobs than destroying them, because automation gradually changed their nature and the skills required for them.[131] Instead of replacing jobs altogether, automation essentially redefines them by increasing the demand for employees with new skills, as happened after the introduction of computers in almost all industries. In the United States (US) between 1982 and 2012, computer-intensive jobs grew remarkably faster than the overall workforce, since automation accelerated some jobs within an industry, enabling employees to do the other jobs that require new skills and avoid technological unemployment.[132] This may be the same regarding the industries where robots are being deployed. Namely, the advent of robots in the agro-food SME clusters could substitute farming and manufacturing jobs with others that may have a more scientific nature. Nevertheless, while it is possible to imagine tasks that robots will replace humans, it is less predictable where technology could generate new jobs. As always, it is difficult to envisage the future jobs, given that today there are occupations that nobody would have predicted in the past.[133]

Focusing only on the assumption that robotics technology will displace vast numbers of workers leads to the fallacy of *lump of labour* doctrine because the amount of jobs is not limited to the jobs that are known presently.[134] Consequently, warnings related to technological unemployment may ignore the matter of the economic reaction to automation.[135] Nevertheless, this time could be different since the impact of this kind of automation is broader-based as it affects every industry, in which numerous workers should move from routine to non-routine and high-skilled jobs. Furthermore, whereas the

[127] John Maynard Keynes, 'Economic Possibilities for our Grandchildren (1930)' in Essays in Persuasion (Harcourt Brace, 1932) 358, 360.
[128] The Ad Hoc Committee on the Triple Revolution, 'The Triple Revolution' (Santa Barbara, California [Linus Pauling, with 34 co-authors] 1964) 5.
[129] Ibid., 9.
[130] Frey and Osborn (n 14) 256.
[131] Erik Brynjolfsson and Andrew McAfee, *The second machine age: Work, progress, and prosperity in a time of brilliant technologies* (WW Norton & Company, 2014) 176; Autor (n 122) 5-9.
[132] James Bessen, 'Toil and Technology' (2015) 52 Finance and Development 1, 17-19.
[133] Joel Mokyr, Chris Vickers and Nicolas Ziebarth. 'The history of technological anxiety and the future of economic growth: Is this time different?' (2015) 29 Journal of economic perspectives 31, 42-45.
[134] Branko Milanovic 'Robotics or Fascination with Anthropomorphism?' (Social Europe, 26 September 2016) <https://www.socialeurope.eu/robotics-fascination-anthropomorphism>.
[135] 'A 2016 study by economist Dr Katharina Dengler on the impacts of digitalization on the working environment in Germany reached similar conclusions, countering the Frey and Osborne study and even suggesting that digitalization could ultimately create new jobs and lead to an overall increase in employment': Katharina Dengler, 'The impacts of digitalization on the working environment' (Friedrich-Ebert-Stiftung ISBN: 978-3-95861-623-3, 2016).

shift from agriculture to manufacturing lasted for a long time, software is able to be developed much faster. For this reason, it is important to enable workers to acquire new skills promptly, including the need to reskill and upskill them in order to stay ahead of technological innovation.[136] However, regulatory concerns and reasons related to labour market and prices of capital are forcing most businesses to implement new technologies relatively slowly.[137] As it takes time for the actual extent and pace of technological progress and workers to acquire new skills, the linkage of the invention and implementation is a crucial matter, which should be seriously considered for the use of robots in the agro-food SME clusters throughout the EU regions.

For all the above-mentioned reasons, it seems that there are two contradictory narratives. There is a narrative that says this time is different and robots will do all the jobs, and another narrative that says technology always creates more jobs than those that it destroys. The truth possibly lies in the middle, as technological innovation may not cause mass unemployment, but it may accelerate the existing technological trends by disrupting labour markets and requiring workers to learn new skills faster than ever before.[138] As this would be a difficult transition, it is important for the agro-food SME clusters in the EU to create appropriate conditions for workers to obtain new skills and change jobs accordingly.

It is noteworthy that an initial reaction to the difficult transition of the job market due to automation is that people try to find ways to work increasingly more hours as work invades into their spare time. Thus, while many jobs tend to be automated, for many others, non-professionals would do them.[139] Under the business model of the *gig economy*, there is a dramatic reduction in specialisation, making unclear the difference between work and leisure, since 'work is rebranded as entrepreneurship, and labour sold as technology.'[140] By using *humans as a service*[141] the platforms of the gig economy give to consumers easier access to their needs at lower cost than offered by other providers,[142] but they ignore the regulatory environment and mainly the protection of traditional employment law.[143] In particular, they have created 'a labour market environment in which non-standard employment and self-employment have become the new normal'.[144] As it is based on the casualisation of previous stable employment forms, the business model of the gig economy

[136] ILO, 'Work for a brighter future – Global Commission on the Future of Work' (Geneva, 2019) 18-24.
[137] Frey and Osborn (n 14) 268.
[138] The Economist, 'The impact on jobs: Automation and anxiety' (Special Report 23 June 2016) <https://www.economist.com/special-report/2016/06/23/automation-and-anxiety>.
[139] Branko Milanovic, 'How Technology Can Eradicate Unemployment And Jobs At The Same Time' (Social Europe, 29 October 2015) <https://www.socialeurope.eu/how-technology-can-eradicate-unemployment-and-jobs-at-the-same-time>.
[140] Prassl (n 17) 4.
[141] Ibid., 3.
[142] Jeff Kenner, 'Uber drivers are ′workers′: The expanding scope of the ′worker′ concept in the UK's gig economy', in Jeff Kenner, Izabela Florczak and Marta Otto (eds), *Precarious Work. The Challenge for Labour Law in Europe* (Edward Elgar, 2019) Chapter 11, 3.
[143] *Aslam, Farrar & Others v Uber BV, Uber London Ltd & Under Britannia Ltd*, Employment Tribunal (ET) case no 2202550/2015, 28 Oct 2016 [1].
[144] Kenner (n 142) 2.

signals the departure from the standard employer-worker relationship, which must be avoided through the implementation of the new model of agro-food SME clustering.

The Luddite movement in England was almost the last act of resistance against a strategy of *normalisation* by the beneficiaries of technological change that had begun one and half century ago. More specifically, this strategy was 'a concerted effort to have existing laws disapplied and new ones adopted to better support their interests.'[145] This process led to the gradual displacement of a *moral economy*, which was based on the guild model of production, by a form of the industrial capitalism where the division between labour and capital caused a disruptive transformation of the previous stable and secure social relations.[146] The Luddite protests focused on employers breaching the laws for the protection of the trades - including customary wage rates, apprenticeship regulations and entry requirements - and peaked in 1811-12 because of the refusal of magistrates in Nottinghamshire to convict hosiery employers for breach of minimum wage rules.[147] The guild model achieved to construct economic relationships on a range of mutual rights and obligations, as well as maintaining the collective knowledge that constituted the basis for the initial forms of industrial production.[148] Luddism was an effort to preserve this set of communal relations and could be an important element for the agro-food SME clustering as an alternative business model against the gig economy, which raises issues related to business responsibilities and the ability of the legal system to regulate it.

The Luddites did not manage to prevent the rise of industrial capitalism, the guild model failed to compete with the manufactured mass production and 'workers lost control over the process of knowledge production and became subject to the discipline of the factory.'[149] However, Luddism left an important long-lasting legacy, as its resistance to the negative consequences of technology was part of the process in which new legal rules and forms of social organisation emerged to mediate the effects of technological change.[150] A few decades after the defeat of the Luddites and the collapse of the guilds, the east Midlands hosiery trade was one of pioneers in organising the employment relationship that became the root for a new social agreement through the establishment of collective bargaining between trade unions and employers. During the next century, the welfare state institutions were created in an attempt to restore economic security in the era of industrial capitalism. However, these institutions are at risk in the current time, as the new technologies have allowed employers to form new ways of controlling the work process, which lead to the casualisation of previous stable and secure employment forms.[151] This is apparent in the EU because the European social model is facing huge challenges that have

[145] Simon Deakin and Christopher Markou, 'The Law-Technology Cycle & the Future of Work", (Centre for Business Research, University of Cambridge, WP 504, 2018) 10.
[146] Simon Deakin, 'Luddism in the Age of Uber' (Social Europe, 3 November 2015) <https://www.socialeurope.eu/luddism-in-the-age-of-uber>.
[147] Deakin and Markou (n 145) 9-10.
[148] Deakin (n 146).
[149] Ibid.
[150] Deakin and Markou (n 145) 10.
[151] Deakin (n 146).

led to some sort of existential crisis, which would prevent the emergence and effective operation of the agro-food SME clusters throughout the EU regions.

3.2 The crisis of the European social model

The European social model is facing one of the biggest challenges of recent decades as it is in the midst of a prolonged crisis of legitimacy, purpose, and regulation, which is reflecting a weightier problem of confidence throughout the EU.[152] Most importantly, its existence is threatened because of socio-economic consequences resulting from the effects of the COVID-19 outbreak on employment. The crisis of this model for a society that combines high living standards, good working conditions, and economic growth, would constitute a major obstacle to utilising the benefits of robotics technology in agro-food SME clustering across the EU regions. According to Article 3(3) of the Treaty on European Union (TEU), the Union 'shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress…'[153] In addition, Article 9 of the Treaty on the Functioning of the European Union (TFEU) provides that '…the Union shall take into account requirements linked to the promotion of a high level of employment, the guarantee of adequate social protection [and] the fight against social exclusion…'[154] However, these provisions are inconsistent with the dramatic reforms to labour law systems of some EU countries[155] which have been imposed as a form of conditionality to the bail-out programmes by the EU Institutions.[156] Wage deregulation and austerity caused a deep recession with high rates of unemployment that threaten social cohesion.[157]

Therefore, the European social model is experiencing a crisis of legitimacy, and despite the EU's commitment to work for a social market economy, its social policy seems constantly to be in a weak position compared with its economic dimension.[158] It is worth noting that Article 148(2) TFEU adopts the aspect that the EU's guidelines related to employment policies shall be consistent with the broad guidelines of the economic policies, but not the opposite. Accordingly, the national systems of welfare state, including employment law, have been programmed in accordance with the EU's Economic and Monetary Union project, so that they can be adapted to the requirements of the single currency.[159] In this way, workers are vulnerable in the times of economic crisis, and for this reason they should acquire strong labour rights to confront the effects of technological innovation in the agro-food SME clustering.

[152] Barnard (n 18) 2.
[153] TEU art. 3(3).
[154] TFEU art. 9.
[155] E.g. Greece and Portugal.
[156] Barnard (n 18) 6.
[157] European Trade Union Confederation (ETUC), 'The functioning of the troika: a report from the ETUC' (2014) 9.
[158] Jeff Kenner, *EU Employment Law: From Rome to Amsterdam and. Beyond* (Hart, 2003) 2-21.
[159] Barnard (n 18) 6.

At the judicial level, the crisis of legitimacy has mainly a substantive dimension that is reflected in *Viking,*[160] and *Laval*,[161] where the approach of the Court of Justice of the European Union (CJEU) favoured the economic interests of employers in the internal market over the collective interests of workers against social dumping. These cases also stressed the EU's structural problem of social deficit, since 'social policy always remained vulnerable to challenge by the four freedoms and competition provisions of the TFEU'[162] due to its initial decoupling from the economic policy.[163] In particular, the social policy is implemented at national level, under national law, and the economic policy at EU level by taking advantage from the enforcement of the primacy of EU law. Furthermore, whereas the negative integration constitutes an important threat for national social policy, it seems that the EU's competence in the social sphere could not lead to a future social policy at EU level.[164] For instance, the Monti II proposal,[165] which intended to address some worker protective issues related to the decisions in *Viking* and *Laval*, was withdrawn.

Nevertheless, in 2017, the EU established the European Pillar of Social Rights,[166] which 'represents the most encompassing attempt to raise the profile of social policy in two decades'.[167] This could be an effective policy to address the consequences of the use of robots in agro-food SME clusters because it focuses on the areas of equal opportunities and access to the labour market, fair working conditions, and social protection and inclusion. Although it is unquestionably a considerable development, the exact implications of the Pillar however remain uncertain.[168] In particular, it is not a part of EU primary legislation, meaning that the social rights built upon its key principles are not actionable for EU citizens. In addition, the influence of the Pillar on secondary legislation is doubtful, despite the fact that the Commission uses it as a reference in several social policy-related regulatory initiatives.[169] For instance, the Council rejected many of these initiatives, such as the formation of the harmonised concepts of 'employee,' 'employment contract,' and 'employment relationship.'[170] Furthermore, the Pillar could influence the CJEU in its judgements in order to mediate the imbalance between social and economic dimension.

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[160] Case C-438/05 *International Transport Workers' Federation and Finnish Seamen's Union v Viking Line ABP and OÜ Viking Line Eesti* [2007] ECR I-10779.
[161] Case C-341/05 *Laval un Partneri Ltd v Svenska Byggnadsarbetareförbundet* [2007] ECR I-11767.
[162] Barnard (n 18) 8.
[163] Kenner (n 158) 293.
[164] Barnard (n 18) 8.
[165] Commission, 'Proposal for a Regulation on the exercise of the right to take collective action within the context of the freedom of establishment and the freedom to provide services' COM (2012) 130 final.
[166] Commission, 'Establishing a European Pillar of Social Rights' (Communication) COM (2017) 250 final.
[167] Ania Plomien, 'EU social and gender policy beyond Brexit: Towards the European pillar of social rights' (2018) 17 Social Policy and Society 281, 292.
[168] Sacha Garben, 'The European Pillar of Social Rights: Effectively Addressing Displacement?' (2018) 14 European Constitutional Law Review 210, 211.
[169] Björn Hacker, 'A European Social Semester? The European Pillar of Social Rights in practice' European Trade Union Institute (ETUI) (WP 12 June 2019) 53.
[170] Commission, Proposal for a Directive of the European Parliament and of the Council on transparent and predictable working conditions in the European Union, COM(2017) 797 final.

However, this may be a difficult prospect, based on the experience with the proclamation of the EU Charter of Fundamental Rights, which failed to help in expanding the social dimension by the EU and prevent the deterioration of social rights from the austerity policies during the crisis.[171]

The European social model is also experiencing the crisis of the purpose of EU labour law. This would cause negative socio-economic effects related to the advent of robots in agro-food SME clustering. Essentially, the principal purpose of labour law was to counterbalance the inherent socio-economic inequality within the employment relationship.[172] However, it seems that the actual aim of the attempts to stabilise employment via employment policy and collective bargaining was the avoidance by the social security system to pay the costs of tackling insecurity.[173] As a result, EU labour directives were drafted to provide a *floor of rights* for workers, on which industrial relation systems and national labour law could add additional layers of protection. This approach is supported by the decision of the CJEU on the Working Time Directive[174] which interprets the expression 'minimum requirements for gradual implementation' in Article 153(2)(b) TFEU as authorising 'Member States to adopt more stringent measures than those which form the subject-matter of Community action.'[175]

Nevertheless, the Commission paved the way for the introduction of the term *flexicurity*,[176] as an effort to reconcile the antithetical concepts of labour market flexibility and employment security by promoting a third way 'to overcome conventional bipolar thinking.'[177] The imposed dramatic reforms in last years,[178] however, show that the aim of flexicurity may be to achieve competitiveness by providing flexibility to employers over security for workers. Certainly, ensuring security for workers is of utmost importance in the age of robots. Furthermore, the recent decisions by the CJEU, in *Rüffert*,[179] and

[171] Hacker (n 169) 53.
[172] Commission, 'Modernising labour law to meet the challenges of the 21st century' Green Paper COM(2006) 708 final.
[173] Simon Deakin, 'Social Rights in a Globalized Economy' in Philip Alston, *Labour Rights as Human Rights* (Oxford University Press 2005) 35.
[174] Jeff Kenner, 'Re-evaluating the concept of working time: an analysis of recent case law' (2004) 35 Industrial Relations Journal 588, 590; Council Directive 93/104/EC of 23 November 1993 concerning certain aspects of the organisation of working time [1993] OJ L307/18.
[175] Case C-84/94 *United Kingdom of Great Britain and Northern Ireland v Council of the European Union* [1996] ECR I-5755 [17].
[176] Jeff Kenner provides an extensive analysis of the phenomenon of flexicurity, which has driven much of the EU's policy agenda: Jeff Kenner, 'New frontiers in EU labour law: from flexicurity to flex-security' in Michael Dougan and Samantha Currie (eds) 50 years of the European treaties: looking back and thinking forward (Hart 2009) 279-310.
[177] Ibid., 281.
[178] See (n 151) above.
[179] Case C-346/06 *Dirk Rüffert v Land Niedersachsen* [2008] ECR I-1989.

Woolworths,[180] adopted the view that the Posted Workers Directive[181] and the Collective Redundancies Directive[182] respectively can provide simultaneously a floor and a ceiling of employment protection, 'permitting no national deviations from the EU-set standard, and certainly no ameliorative action at a national level'.[183] This is an important risk because these judgements that limit the ceiling of employment protection could be applied under the same legal basis for other EU labour directives.[184] This would be a detrimental development for workers to meet the challenges of technological advancements in the agro-food SME clusters.

Regarding the crisis of regulation, the heterogeneous EU seems to face difficulties to easily adopt EU legislation on matters related to social policy, as shown by the failure of Monti II proposal.[185] This constitutes a major disincentive for associations of employers to engage at EU level collective bargaining in order to reach a collective agreement that could concern all workers. Most importantly, although the high rates of unemployment across the EU, job creation, by definition, is not subject to EU legislation as there is no directive that can mandate the creation of jobs.[186] As a policy-making mechanism, the Open Method of Coordination process could provide a framework in which Member States would be able to support the 'implementation and evaluation of their social policies and to develop their mutual cooperation'.[187] This may be a useful development in dealing with the consequences on employment due to the use of robotics technology in agro-food SME clusters. The imposed austerity measures during the crisis, however, significantly affected the impact of the Open Method of Coordination and led to the lack of appropriate support for social systems which is considered as a key reason for the continuation of the crisis in the EU. Subsequently, the EU launched the European economic governance framework,[188] but its recommendations mainly focused on national reforms related to the labour market

[180] Case C-80/14 *Union of Shop, Distributive and Allied Workers (USDAW) and B. Wilson v. WW Realisation 1 Ltd and Others* EU:C:2015:291.
[181] Directive 96/71/EC of the European Parliament and of the Council of 16 December 1996 concerning the posting of workers in the framework of the provision of services [1997] OJ L18.
[182] Council Directive 98/59/EC of 20 July 1998 on the approximation of the laws of the Member States relating to collective redundancies [1998] OJ L225.
[183] Nicola Countouris and Aristea Koukiadaki, 'The Purpose of European Labour Law: Floor of Rights – or Ceiling?' (Social Europe, 6 June 2016) <https://www.socialeurope.eu/purpose-european-labour-law-floor-rights-ceiling>.
[184] Ibid.
[185] See (n 165) above.
[186] Barnard (n 18) 13-14.
[187] EUR-Lex 'Reinforcing the Open Method of Coordination for social protection and social inclusion' Document 52008DC0418 <https://eur-lex.europa.eu/legal-content/GA/LSU/?uri=celex:52008DC0418>; Commission 'A renewed commitment to social Europe: Reinforcing the Open Method of Coordination for Social Protection and Social Inclusion' (Communication) COM (2008) 418 final.
[188] Commission, 'EU Economic governance: monitoring, prevention, correction' <https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction_en>.

flexibilisation, raising the retirement age and reducing wages relatively below productivity gains, thereby further weakening the European social model. [189]

Consequently, the European social model should overcome the crises of legitimacy, purpose and regulation, so that it can face the enormous challenges of technological change. In this way, it would be able to contribute to the prosperity of citizens and businesses, and support large-scale projects, such as the development of the agro-food SME clustering across the EU regions. Technological innovation has allowed employers to cause the casualisation of previous stable employment forms through the business model of the gig economy, which is based on undeclared work and no predictable earnings and hours.[190] However, the case of Luddism has shown that social resistance can trigger a response to the disruptive effects of technological change and ultimately lead to a compromise between capital and labour. This difficult compromise proves that 'there is no iron law of capitalism which dictates that technological change leads to immiseration.'[191] The gig economy is a business model, which is aided by the support that the legal system provides to business enterprise. Nonetheless, it is necessary to control it because if technology is able to evolve, then law can also evolve and find appropriate solutions that would face the effects of the advent of robots in agro-food SME clusters. Already, the EP report recommends considering new employment models and issues on the sustainability of social systems by putting in place the introduction of a general basic income as a response to the challenges of the development and deployment of robotics technology.[192]

3.3 Basic income vs. the right to work

The EP report's recommendation for the introduction of a general basic income may be a feasible solution to the threat of a jobless future due to the advent of robots, which clearly showed its signs during the pandemic period. For this reason, the agro-food SME clusters could have an active role in the adoption of basic income that is necessary. This is because according to Article 25 of the Universal Declaration of Human Rights, 'everyone has the right to a standard of living adequate for the health and well-being of himself and of his family'.[193] Although the idea to provide a basic income unconnected to work was an old utopian dream, nowadays it has become a global movement expressing one of the most widely debated social policy proposals in the world.[194] This is because the adoption of basic income could be a possible solution to the economic disruptions resulting from new technologies by providing an elementary social level to citizens and letting them choose

[189] Christoph Hermann, 'Crisis, structural reform and the dismantling of the European Social Model (s)' (2017) 38 Economic and Industrial Democracy 51, 63-64.
[190] See (n 151) above.
[191] Deakin (n 146).
[192] EP report (n 13) 15.
[193] Universal Declaration of Human Rights (n 106) art. 25.
[194] Philippe Van Parijs and Yannick Vanderborght, *Basic Income: A Radical Proposal for a Free Society and a Sane Economy* (Harvard University Press 2017) 70-98.

how to use this support, as well as helping to streamline the bureaucracy in managing social support programmes.[195]

The impact of the acceleration of technological innovation on the labour market seems to cause important externalities, such as rising poverty and income inequality.[196] This may justify some public intervention through the adoption of basic income which has never been developed as a national initiative of social protection, but various pilot programmes have been implemented in recent years in some parts of the Western world.[197] However, those programmes have offered only partial support rather than a full income assistance that would ensure a decent living for the recipients.[198] Certainly, guaranteeing sufficient benefit levels that would reduce poverty and income inequality entails a considerable cost that requires suitable financing policies. This means that the affordability of basic income depends mainly on the planned benefit level and the financing sources, which may result from the reallocation of public expenditures and the increase of tax revenues.[199] In this way, the agro-food SME clusters could provide revenues to contribute to the funding of basic income due to the use of robots, which is considered as a labour-displacing technological innovation.

Nevertheless, the question is whether the adoption of basic income could actually be the appropriate solution to reduce poverty and income inequality. Despite the fact that the Scandinavian countries have not adopted a basic income, they are considerably more effective in reducing poverty and income inequality than other parts of the world.[200] Due to their social democratic tradition, they have focused on economic security by combining work-related programmes, income transfers based on specific conditions, and guaranteed income for people who are at risk of poverty. Additionally, by making labour market interventions and implementing relevant redistributive policies, the Scandinavian countries demonstrate that the most important variables in the reduction of poverty and income inequality are political, such as the power of labour, and depend on the status of

[195] Kemal Derviş, 'Getting basic income right' (Project Syndicate, 21 March 2017) <https://www.project-syndicate.org/commentary/universal-basic-income-france-social-account-by-kemal-dervis-2017-03?barrier=accesspaylog>.
[196] Anthony Atkinson, *Inequality. What Can Be Done?* (Harvard University Press 2015) 290-292.
[197] Indicatively, several Dutch municipalities have experimented with a basic income for social assistance recipients. Also, Alaska has had a longstanding basic income scheme in place, though the level of benefit granted is relatively low, and Ontario in Canada has piloted basic income among randomly selected members in three communities.
[198] ITUC 'Economic and Social Policy Brief: Universal Basic Income' (International Trade Union Confederation 2018) 3.
[199] Isabel Ortiz and others, 'Universal Basic Income proposals in light of ILO standards: Key issues and global costing' (International Labour Organization WP 62, 2018) 17-19.
[200] OECD 'Poverty rate - indicator' (doi: 10.1787/0fe1315d-en, 09 June 2020) <https://data.oecd.org/inequality/poverty-rate.htm#indicator-chart>; OECD 'Income inequality – indicator' (doi: 10.1787/459aa7f1-en, 09 June 2020) <https://data.oecd.org/inequality/income-inequality.htm#indicator-chart>.

capital-labour relations.[201] Therefore, a guaranteed income via work may be a better way than the option of the basic income because its main aim is to preserve an income at the level of decent livelihood of the working people.

Furthermore, the implementation of basic income may encounter practical difficulties related to complex levels of the amount, goals, and priorities. These are associated with the risk of abolishing the welfare state and replacing other social programmes that exist to address specific problems, such as the vulnerability of unemployed, children, elderly, and people with disabilities.[202] The adoption of basic income would also reduce the value of work to a mere income. This is because work should not be considered only as a wage labour, since it is valuable to maintain the social aspects of work environment, in which people develop social relationships as they spend many hours in interacting with others.[203] For these reasons, it is important to create policies that ensure the right to work for everyone. A job guarantee could offer a significant value to work without downgrading it to a mere income, thus making efficient use of public and private resources, as well as preserving and developing workers' skills, and retaining the nature of the social market economy.[204] Consequently, the job guarantee is more important than the adoption of a basic income, thereby strengthening the fundamental right to work for everyone.

The value of work is one of the most important principles of the human life in the current world and for this reason, it should be constituted an essential concept for the development of the agro-food SME clusters in light of the challenges stemming from the advent of robots. Work is vital for the position of people in society by inspiring a feeling of attainment and self-esteem and is crucial because productive labour generates income by producing material goods that people wish to purchase and consume them in order to live an enjoyable life.[205] Given that work brings both non-material and material benefits, it is important to consider how the value of work would be able to become a human right to work.

Employment law typically adopts an instrumental approach in which the right to work may be a human right when courts are able to protect it and organisations of civil society can

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[201] Vicente Navarro, 'Why the Universal Basic Income is not the Best Public Intervention to Reduce Poverty or Income Inequality', (Social Europe, 24 May 2016) <https://www.socialeurope.eu/why-the-universal-basic-income-is-not-the-best-public-intervention-to-reduce-poverty-or-income-inequality>.
[202] Daron Acemoglu, 'Why Universal Basic Income is a Bad Idea' (Project Syndicate, 5 June 2019) <https://www.project-syndicate.org/commentary/why-universal-basic-income-is-a-bad-idea-by-daron-acemoglu-2019-06?barrier=accesspaylog>.
[203] Cemal Karakas, 'Basic income: Arguments, evidence, prospects'(European Parliament - briefing, September 2016) 4; See generally: James Bernard Murphy, *The Moral Economy of Labour: Aristotelian Themes in Economic Theory* (Yale University Press, 1993); Arendt, Hannah. *The Human Condition* (Chicago University Press, 1998 [1958]); Judith Shklar, *American citizenship: The quest for inclusion* (Harvard University Press, 1995).
[204] Henning Meyer, 'Five Reasons why a Basic Income won't Solve Technological Unemployment' (Social Europe, 4 February 2016) <https://www.socialeurope.eu/why-a-basic-income-wont-solve-technological-unemployment-but-a-job-guarantee-might>.
[205] Virginia Mantouvalou, 'The Protection of the Right to Work through the European Convention on Human Rights' (2014) 16 Cambridge Yearbook of European Legal Studies 313, 313.

achieve to use it deliberately to support related goals.[206] Additionally, in positive law, at international and European level, the right to work or some of its elements appears to be protected in relevant documents, discussed below, such as the International Covenant on Economic, Social and Cultural Rights (ICESCR), the European Social Charter (ESC), the EU Charter of Fundamental Rights (EUCFR), and the European Convention on Human Rights (ECHR). However, these documents do not clarify if a right to work requires from the government to create jobs for any individual, or if it merely means that there must be access to existing jobs without discrimination, [207] or to what degree it protects from unfair dismissal.[208]

More specifically, the ICESCR protects the right to work, 'which includes the right of everyone to the opportunity to gain his living by work which he freely chooses or accepts, and will take appropriate steps to safeguard this right.'[209] To ensure the appropriate use of the right to work, however, the ESC asks from the contracting parties to put as 'their primary aims and responsibilities the achievement and maintenance of as high and stable a level of employment as possible, with a view to the attainment of full employment.'[210] Furthermore, the EUCFR determines the full range of political, civil and socio-economic rights containing a right to work, especially 'the right to engage in work and to pursue a freely chosen or accepted occupation'.[211] On the other side, the ECHR does not explicitly refer to the right to work but it enjoys an effective monitoring mechanism and a binding force that do not exist in the abovementioned documents.[212]

The ECHR only contains some labour rights, such as the 'prohibition of slavery or servitude', and 'forced and compulsory labour',[213] and the 'freedom of assembly and association… including the right to form and to join trade unions'.[214] However, in the context of judicial interpretation of the ECHR by the European Court of Human Rights (ECtHR), the case law identifies certain normative principles, such as the principles of dignity, non-exploitation, non-domination and self-fulfilment.[215] These principles underpin the right to work and would be able to dominate as essential elements to address the consequences of new technologies in the agro-food SME clusters. In particular, the ECtHR recognises that a living

[206] Kenner (n 158) 136-152.
[207] Mantouvalou (n 205) 313.
[208] Jeff Kenner argues that Article 30 EUCFR on the right to protection against unjustified dismissal has an enigmatic quality: Jeff Kenner, 'Article 30: protection in the event of unjustified dismissal' in Jeff Kenner and others (eds.), T*he EU Charter of Fundamental Rights: a commentary* (Hart 2014) 27.
[209] International Covenant on Economic, Social and Cultural Rights, (adopted 16 December 1966, entered into force 3 January 1976) 993 UNTS (ICESCR) art. 6(1).
[210] European Social Charter of 1961, CETS 35 (ESC); Revised European Social Charter of 1966, CETS 163 (ESC) art. 1(1).
[211] Charter of Fundamental Rights of the European Union, OJ C 326, 26 October 2012 (EUCFR) art. 15(1).
[212] Mantouvalou (n 205) 317.
[213] Convention for the Protection of Human Rights and Fundamental Freedoms (European Convention on Human Rights, as amended) (ECHR) art. 4.
[214] Ibid., art. 11.
[215] Mantouvalou (n 205) 320-331.

obtained via work is vital for human dignity,[216] substantiates the principle of non-exploitative work,[217] provides protection to the worker against the domination of employer,[218] and stresses the significance of work for self-fulfilment.[219]

Interestingly, invoking these normative principles does not necessarily entail a breach of the ECHR because there are conflicting interests among workers, which labour protective legislation and associative activities of unions and related organisations endeavour to tackle. For instance, the right to access a job may conflict with the right to fair working conditions. Accordingly, the ECtHR alone may not be able to confront the issue of unemployment, which is an important structural injustice at work and seems to become one of the most crucial challenges of robotics technology in agro-food SME clustering across the EU regions. For this reason, the contribution to the creation of jobs with a decent living wage and strong labour rights, especially at the time of COVID-19 crisis and beyond,[220] should be a vital purpose for the development and effective operation of agro-food SME clusters in the age of new technologies.

4. Contribution of agro-food SME clustering and new technologies to society

4.1 Regional basic dividend vs. robot tax

Instead of supporting the idea of a basic income to face the consequences on employment due to the advent of robots, it would be socially more efficient to focus on policies that promote a job guarantee, preserving the social aspects of work and reinforcing the fundamental right to work for everyone. Accordingly, the agro-food SME clusters must find suitable ways to contribute to ensuring jobs for everyone and, therefore, enhancing the right to work in their geographical territory. In particular, they could financially support the creation of new jobs that would offer a decent income and good working conditions throughout the EU regions. To this end, various options for the agro-food SME clusters could be available, such as either their robots may pay an income tax or their businesses may pay a tax to replace workers with robots or any other possible solution.

The EP report considers the option of a tax on robots by introducing a notification system prior to the establishment of them with reference to their relative participation to the

[216] Sidabras and Dziautas v Lithuania, App Nos 55480/00 and 59330/00, Judgment of 27 July 2004; Stummer v Austria, App No 37452/02, Grand Chamber Judgment of 7 July 2011.
[217] Siliadin v France, App No 73316/01, Judgment of 26 July 2005; CN v United Kingdom, App No 4239/08, Judgment of 13 November 2012; Rantsev v Cyprus and Russia, App No 25965/04, Judgment of 7 January 2010.
[218] IB v Greece, App No 552/10, Judgment of 3 October 2013; Vogt v Germany, App No 17851/91, Judgment of 2 September 1996.
[219] Niemietz v Germany, App No 13710/88, Judgment of 16 December 1992; Campagnano v Italy, App No 77955/01, Judgment of 23 March 2006.
[220] Jeff Kenner, 'Brexit and Labour Standards at the time of COVID-19 – To Converge or to Diverge, that is the Question', (Regulating for Globalization, 25 May 2020) <http://regulatingforglobalization.com/2020/05/25/brexit-and-labour-standards-at-the-time-of-covid-19-to-converge-or-to-diverge-that-is-the-question/>.

business turnover.[221] Imposing a robot tax, however, seems to be the wrong approach because, unlike the worker, the robot will receive no income and never negotiate a labour contract with the business. Certainly, it is feasible to introduce an income tax on behalf of the robot,[222] by using the displaced worker's last annual income that would operate as a reference salary in order to extract from the business's revenues income tax, and social security and pension contributions equivalent to those that the worker was paid.[223] As a result, the tax system should be adjusted so that it can be relatively neutral between human and robot workers. The *neutrality* of taxation might be achieved by prohibiting corporate tax deductions for robots and creating a robot tax that reflects existing unemployment patterns, thereby allowing the marketplace to adapt without tax distortions.[224]

Nevertheless, the agro-food SME clustering would need to cope with a number of difficulties related to this approach. While a worker's wage can change over time, it is impossible for the reference salary to be different, unless the tax authorities would change it in an arbitrary manner against the business that uses the robot. This means that tax office and business would have conflicts over the precise estimation of the change of worker's salary.[225] In addition, it is hard to calculate a robot tax for each robot-operated machine that has never been used by humans because there is no previous human income to operate as a reference salary.[226] Therefore, the introduction of robots is difficult to be related to specific job losses in order to count the exact number of workers who would be replaced by each robot.[227]

Furthermore, it may be difficult to justify forcing businesses of the agro-food SME clusters to pay income tax for the robots but not for the machines that the robots may operate. For example, an agricultural business decided to replace a worker, who operates a harvester, with a robot because the robot can operate the harvester more safely, in any weather, and longer without breaks, sick pay, holidays and more.[228] In fact, robot and harvester are both machines, and the harvester has previously caused the displacement of far more workers than the robot has. The matter that the robot possesses more autonomy than the

[221] EP report (n 13) 44.
[222] Kevin Delaney, 'The robot that takes your job should pay taxes, says Bill Gates' (Quartz, 17 February 2017) <https://qz.com/911968/bill-gates-the-robot-that-takes-your-job-should-pay-taxes/>.
[223] Sam Mitha, 'Robots, technological change and taxation' (Tax Journal, 15 September 2017) 10.
[224] Ryan Abbott and Bret Bogenschneider, 'Should robots pay taxes: Tax policy in the age of automation' (2018) 12 Harvard Law and Policy Review 145, 151-152.
[225] Yanis Varoufakis, 'A Tax on Robots?' (Project Syndicate, 27 February 2017) <https://www.project-syndicate.org/commentary/bill-gates-tax-on-robots-by-yanis-varoufakis-2017-02?barrier=accesspaylog>.
[226] Ibid.
[227] Mitha (n 223) 10.
[228] Recent developments about robot harvesters, see Simon Akam, 'Driverless Tractors Are Getting Ready for Harvest Season' (Bloomberg Businessweek, 2 June 2020) <https://www.bloombergquint.com/businessweek/driverless-tractors-are-coming-soon-to-u-k-farms>.

harvester is the only defensible justification for considering them differently, but this might not convincingly justify the implementation of a robot tax.[229]

A sophisticated robot could be a truly autonomous machine, and thus distinct from the harvester, if it would be able to develop a high level of consciousness, which currently seems to be restricted to biological beings. Nonetheless, this does not preclude the possibility of non-biological consciousness,[230] where a robot could be a thing that thinks, a *res cogitans*,[231] such as the Nexus-9 replicants in Blade Runner 2049,[232] which are considered as people despite the fact that the content of their consciousness is not real. In this regard, humanity should produce a new species that she/he/it may simulate consciousness as a strategy to claim civil rights,[233] demanding freedom and equal rights with the workers. Until then, however, a robot could be a distinct machine from the harvester in the agro-food SME clustering via an internal mechanism that can simply work as a *robot consciousness* by using sensor systems with law-enforcement algorithms.[234]

This does not mean that the robot can pay income tax without generating conflicts between business and tax authorities, and therefore, it may be a proper manner taxing the robot at the point of sale to the business.[235] Moreover, the tax authorities could collect a *lump-sum tax* from the business the moment that it replaces the worker with the robot. The lump-sum tax is the only tax that would not introduce distortions in the economy,[236] but this could incentivise robot producers to bundle artificial intelligence within other machinery.[237] For example, the robot may be incorporated within the harvester, thus making it difficult to tax the robotic component separately from the other non-intelligent parts. As a result, the robot sales tax should be either eliminated or generalised into a capital goods sales tax, which is a catastrophic choice for society because imposing a tax on all capital goods would lead to a substantial diminishment of domestic productivity and competitiveness.[238]

Given that robots are able to produce better goods and services as well as improving productivity significantly, taxing them would lead to restraining innovation and obstruct

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[229] Varoufakis (n 225).
[230] Lawrence B. Solum, 'Legal Personhood for Artificial Intelligences' (1992) 70 North Carolina Law Review 1231, 1265-1266.
[231] Descartes Rene, *Discourse on the Method of Rightly Conducting One's Reason and of Seeking Truth in the Sciences* (1637, Part IV).
[232] Blade Runner 2049 (2017 film), Director: Denis Villeneuve.
[233] Bert-Jaap Koops, Mireille Hildebrandt and David-Olivier Jaquet-Chiffelle, 'Bridging the Accountability Gap: Rights for New Entities in the Information Society?' (2010) 11 Minnesota Journal of Law, Science & Technology 497, 527.
[234] See (section: Towards the formation of EU robot law) above.
[235] Delaney (n 222).
[236] Robert Shiller, 'Robotization without Taxation?' (Project Syndicate, 22 May 2017) <https://www.project-syndicate.org/commentary/temporary-robot-tax-finances-adjustment-by-robert-j--shiller-2017-03?barrier=accesspaylog>.
[237] Varoufakis (n 225).
[238] Ibid.

growth and/or possibly driving the production offshore.[239] Accordingly, instead of a robot tax to support a job guarantee, a suitable solution may be a better redistribution of wealth,[240] through the implementation of a basic dividend that would assist in addressing the problems of structural joblessness and supporting full employment. More specifically, a basic dividend that should be financed from the returns of agro-food SME clusters may be able to contribute to the creation of new social jobs needed in their geographical territories throughout the EU regions.

A fixed share of equity issues could be directed into a regional public trust in each EU region that would generate an income stream from which a *regional basic dividend* can be provided to support the aim of job guarantee. In particular, the certain portion of equity issues by every agro-food SME cluster should go, via initial public offerings (IPOs) that is a type of public offering,[241] to the corresponding regional public trust that represents the specific EU region.[242] Every regional public trust in the EU regions is created for its beneficial social impact through the potential generating of an income stream that could be a steady flow of money from which a regional basic dividend will be paid. In this way, society becomes a shareholder in agro-food SME clustering, and the dividend payments are allocated to reduce unemployment across the EU regions.

To the extent that robotics technology increases output and corporate profitability of agro-food SME clusters, European societies would begin to reap the social benefits without any new tax imposition, tax code complexities, or effects on the welfare state. Indeed, higher profits would ensure more funds available to society, which will be allocated automatically via the regional basic dividend to financially support the creation of new social jobs with a decent living wage and strong labour rights. The previous industrial revolutions were based on machines made by insightful inventors and purchased by entrepreneurs who claimed property rights over the income stream those machines generated.[243] On the contrary, the current technological revolution should be characterised by the growing socialisation of the production of capital, and thus 'a practical response would be to socialise the property rights over the large income streams capital is now generating.'[244] For this reason, an appropriate way could be the place of equity issues by the agro-food SME clusters in the regional public trusts, which would create regional basic dividends that will be directed to address the critical problem of unemployment by financing the creation of new social jobs throughout the EU regions.

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[239] Lawrence Summers, 'Robots are wealth creators and taxing them is illogical' (Financial Times, 5 March 2017) <https://www.ft.com/content/42ab292a-000d-11e7-8d8e-a5e3738f9ae4>.
[240] Ibid.
[241] See generally for IPOs: Douglas Cumming and Sofia Johan (eds.) *The Oxford Handbook of IPOs* (Oxford University Press, 2019).
[242] See e.g. Gary Watt, *Equity and Trusts Law Directions* (Oxford University Press, 2019).
[243] All the inventions of today's technological revolution are public funded but corporations (apple, google etc.) gain the profits; 'Without the massive amount of public investment behind the computer and internet revolutions, such attributes might have led only to the invention of a new toy': Mariana Mazzucato, *The Entrepreneurial State: debunking public vs. private sector myths* (Anthem Press 2013) 87.
[244] Varoufakis (n 225).

4.2 Blockchain for a new economic and business model

Each of the regional public trusts related to agro-food SME clusters in the EU regions may be a decentralised autonomous organisation (DAO). This organisation would generate via blockchain technology an income stream to ensure more funds available for new jobs, thus confronting the implications of the use of robots on employment. As a form of distributed ledger technology, 'a blockchain is, essentially, a database that is replicated across a network of computers updated through a consensus algorithm'.[245] Accordingly, value in blockchain-based trusts of agro-food SME clustering could be transferred via blockchain networks, thereby reducing the need for the traditional intermediaries that are responsible for the verification and validation of transactions. Perhaps, human operated institutions become obsolete as blockchains can generate systems ruled by protocols and additional code-based rules that are enforced automatically through the underlying blockchain-based network.[246] The technical authenticity of the information on the blockchain, nevertheless, is ensured through cryptographic tokens that are allocated among anonymous accounts.[247] As a result, the blockchain-based trusts of agro-food SME clusters should follow the process of tokenisation, which would be able to maintain the accuracy and security of the ledger.

Accordingly, those blockchain-based trusts aiming to finance the creation of new jobs throughout the EU regions, can be more transparent than the traditional model of trusts, while ensuring the security of their funds. In general, records in public blockchain systems are entirely transparent and thus visible to anyone on the network,[248] thereby creating a 'distributed, shared, encrypted-database that serves as an irreversible and incorruptible public repository of information.'[249] Therefore, encryption is a central element in blockchain technology, which enables participants to generate a key pair, public key, and a private key, in order to validate transactions by concealing their real-life identity but, contrariwise, showing their encrypted identity.[250] Namely, there is a 'necessity to announce all transactions publicly … but privacy can still be maintained by breaking the flow of information in another place: by keeping public keys anonymous.'[251]

Therefore, the blockchain-based trusts related to the agro-food SME clusters may be mapped in no-trust environments where participants will not need to know and trust each other in order for them to conduct transactions with absolute assurance. This *trustless trust*

[245] Michèle Finck, *Blockchain Regulation and Governance in Europe* (Cambridge University Press, 2018) 1.
[246] Primavera De Filippi and Aaron Wright, *Blockchain and the Law: The Rule of Code* (Harvard University Press, 2018) 6.
[247] Karen Yeung, 'Regulation by blockchain: the emerging battle for supremacy between the code of law and code as law' (2019) 82 The Modern Law Review 207, 210-211.
[248] Ibid., 211.
[249] Aaron Wright and Primavera De Filippi 'Decentralized Blockchain Technology and the Rise of Lex Cryptographia' (Available at SSRN 2580664, 10 March 2015) 2.
[250] Thibault Schrepel, 'Blockchain and human rights: utopia, or dystopia, or both?' (Oxford Business Law Blog, 4 December 2019) <https://www.law.ox.ac.uk/business-law-blog/blog/2019/12/blockchain-and-human-rights-utopia-or-dystopia-or-both>.
[251] Satoshi Nakamoto, 'Bitcoin: A peer-to-peer electronic cash system' (bitcoin.org, 24 May 2009) 6.

can be created by smart contracts,[252] which can execute automatically and autonomously, thus enabling transactions in situations devoid of human and institutional trust, as well as lowering transaction costs and reducing counterparty risk and interpretative uncertainty.[253] A smart contract is a computerised transaction protocol that automatically executes the terms of an agreement.[254] In particular, it is a computer programme code that automatically verifies, executes, and enforces, the exact terms and conditions of a contract.[255] For example, the fixed characteristics of traditional trusts, such as the delivery of returns at a specific date, could be written into a smart contract, so that the tokenised funds of blockchain-based trusts that are linked with the agro-food SME clusters can automatically vest at the relevant date.

However, smart contracts are written in a programming language that is based on the rigidity of automated software, removing the flexibility offered by legal contracts due to the vagueness inherent to natural language.[256] Consequently, smart contracts are used to memorialise legal agreements, thereby creating commercial arrangements which are dynamic and potentially difficult to terminate.[257] This offers a high degree of certainty that can bring considerable efficiency gains for the blockchain-based trusts related to the agro-food SME clusters, thus improving their overall investment strategy and therefore generating better returns for the creation of new jobs in each EU region. Furthermore, their decentralised nature eliminates the necessity for constant human intervention in trust operations, which constitutes an important factor for raising concerns with regard to accountability and the possibility for any breach of trust.

By replacing the traditional model of trust intermediaries with trust based on numbers,[258] every blockchain-based trust of agro-food SME clustering would become a decentralised organisation. In contrast with a centralised trust's management that is entrusted to a corporate trustee or a body of individuals, a decentralised trust is managed by a decentralised organisation-application[259] which relies on blockchain and smart contracts as its main or exclusive source of governance.[260] More specifically, blockchains facilitate the development of smart contracts, which are executed in a distributed manner by an whole network, rather than run on any central server, thus enabling them to 'be combined to form an interconnected system of technically enforced relationships that collectively define the rules of an organisation.'[261] Based on suitably defined rules, therefore, the

[252] Kevin Werbach, *The Blockchain and the New Architecture of Trust* (MIT Press 2018) 28-32.
[253] Finck (n 245) 25.
[254] Nick Szabo, 'Smart Contracts' (1994) <http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart.contracts.html>.
[255] Yeung (n 247) 223.
[256] Finck (n 245) 26-27.
[257] De Filippi and Wright (n 246) 3.
[258] Finck (n 245) 11.
[259] James Brockhurst, 'Is it time to consider blockchain-based trusts?' (Forsters LLP, 8 April 2019) <https://www.forsters.co.uk/news/blog/time-has-come-consider-blockchain-based-trusts>.
[260] De Filippi and Wright (n 246) 136.
[261] Ibid.

blockchain-based trusts could hold equity issues as tokenised assets stemming from the agro-food SME clusters, and provide token dividends in the form of regional basic dividends for the creation of new social jobs across the EU regions.

These organisations can be designed to be extremely autonomous and progressively independent from human control. As decentralised autonomous organisations (DAOs), they would be able to form contractual relationships and 'create a complex ecosystem of autonomous agents interacting with one another according to a set of pre-determined, hard-wired, and self-enforcing rules.'[262] This signals the gradual structural shift of power from government authorities' legal rules and regulations to decentralised blockchain-based networks' code-based rules and protocols.[263] Although DAOs could be designed to operate in accordance with rules and principles that would diverge from those required by law, it should be useful to be developed within the boundaries of established legal orders by complying with the law in order 'to secure interoperability with the real world'.[264]

Given that the concept of DAO, in which technical protocols would replace human interaction, currently remain largely an idea,[265] it is important to consider how the blockchain-based trusts as DAOs could work in practice. Researchers in blockchain and a group of artists created an artistic blockchain-based experiment that could constitute an important basis for the design of the DAOs in agro-food SME clustering throughout the EU regions. This experiment is about the concept of the *plantoid,*[266] which is a robot plant equivalent of an android. While the android is a robot with human appearances, the plantoid consists of the characteristics of a plant. Namely, 'it is a robot or synthetic organism designed to look, act and grow like a plant.'[267] The main distinction between a plant and the plantoid lies in the process of reproduction. Many organic plants often need help by insects, such as bees and butterflies, to reproduce themselves through the pollination process. The plantoid does not rely on pollination, but rather on the cooperation of human beings through the process of capitalisation.[268]

The body of the plantoid consists of a mechanical plant and its spirit, which is embedded within the blockchain as a smart contract. These two components give life to an autonomous and self-sufficient device that can be independent from its creators and capable of reproducing.[269] Humans donate in its wallet and when it accumulates a specific amount of funds, anyone can submit proposals on what they want for the next version of the plantoid to look like. Through voting on these proposals by those who contributed to its wallet, the funds are transferred to the selected agent who submitted the most popular

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[262] Wright and De Filippi (n 249) 17.
[263] De Filippi and Wright (n 246) 7.
[264] Finck (n 245) 23.
[265] Ibid.
[266] Plantoid.org, 'I'm a PLANTOID: A Blockchain-based life form' <http://okhaos.com/plantoids/>. See also Kat Mustatea, 'Meet Plantoid: Blockchain Art with a Life of its Own' (Forbes, 31 January 2018) <https://www.forbes.com/sites/katmustatea/2018/01/31/meet-plantoid-blockchain-art-with-a-life-of-its-own/#461c11e83f64>.
[267] Ibid.
[268] De Filippi and Wright (n 246) 167.
[269] Ibid.

proposal to create the new plantoid, and then the whole process starts all over again.[270] By following the Darwinian approach,[271] the reproduction of every plantoid is related to an evolutionary algorithm, so that humans can select the most favourable plantoids based on their particular characteristics. In addition to this, a pyramid scheme,[272] which is similar to a multilevel marketing model, operates as an incentive structure for the participants of the DAO in order for them to contribute to the reproduction of plantoids. This is beneficial to the system as it encourages the production of derivative works by maximising the return on investments, as ex-post royalty payments.[273]

As the experiment of plantoid is the first DAO in the world, it creates the possibility for new economic and business models,[274] which may be useful for the operation of blockchain-based trusts of agro-food SME clustering in the EU. The plantoid signifies the commencement of a new relationship between creators, their work, and the descendants of their creatures. Instead of funding a creator to continue producing new works, it currently becomes feasible to directly fund the creature itself, which would be in charge of selecting and hiring the creators that would be responsible for its reproduction.[275] Accordingly, the DAOs of blockchain-based trusts related to the agro-food SME clusters, which will trigger an income stream to generate the regional basic dividend, could work in a similar way. Members of society may participate, via a pyramid scheme, to the accumulation of funds in order to finance the creation of new social jobs in the EU regions. Subsequently, they can submit proposals on what kind of social jobs they need in their local areas, such as their town, neighbourhood or village.

Though the DAOs of blockchain-based trusts related to the agro-food SME clusters could be an innovative and effective approach for the creation of new jobs throughout the EU regions, it might be interesting to examine what can happen if this technology would be used for malicious purposes. This raises questions about responsibility and regulability,[276] because the decentralised nature renders the legitimate and effective governance of DAOs particularly challenging, as opposed to vertically integrated and bureaucratic organisation forms.[277] More specifically, as regards responsibility, the question is who should be liable in case that the DAO of a blockchain-based trust would cause damage to someone. If the creators will be liable, stopping and criminalising them does not mean the shutting down of the operation of the DAO because it will be completely autonomous. On the other side, the participants who will be triggering and constantly transacting with this DAO may be liable. However, criminalising users is arguably a completely ineffective and practically

[270] Plantoid.org (n 266).
[271] Daniel Rankin, 'A Darwinian Approach' (2011) 333 Science 526 DOI: 10.1126/science.1209324.
[272] Rodney K. Smith, *Multilevel Marketing* (Baker Publishing Group, 1984) 45.
[273] Ibid.
[274] See generally, Melanie Swan, *Blockchain: Blueprint for a new economy* (O'Reilly, 2015).
[275] Plantoid.org (n 266).
[276] Primavera De Filippi discusses the issues of responsibility and regulability in her presentation: 'Blockchain Technology and the Future of Work' (Geneva 11 February 2016) <http://videos.liftconference.com/video/12885329/primavera-de-filippi-blockchain-technology-and>.
[277] Yeung (n 247) 214.

problematic approach.[278] Perhaps, the DAO itself should be responsible, but this raises the question of regulability because it is quite challenging to regulate a technology that is completely autonomous and independent.[279] For this reason, it is necessary for engineers and lawyers who currently explore this technological tool to start considering its legal, ethical and political implications. In this way, they would be able to identify what kind of governance system of blockchain-based trusts related to agro-food SME clustering in the EU can be regulated without undermining the potential and the benefits offered by their decentralised nature.

Conclusion

As a new model of prosperity, the proposed project of agro-food SME clustering would be able to contribute significantly to addressing the consequences of a constant crisis in the last decade in Europe, which have been exacerbated to a large extent by the COVID-19 outbreak. In addition, robotics technology can positively influence the operation of agro-food SME clusters in the EU since it has already begun to play an important role in transforming the key sectors of agro-food supply chain, such as agriculture, food processing and the food distribution systems. Accordingly, the examination of legal aspects and socio-economic implications related to the advent of robots is of immense importance in order to design policies that would ensure high levels of efficiency via agro-food SME clustering throughout the EU regions.

In particular, the development of a well-adapted regulatory framework for robotics should take into account various complexities associated with highly sophisticated devices entering the real world. Specifically, the matter of robot liability is complicated due to inadequacies in the legal system which presumes linear causation, but the actions of robots that are complex machines will be nonlinear and unpredictable. For this reason, by taking into consideration the relevant EP report's recommendations, this article suggests the development of specific insurance products for the use of robots in agro-food SME clustering, which should be designed in such a way that their behaviour would be relatively convergent with human expectations. Accordingly, robot actions will largely be amenable to the current legal system that already contains internal mechanisms to ensure a balance of competing interests. This conjunction of robot design and law-abidingness requires the creation of an ethical framework, as complement to the legal framework, which would assist the adoption of a suitable licensing approach that can guarantee a proper design and use of robots. Consequently, this article argues that robots in the agro-food SME clusters should acquire a special legal status by equipping them with an internal mechanism that integrates sensor systems with law-enforcement algorithms to control their behaviour, so that they can sufficiently be legally and ethically compatible.

Additionally, the agro-food SME clusters must cope with the socio-economic implications stemming from the disruption in the labour market due to the advent of robots. Unlike the past, it seems that technology currently destroys jobs faster than creating them and the

[278] Primavera De Filippi explains that the experience about the war against copyright infringement has shown that criminalising users is quite ineffective and problematic approach: De Filippi (n 276).
[279] Ibid.

initial reaction to this situation is the emergence of the gig economy, which is based on the normalisation of nonstandard employment and self-employment. This means that the welfare state institutions that were created due to the Luddite movement, are at risk particularly in the EU where the European social model is in crisis. As a response, the EP report recommends the possible introduction of a general basic income which, however, may face practical difficulties to its implementation. It also would threaten the existing social programmes and downgrade the value of work to a mere income. Hence, this article claims that a job guarantee may be socially more efficient than the basic income because it preserves the social aspects of work and strengthens the fundamental right to work for everyone. To this end, the financial contribution to create new social jobs with a decent living wage and strong labour rights in their geographical territory should be among the central objectives of the agro-food SME clusters in the era of robotics technology.

Instead of imposing a robot tax for this purpose, however, this article proposes the adoption of regional basic dividends that will be financed from the returns of agro-food SME clusters. These dividends can be provided through equity issues that may be directed into a regional blockchain-based trust in each EU region, which would be a DAO designed to be extremely autonomous and progressively independent from human control. In this way, it could reduce the need for the traditional intermediaries and be, via smart contracts, more transparent than the traditional model of trusts. This offers a high degree of certainty that would improve the investment strategy of the blockchain-based trusts related to the agro-food SME clusters. Accordingly, better returns can be generated for the creation of new jobs, thereby providing more funds available to society, which becomes a shareholder in agro-food SME clustering through the growing socialisation of the production of capital. This approach may lead to the formation of a new economic and business model that would work in accordance with code-based rules and protocols of decentralised blockchain-based networks. However, their decentralised nature renders the legitimate and effective governance of DAOs particularly challenging as there are issues related to responsibility and regulability in cases where this technology may be used for purposes intended to cause harm. Consequently, further research is needed to explore relevant legal, ethical and political implications, as well as identifying an appropriate governance system for DAOs, which may be regulated in such a way that would ensure the capability and the advantages of their decentralised operation.