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The law related to the digitization of agriculture

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Introduction

The exponential technological evolution at the end of the last century and beginning of the 21st century, within a globalized economy, has produced profound changes in social relations. Such changes have brought new dynamics to capitalism, based on information and data processing. The phenomena behind these transformations are related to the intensification of the use of information and communication technologies (ICT), the democratization of access and production of information brought on by the internet, the growing relevance of analyzing large data volumes in the economy (Big Data), the dissemination of connected devices (internet of things) and artificial intelligent agents.

Modern-day world economy is strongly characterized by computational processing of information to generate knowledge, produce goods and services and generate value, changing the notion of wealth from a material asset to an intangible asset (Mendes et al., 2015).

The term "digital economy" emerged within the scope of these phenomena and is characterized by the central role of science, technological development and the use of digital technologies as leverage instruments for countries and economic agents to strategically and competitively position themselves in the international geopolitical scenario and in the market (Soares; Prete, 2018). The main factor of digital economy generating wealth is the transmission, processing and sharing of information. If at the initial stage the production of this information its processing was concentrated in large companies as the main productive agents, within a society of organizations, in the second stage, at the turn of the millennium, this production and consumption of information and data, from which new information is extracted, began to be decentralized, given the possibility of direct communication and economic peer-to-peer interactions through online platforms. Thus, the digital economy started to organize itself through the network society, which is defined by Castells (2006, p. 20) as a social structure based on networks

operated by communication and information technologies based on microelectronics and on digital computer networks that generate, process and distribute information from accumulated knowledge.

Information and communication technologies, combined with a new social organization, enabled interconnecting factors on a global scale, with new production models, in which individuals can collaborate in common projects or directly establish relationships, reducing information costs through digital platforms, blurring the difference between production and consumption of information (Benkler, 2006). Given that the provision of technological infrastructure for communication became key, there was a strong increase in the value and economic power of providers, which began to mark the economy through a new model, known as "platform economy." In this model, each platform connects two groups of agents in a "two-sided market," offering low-cost or sometimes free services to one of the sides in order to collect data and process it to generate value to be marketed to the other side of the platform (example: social networks or search engines that collect data and content generated by free use, in order to economically exploit the advertising market).

This model centralizes the economy by collecting and processing data on one side of the platform, while generating intelligence to be exploited to obtain economic gains from the other side. Hence, massive investments in data analysis and artificial intelligence tools to increasingly encourage the use of the platform and enhance data collection in order to feed this value generation cycle.[1]

The network society, under which the new digital economy is structured, has produced profound institutional, economic, social, technological, cultural and behavioral changes, which raises questions about the role of regulations in relation to new types of conflict in this new economic order.

Such transformation in productive relations is reflected in the most varied economic sectors, including the agricultural sector. As evidenced in the preceding chapters of this book, there is extensive use of information and communication technologies in agriculture based on digital content. It is also observed that the data generated by technology consumption also generate value to its providers, which can increase the efficiency of their services, which is worthy, but can also create the concentration of power or questions about the autonomy of the producer, from which data is extracted. New legal implications arise in this new scenario, in view of the intervention of several new agent-based production activities, which are reflected in the sphere of copyright and civil liability, the protection of personal data, access to goods and services in consumer relations, as well as in labor. Thus, in a complementary and transdisciplinary approach, this chapter analyzes aspects of digital law in the context of digital agriculture.

Given the above, the objective of this chapter is to analyze digital agriculture from the perspective of the law. Thus, the chapter is divided into five sections, including this introduction and the conclusion. With thematic focus on the agricultural economic segment, the following section addresses some of the main elements that characterize digital agriculture to serve as a backdrop for the analysis carried out. The third section reviews the approaches to digital law and the stage of knowledge development related to the subject, in addition to tracing a global and Brazilian panorama and analyzing the legal implications in digital agriculture. With the presentation of the legal framework of digital law, the constituent elements of digital agriculture are addressed. The next section, with a more empirical approach, discusses the legal support related to Embrapa's performance – as a digital economic agent – regarding the application of its technologies from information to agriculture, presenting legal instruments that support Embrapa's business with digital assets, particularly those that regulate the relationship between Embrapa and its users, as well as the services provided by the company, through its websites and mobile applications. The end of the chapter presents the closing remarks by way of conclusion.

[1] Given the emphasis on data collection, often personal data, Zuboff (2019) calls this model "surveillance capitalism."

Digital agriculture: object of regulation by digital law

As shown in the preceding chapters of this book, there is an unprecedented agricultural technological revolution taking place.

The evolution of total factor productivity (TFP)[2] confirms the rise of the central role of technology in the growth of agricultural production and the reduced importance of land. According to Gasques et al. (2019), total factor productivity has been the main source of growth in agricultural production. The current phase of Brazilian agrarian development is characterized by a change in the pattern of accumulation in agriculture, as the role of land has decreased and the role of investment in technology, the use of knowledge and the application of capital has increased (Mendes, 2015).

Within the scope of innovative technologies applied to agriculture, the advancement of ICT in the rural area plays an essential role for the growth of agricultural production. ICT has contributed to several areas of knowledge, allowing the storage and processing of large volumes of data, the automation of processes and the exchange of information and knowledge (Massruhá, 2020).

Considering the relevance of agriculture to the country's economy, it needs to be able to absorb and use innovations and information technologies to increase the dynamic competitiveness of the agricultural sector (Mendes et al., 2014).

As described in Chapter 1, there is a continuous technological evolution in the field. Currently, a new era of agricultural technology is being consolidated, called digital agriculture, and 5.0 agriculture is in progress (intensive use of artificial intelligence tools – AI).

According to Cema (2017), Agriculture 4.0 is moving towards Agriculture 5.0. While agriculture 4.0 is characterized by the evolution of several technologies such as sensor networks, machine sensors, drones, satellite image processing, cloud-based information technology systems, analysis of large volumes of data (big data), mobile applications and autonomous tractors, the current threshold of 5.0 agriculture is primarily based on artificial intelligence, robotics, 3D and 4D printing, synthetic biology and vertical agriculture.

Therefore, Agriculture 4.0 has already paved the way for the next agricultural evolution, Agriculture 5.0, which consists of autonomous decision systems, unmanned vehicles, robotics and artificial intelligence (Cema, 2017).

It is observed, therefore, that one of the predominant characteristics of Agriculture 5.0 refers to the expanded use of artificial intelligence tools. artificial intelligence is a broad concept that encompasses studies on autonomous vehicles, machine learning, which gives the computer the ability to perceive the surrounding environment and identify patterns. The evolution of Agriculture 1.0 to 5.0 is represented in Figure 1.

As reported in the previous chapters, Embrapa Digital Agriculture is a public institutions and part of the agricultural innovation ecosystem that develops technologies to advance digital agriculture. However, despite the extended offer of digital technologies for agriculture by several public and private institutions – such as Embrapa – as well as the progress from Agriculture 4.0 to Agriculture 5.0, primarily characterized

[2] The concept of Total Factor Productivity (TFP) is defined as the relationship between the aggregate product and the inputs used in production (Gasques et al., 2019).

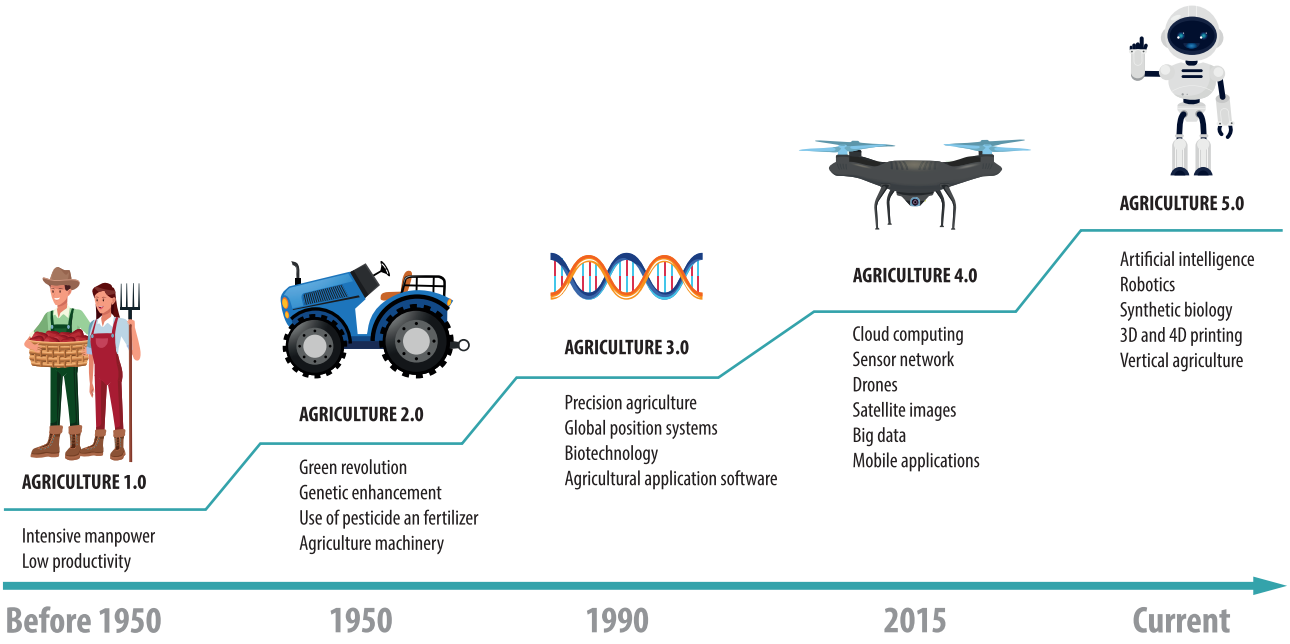

Figure 1. Evolution of Agriculture 1.0 to Agriculture 5.0.

Source: Adapted from Cema (2017), Melgar (2018) and Massruhá (2020).

by the intensive use of data, autonomous systems, unmanned vehicles, robotics and artificial intelligence, digital agriculture has also raised controversy. In a recent study by the European Union, Schimpf (2020) discusses some elements of these controversies, namely: the merging and market concentration of large agribusiness companies in digital agriculture; the social, ethical and legal implications of digital agriculture; and the need to define a legal framework to regulate the rights, ownership and privacy of agricultural data. Table 1 presents such controversies.

With regard to the capitalist movement of mergers and incorporations in the digital agriculture sector, Schimpf (2020) warns of a "digital arms race," possibly culminating in the control of digital tools by global agrochemical companies, as observed in the seeds and pesticides sectors.

The data is the fuel – or oil – of the 21st century. However, its added value depends on the ability to analyze, generate information and knowledge to support decision-making processes. In data-based digital agriculture, there are farmers who generate data from their farm, there are those who are able to collect and process the data through digital machines and devices, and there are those who are able to analyze the data, usually agribusiness companies. Therefore, the agricultural producers or farmers using smart machines generate data about their agricultural property – sometimes even personal data – and can maintain the rights to their data. However, adding value to data depends on analysis models to generate agronomic recommendations that can be marketed through digital platforms.

The study of the European Union on digital agriculture indicates the risk that the digitization of agriculture is driven only for profit and by the availability of tools and technologies, instead of being directed towards meeting specific demands identified in agriculture, in the environment or in society. The risk, pointed out in the literature, concerns the excess of economic concentration, fed back by a concentration of data, generating a competitive advantage for large agricultural groups that will barely be challenged by competitors or new agents.This can have important implications for agriculture and livestock and for the protection of natural resources and biodiversity, as the data holder can control food, agricultural producers and the rural area (Schimpf, 2020). Hence the need for action by antitrust

Table 1. Digital Agriculture: controversies raised in the European Community.

Dimension	Elements
Mergers and concentration in the digital agriculture market	
Monsanto and Bayer	The merger of Monsanto and Bayer (in 2018) will allow the companies to combine their digital agricultural acquisitions with their seeds, Genetically Modified Organisms and chemicals businesses, creating an unprecedented digital platform across the entire agricultural chain. Integration allows companies to extract data from agricultural producers and use it to drive their product choices, thus technologically dependent on the company's value chain. Create one-stop platforms, offering agricultural producers an inclusive package of services and decision-making guidance throughout the year.
John Deere and global seed and pesticide companies	John Deere (agricultural machinery company) is investing in digital agriculture. It has partnered with global seed and pesticide companies such as: Bayer/Monsanto, Syngenta/ ChemChina, Corteva (Dow, Dupont, Pioneer) and BASF. It developed its own platform for digital agriculture, automation and data.
Global companies investing in agricultural digitization	Cargill (mainly grain) invested in the digitization of the livestock sector, including dairy products. Companies from other segments invest in digital agriculture projects: Sony, Philips, Orange, Uber, Bosch, Siemens, Google and Microsoft.
Social, ethical and legal implications of digital agriculture	
Collect and store agricultural data	The risk of misusing the collected data. Anti-competitive practices, including price discrimination and commodity speculation. It can affect food security.
Yield and performance in agricultural data	Information related to crop yields and performance of crop or animal management contained in the collected data can provide a market advantage for the seed and fertilizer companies that own them. Agricultural data transmitted to large agribusiness companies can influence input prices.
Data rights, ownership and privacy	
Rules for use and access to agricultural data.	An agricultural group in the European Union has published a code of conduct to define the rights to use data. The code recommends license agreements between farmers as data owners and agribusiness companies. The agricultural producers must retain their right to decide who can access and use their data, including monetary compensation for its use.
Data protection and governance	Europe is close to allowing the centralization and concentration of data at an unprecedented scale, in the absence of any regulation. The power of large agribusiness companies to centralize and concentrate data is likely to give them decision-making power over agricultural producers throughout the entire production process, from seed to harvest. The large agribusiness companies that hold the data are in the central position of power, creating added value and earning a large part of the income generated in digital agriculture. In the absence of a legal framework for digital agriculture, weaker parties (farmers) will lose their data to platforms belonging to large corporation.

Source: Adapted from Schimpf (2020).

and data protection authorities to prevent abuses of market power or abuse in the collection and use of personal data beyond its intended purpose. To address these concerns, it is also effective to fill legislation gaps, by specifically regulating digital agriculture, taking into account proposals to mitigate the effects of economic concentration and data monopoly, in addition to directing the use of data and artificial intelligence for jobs that are socially beneficial, while ensuring ownership, data governance, and the privacy of farmers/agricultural producers.

Therefore, the relevance of having legal protection and regulation regarding the use and governance of agricultural data – collected, processed and analyzed through digital agriculture tools – refers to the interconnection and relationships arising from three elements, represented in Figure 2.

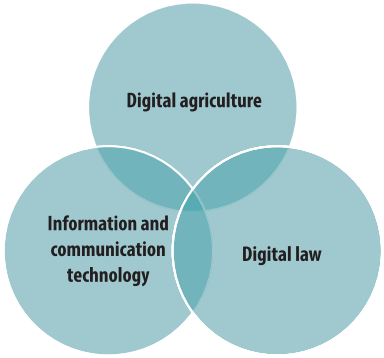

Figure 2. Interconnection between Digital Agriculture, Information and Communication Technology and implications of Digital Law.

Source: Mendes (2020).

Digital law: introductory lines

Within the scope of legal theory in Brazil, several authors have studied the transformations of legal relations stemming from advances on information technology, such as Leite (2016), Maranhão (2018), Novais and Freitas (2018), Nogueira and Nogueira (2019) and Abrusio (2020).

The network society, at the heart of the digital economy, is permeated by new types of conflicts in social relations within virtual environments or with the actions of artificial agents, presenting a series of difficult questions. For instance, what is the responsibility of online platforms that offer technical infrastructure, when the communication by third parties produces damages to individual rights? If personal data is the main source of value in the digital economy, should its collection be paid for? How to reward rural producers for the data generated with the use of digital products?

And how to ensure that the producer can control the use of his personal data? Is personal data a type of property? And who owns the inferences obtained from the aggregation of personal data? How to assess the market power of digital platforms in an economy constantly pressured by innovations? Can there be an electronic signature consent by artificial intelligence? What does "consent" mean in relation to artificial intelligence? Does an application that facilitates the interaction between drivers and passengers, receiving financial return, create an employment relationship with the driver? If the artificial intelligence wrongly indicated the harvesting period, harming producers and compromising investments, who will be responsible?

In general, several regulations, codes and judicial precedents created in the last century had social and economic relations as prototypical instances in the physical world. Its application to conflicts in the digital environment may face a series of gaps or indeterminacy and inadequacy of concepts. Such difficulties, as shown in the above questions, are manifested in the different branches of law (labor, competition, registration, contractual, civil liability, etc.).

Therefore, it is normal to question the legal nature of conflicts arising from the virtual environment. On the one hand, some will advocate the creation of a new branch of law, called digital law, cyber law or even computer law. According to Pinheiro (2019), digital law is the evolution of the rule of law and encompasses the fundamental principles and legal institutes[3] of the law in effect and currently applied, as well as introducing new institutes. This aspect is fed by the creation of specific regulations, such as the civil rights framework *Marco Civil da Internet*, which deals with the responsibilities of connection providers

[3] Legal institutions are a set of regulatory norms for the creation of specific laws/regulations, with their own characteristics, constituting an autonomous legal entity, which serves the interests of private or public order (Jusbrasil, 2020).

and online applications, as well as the development of new concepts or the recognition of new types of fundamental rights, such as the right to informative self-determination.[4]

On the other hand, it is recognized that digital issues and conflicts are transversal, affecting different branches of law, which could lead to concluding that there is no new branch of law, but only the application of different branches to a new object. Pimentel (2018, p. 37) argues, in a conciliatory line, that "Digital Law covers all areas of Law, in a transversal way, and brings together new elements to settle conflicts that have arisen with technology, especially the internet, and regulate the relations of the so-called information society".

Maranhão (2018), however, emphasizes the aspect of conceptual reconstruction driven by new conflicts in the digital environment, which affects all manifestations of the rule of law. This reconstruction is bidirectional: not only the legal concepts formulated for the physical world, in the different branches, are adapted to a possible "digital universe", but also the new concepts developed in the digital sphere affect their application in the physical world. Along these lines, Maranhão (2018) argues that society is facing a transformation of the law, which may affect several legal branches, in a new reconfiguration of its fundamental concepts such as responsibility, property, employment relationship, legal contracts, etc.[5]

Thus, it is possible to circumscribe a set of themes, including specific legislation, typical for a branch of "digital law," such as neutrality of networks, databases, electronic commerce, protection of personal data, artificial intelligence, obligations and responsibilities of internet connection and application providers, but without losing sight of the fact that the concepts developed in this field, due to their transversal nature, bring transformative implications for the law as a whole.

It is therefore necessary to undertake a "bottom-up" analysis, that is, to understand the characteristics and impacts of a given technology applied in a specific domain, such as agricultural production, to then identify its implications on rights and duties in possible conflicts, and understand whether the legal concept or institute, generally formulated for the physical world, can be applied or needs to be adapted. The adaptation effort cannot be isolated, and all concepts relevant to the domain must be considered: for example, to what extent can an eventual extension or restriction of civil liability affect liability for environmental damage and vice versa? A possible conservative interpretation, in a given court decision, that assigns civil liability for damage caused by a specific choice of an artificial intelligence to its developer, would also lead to liability for environmental damage, creating potential liability capable of discouraging the development and use of this technology. Hence the need to coherently elaborate legal concepts, considering all implications for the legal system and its consequences on economic activity.

The application of the law must, therefore, broadly assess the interests at stake in order to understand the new challenges that confront us when machines, soils, animals and other information on rural property are monitored by companies that generate an immense volume of data arising from rural activities and now hold precious and qualified information that will be processed by Big Data. This valuable information can be used by developing companies to eventually induce behaviors related to production and consumption (Leite, 2016). The massive collection of information from rural activities and its use by companies that develop computerized systems integrated to digital agriculture are challenges for

[4] In this regard, see the decision of the Federal Supreme Court (STF), in the judgment of the Provisional Measure in the Direct Action of Unconstitutionality 6,387 - Federal District, which suspended the effects of the Measure Provisional No. 954/2020 and recognized the fundamental right to informative self-determination (Brasil, 2020b).

[5] The chapter does not intend to exhaust such a profound discussion on the genesis of digital law. To expand the debate, in addition to the aforementioned works by Pinheiro (2019-), Maranhão (2018) and Pimentel (2018), see also Hoeschl (2011), Madalena (2016) and Costa and Pendiuk (2020).

public policy makers and public agricultural research institutions, such as Embrapa, which develop these computerized systems. Knowing how to deal with legal issues that arise from the generation and use of this large volume of data is a relevant factor for Embrapa.

This avant-garde theme motivated the creation of several research centers to support the growth of digital law, in a multidisciplinary perspective that includes computer science, engineering and law (Maranhão, 2017). Table 2 lists some of these centers, not exhaustively, but as an example.

Table 2. Digital Law research centers [1].

Research Center	Institution/Country	Website
The Stanford Center for Legal Informatics (CodeX)	Stanford University, United States	https://law.stanford.edu/ codex-the-stanford--center- for-legal-informatics/
Center for Research in Legal informatics (Cirsfid)	University of Bologna, Italy	http://www.cirsfid.unibo.it/
Intelligent Systems Program	University of Pittsburgh, United States	http://www.isp.pitt.edu/
Centre for Technology, Ethics, Law and Society	King's College London, England	https://www.kcl.ac.uk/law/ research/centres/ telos
Institute for Ethics in Artificial Intelligence	Technical University of Munich	https://ieai.mcts.tum.de/
Lawgorithm[1]	University of São Paulo, Brazil	https://lawgorithm.com.br/
International Association for Artificial Intelligence and Law		http://www.iaail.org/

[1] Lawgorithm is an association for research in artificial intelligence applied to the law, created in 2017 at the University of São Paulo, and brings together professionals from law, engineering, computing, Escola Politécnica and USP's Institute of Mathematics and Statistics (Maranhão, 2019).

Source: Maranhão (2017) cited by Mendes (2020).

These centers address two perspectives on the interaction between information technology and artificial intelligence and law: a) artificial intelligence law, which seeks to technically understand digital agents (such as AI tools developed by Embrapa) and reflect on what the social impacts are and the new legal issues arising from them; b) artificial intelligence in law – the application of artificial intelligence in legal practice (to predict decisions, perform intelligent jurisprudence searches, automatically generate legal documents, use chat bots on legal topics, etc.) (Maranhão, 2017).

Based on the first perspective of artificial intelligence law, Maranhão (2017) highlights that its applications bring new types of conflict and new issues, at least, to the following areas of law:

a) **Intellectual property:** the use of artificial intelligence for the creation of intellectual works – such as software, utility models, brands and industrial designs – raises the questions: who are the holders of the author's patrimonial and moral rights? Would the owner be the software developer or the company that invested in the development of the program? This first topic may have relevant implications for the activities of Embrapa and agribusiness, as artificial intelligence[6] can be used in the creation of new cultivars, among other forms of intellectual property.

[6] The generic term "artificial intelligences" refers to computer systems or programs that incorporate some machine learning or knowledge representation methodology or technique.

b) **Civil responsibility:** systems that employ artificial intelligence could, eventually, violate third-party rights, as systems based on machine learning make autonomous decisions based on the analysis of Big Data. This aspect will undoubtedly be relevant for the application of artificial intelligence in the production process, simply considering an investment chain for a given crop, pointed out by artificial intelligence, that proves to be wrong, or an artificial intelligence that uses a specific agricultural pesticide at an inadequate dose.

c) **Data protection:** artificial intelligence systems collect data for future decision making at each interaction. The question is how are these data collected, processed and used? The processed data, if skewed, can generate automatic decisions that interfere with individual rights. Therefore, concerns are related to the fact that the AI system can extract knowledge of decisions based on complex machine learning algorithms and, also, the necessary regulation and guarantees of people's rights – natural or legal – who are affected by such automated decisions. Here, too, there may be relevant issues, as artificial intelligences start to collect data from rural producers so as to draw profiles for the supply of consumer goods or, also, to influence their decisions on what, when and how to produce. Conflicts may also arise regarding collecting data from rural workers to create profiles and monitor their work.

d) **Impacts on employment:** there may be new labor issues, related to the hiring of workers, based on profiles created using artificial intelligence systems or automated contracts that may involve the rural producer monitoring the worker. Although not strictly legal, the impact of the use of artificial intelligence on employment in agricultural activities must also be analyzed and weighed to enable relocation and training programs for farmers, so they can be able to deal with Agriculture 5.0.

e) **Environmental law:** artificial intelligence systems are used to increase efficiency in a given activity. The focus on increasing agricultural productivity, a natural motivator for these investments, can neglect and bring risks to the environment, which can bring new issues about responsibility for environmental damage.

In addition to the legal implications emphasized, the use of artificial intelligence has produced a series of ethical questions. There are two types of risk observed in the discussion, that of overutilization, when such systems can have negative impacts on human rights, and that of underutilization, when the fear of artificial intelligences may fail in taking advantage of their potential benefits to humanity (Floridi et al., 2018).

In recent years, in response to concerns about the use of artificial intelligence, especially those based on machine learning, documents have been produced by government bodies, research associations and private organizations, proposing ethical parameters for the development and application of AI systems. The various documents show there is some convergence around the principles of transparency (it must be clear to the user who interacts with an artificial system), explanatory information (information disclosure to the interested party, allowing the user to understand the decision-making criteria), non-discrimination (preventing systems from incorporating biases that may offend fundamental rights), non-maleficence (AI systems cannot harm humans), accountability and privacy/data protection, although there are differences regarding its meaning and form of implementation (Jobin et al., 2019). As they are common, vague and potentially conflicting, their implementation is difficult.[7]

[7] This difficulty can be seen in a recent report by the Berkman Klein Center (Principled Artificial Intelligence: Mapping Consensus in Ethical and Rights-Based Approaches to Principles for AI, 2020), associated with Harvard University, which identified 36 sets of potentially conflicting principles.

The European Union created the High-Level Expert Group of AI, which produced two reports, one to define artificial intelligence, indicating its potential benefits and risks, and another to establish ethical standards for artificial intelligence.[8] Although there are fears regarding regulatory intervention in a constantly changing environment (Maranhão; Coutinho, 2019), in early 2020 the European Commission released the White Paper "On Artificial Intelligence - A European Approach to excellence and trust", which points to regulation, mainly areas considered to be at risk (health, transport, energy and part of public services, in addition to applications that affect workers' rights and remote biometric identification). There is no detailed suggestion of regulation or exclusion of methodologies, but a convenient indication for AI developers to adopt internal transparency, that is, mandatory documentation of the entire decision-making process of software development (design, training, launching, monitoring), as well as the inclusion of reports that assess the aggregated outputs, which are easily accessible in audits.

In Brazil, there is an initiative by the Ministry of Science and Technology to publish a National AI Strategy, which will guide the investment targets for this technology in the country, in addition to creating ethical parameters (Brasil, 2020a). There are also two bills pending in the Senate regarding the subject to make sure the contribution of the Lawgorithm institute defends the need to define "bottom up" ethical parameters, that is, take into account the peculiarities of each application sector.[9] Therefore, for example, the specific ethical parameters for its application in agricultural production must be different from those applied to medicine or law.

Finally, from the perspective of artificial intelligence applied to law, although it is not the field of agricultural application, another research frontier is noteworthy. Given the ubiquity of AI systems and the impossibility of human oversight of all possible decision-making and actions by intelligent digital agents, it is imperative that artificial intelligence incorporates intelligent ethical/legal agents capable of processing law or standards that are computationally moral (see the CompuLaw project of the European Community[10]).

Therefore, the ethical rules defined for each application sector should be computable. A regimental programming model, in which the programmer prevents certain ex-ante actions, is not enough, as AI systems adapt their behavior to the circumstances. Thus, AI systems will need to process and apply ethical and legal rules when choosing their course of action, considering the particularities of the context.

In the agricultural field, artificial intelligence that makes decisions about cultivation and pesticides must incorporate a digital legal agent, which ensures compliance with the environmental rules in force. The creation of intelligent ethical/legal agents or the development of a "computable law" depends on research investments, which are currently one of the vanguard areas in artificial intelligence and law.[11] The perspective of applying artificial intelligences in agriculture should be attentive to these developments in order to develop systems that take into account ethical and legal compliance in their decision-making.

For Embrapa – as a digital agent that integrates the ecosystem of agricultural innovation and that develops and provides digital tools for agriculture – it is pertinent to analyze the legal aspects arising from ICT applied to agriculture and explore issues that are at the interface between the rule of law and the technological development of digital agriculture.

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[8] AI-HLEG A definition of AI: Main capabilities and scientific disciplines e AI-HLEG Ethic Guidelines for a Trustworthy AI.

[9] Available at: https://lawgorithm.com.br/estrategia-nacional-de-inteligencia-artificial

[10] Available at: https://cordis.europa.eu/project/id/833647

[11] In Brazil, only the Faculty of Law of the University of São Paulo offers subjects related to computable law, in the postgraduate course.

The digital tools for agriculture, developed by Embrapa, may be subject to regulation, through legal instruments that support Embrapa's business with digital assets, to discipline the relationship between Embrapa and its users, in the services provided by the company, through their websites and mobile apps.

Digital assets for agriculture: legal support for Embrapa's performance

Following this reality of the agricultural technological revolution, Embrapa has been enriching its portfolio of digital assets by expanding the offer of services and products electronically, as research and innovation in agribusiness are increasingly associated with digital tools. Embrapa has a total of 292 software and web services[12], covering a wide range of topics so as to meet society's demands.

Among the mobile apps that were made available, the champion of downloads is "Roda da Reproduction", which already has 18,828 active installations[13]. This tool was developed to assist managing dairy herds, enabling to monitor the productive and reproductive stages of a herd in a simple manner. The name is due to the application's display, displaying the herd on a wheel that allows to quickly visualizing these stages, with color scales and placements. The use of technology brings enormous ease and simplification to the work of rural producers, hence abandoning the use of paper records to monitor the herd. Figure 3 shows the mobile applications made available by Embrapa.

In the entire universe of Embrapa's digital tools, more than half (165) are available on Embrapa's Portal, which are suitable for technology transfer. It should also be noted that the qualification of 119 digital assets[14] has already been carried out, using the criteria of the TRL/MRL scale[15].

Immersed in this reality and digital need for agribusiness, and aware of its legal status as a federal public company and all the social and technical responsibility involved, Embrapa's performance is focused on the multidisciplinary work of its team, in order to ensure that the development of technologies is always surrounded by legal protection.

Ultimately, it is up to the law and its operators – lawyers, judges, members of the Public Ministry – to face the challenges posed by digital technology, promoting the due legal protection not only to developers and owners, but also to users. One of the main challenges of the jurist in the world today is to consider the repercussion of the

Mobile application	Active installations	Score on Google Play
Roda de produção	18,828	4.34
Zarc - Plantio Certo	8,218	3.92
Guia InNat	3,562	4.25
Doutor Milho	2,955	3.98
AppLeite	2,115	4.29
Suplementa Certo	2,113	4.52
AgroPragas Maracujá	1,865	4.69
Custo Fácil	1,647	4.45
+Leite	1,550	4.40
SAC Gado de Corte	1,535	4.32

Figure 3. Digital assets: mobile applications provided by Embrapa (June 2020).

Source: Embrapa (2020).

[12] The total of 292 software and web services are from June 2020.

[13] Active installations in June 2020.

[14] Digital asset data in June 2020.

[15] Technological maturity level scale, TRL/MRL scale – Technology Readiness Levels/Manufacturing Readiness Levels.

law in view of the entirely new circumstances that are now presented, bearing in mind the paths for its transformation (Lemos, 2005).

Focusing on its research purpose, addressing innovation, Embrapa's lawyers are responsible for regularly analyzing the disruptive application of the law aimed at public administration, to monitor the technological evolutions promoted by the Company's technical staff based on the needs of the agribusiness.

Bureaucracy mirrors the functioning model of the hierarchical and standardized industrial society, while research requires management flexibility to meet its objectives in search of the unknown and transforming it into new goods or services. If research requires management flexibility, applying the law at Embrapa demands the same requirement (Peregrino, 2018).

Thus, in order to promote due legal protection of its digital assets, Embrapa, guided not only by its Innovation Policy, aligning national legislation on science, technology and innovation and intellectual property, but also by the General Data Protection Law – LGPD (Law No. 13,709/2018) (Brazil, 2018) and Access to Information (Law No. 12,527/2011) (Brazil, 2011), which edited the main contractual instruments that provide legal support to the Company's digital business management.

The LGPD emphasizes, in its article 50 (Brazil, 2018), the importance of formulating rules of good practices and governance, which set the conditions of organization, the operating regime and procedures adopted in the processing of data, security norms, technical standards, specific obligations for the various actors involved, educational activities, internal mechanisms for the supervision and mitigation of risks and other aspects related to processing personal data and handling complaints and doubts of the data owners.

Thus, these model documents were prepared to promote the legal security of Embrapa's digital assets, in addition to being a mechanism to standardize the relationship between Embrapa and its customers and users, in order to safeguard the Company's macro process of innovation efficiently and effectively.

The following legal instruments were created: Term of Use; Privacy Policy; Service Level Agreement (SLA) and Technical Support Guidelines. These instruments are atypical electronic agreements that promote legal certainty for digital services, with the ability to delimit the responsibility of both Embrapa for providing the service and the user for its satisfaction, explaining the conditions of operation of the asset.

The electronic contract is characterized by using an electronic means for its execution or by being related to a bilateral legal transaction that results from the assembly of two declarations of will, as agreed through the electronic transmission of data. (Finkelstein, 2004 cited by Pinheiro, 2019).

It can also be defined as an electronic transaction in which declarations of will are manifested by electronic means and may also be manifested automatically by a computer (automated computer system), or through a public offer on a website and acceptance by the consumer through a click (Lorezetti, 2006 cited by Pinheiro, 2019).

With regard to the Terms of Use and Privacy Policy instruments, as there are no legal definitions, there is no doctrinal consensus on the concepts, and it is common among authors to permeate the content of one into the other.

This interposition exists between the aforementioned instruments because they both clarify how the digital asset is used, determining obligations and clarifying doubts about its functioning. On the other hand, the SLA Agreement and the Technical Support Guidelines, which are more specific, do not undergo this emission.

Within the scope of Embrapa, the Term of Use is the adhesion contract that allows determining the conditions for accessing and using the website or mobile application and which must be observed by

users. This instrument lists important information, through which the service or product is described. The essential clauses are: the adopted nomenclatures, the obligations of the user and Embrapa, how the application or website works, the cost of the service, the hypotheses of any pauses and termination of the service and in what way Embrapa handles third-party information.

The Privacy Policy deals with the terms and security conditions that will guide the relationship to be established between Embrapa and users, especially the privacy of users' personal information, in order to offer the due credibility and transparency to users regarding the use of its websites and applications.

Through this document, Embrapa proposes to communicate how the information the user entered on the website or in the application will be used, such as registration data, and those resulting from the tool to capture information, posted items, stored messages, also informing that the information may be shared with partner companies or used for research, in order to improve the performance of the site or application, as well as if there will be transfer of information to third parties and how this transfer can take place.

The rights and duties of the user were also outlined, with a specific chapter on sharing information with third parties allowed by the user, in order to clarify the exceptions that allow the transfer of information to third parties, such as by court order, legal determination, etc.

It should be noted that all these topics involved legal effort to reconcile the laws applicable to Embrapa as a public company. And as already mentioned, it is necessary to pay attention not only to laws affecting intellectual property, innovation and protection of personal data, but also to legislation relevant to Public Administration, such as the Access to Information Law (Law 12,527/2011) (Brasil, 2011), which simultaneously provides the duty to give access to public information and the confidentiality of private information.

The Service Level Agreement (SLA) instrument is the document required in any IT contractual relationship, which measures the performance and quality with which a service is effectively delivered, through objective criteria.

The purpose of the SLA is to be a tool for monitoring and controlling compliance with the standard established in the service agreement contracted between the parties, allowing for clear and unambiguous customer expectations and the supplier's obligations and limits of responsibility (Pinheiro, 2019). Such control requires overt monitoring, the stipulation of fines for insufficient performance, co-sourcing (having more than one supplier) to avoid concentration, guarantees and insurance, if applicable (Pinheiro, 2019).

The SLA designed by Embrapa defines the main technical terms, presents the Calculation of Monthly Activity and Service Levels, and outlines the limitations that are not applicable to the SLA, clarifying that they do not apply to any performance or availability issues.

Embrapa also provided for any compensation to the user, in the event of extrapolation of the service's downtime, which will only be carried out through a service credit, whose compensation cannot be made unilaterally by the user in their Applicable Monthly Service Fees.

Finally, the Technical Support Guidelines outline the supplier's responsibility to maintain the stability of the service provided, whether by offering technical support, clarifying doubts or performing preventive and corrective maintenance, among other support activities.

The objective of the technical support guidelines is to promote customer and user satisfaction in the services provided by Embrapa, through its websites and mobile applications, by efficiently meeting the respective demands, as quickly as possible, as well as by maintaining the proper functioning of the

services provided by such channels. They also aim to correct any stoppages or loss of quality, disparate doubts, complaints, requests for new services and requests for changes to services or configuration items.

It should be noted that the edition and consolidation of these legal instruments, by the CID and CSJ of SIN, for the due legal support to Embrapa's digital business management, were also aware of the fact that the regulations applied to this type of business must be "globalized", so that they are effective not only internally, but also abroad. After all, digital activity breaks boundaries and there must be compatibility with globally established guidelines.

Acting as a legal support for the innovation and implementation of research, for the realization of agriculture fueled by science, Embrapa's statutory role, it is essential for its legal body to also operate in an innovative manner in terms of regulation/law. It is necessary to emphasize the need to apply the law with due attention to the impact and indispensability of technology, in order to offer adequate legal security, supporting the promotion and access to knowledge, science and technology. More specifically, considering that it is a state-owned company subjected to legislation affects Public Administration, it is imperative to link its obligations without impeding innovation, quite the contrary, helping it to succeed.

Final considerations

Science driven agriculture is a reality in Brazil. Embrapa has made and is still making relevant contributions to accomplish this – together with partner institutions of the National Agricultural Research System – through the development of RD&I solutions for the sustainability of agriculture, to benefit Brazilian society.

For Brazil to continue to be a world competitor in food exports, as well as a supplier to meet the domestic demand for food, it is essential to train agricultural agents and appropriate the most advanced digital technologies. This technological appropriation qualifies Brazilian agriculture to face the challenges of feeding Brazil, improving the performance of agribusiness' participation in the trade balance and increasing the sector's competitiveness in relation to competitors.

Agricultural innovation based on digital content lacks participatory governance and multidisciplinary approaches, such as the one presented in this chapter, which directs the legal views to digital agriculture. For the full advance of digital agriculture in Brazil to take place, it is imperative for its activities to focus on: a) solving Brazilian agricultural problems and developing the production system; b) meeting the goals of sustainable development to promote food security in the country; c) promote the training and ownership of digital technological innovations by farmers; d) advance digitalization in the field and rural areas with innovations that value and respect people, the climate, biodiversity and the environment.

It is important to observe the warning about the risk of digital agriculture being controlled and structured by a few giant companies of global agribusiness, considering the merger and market concentration movement, with the priority to detain and monopolize the oil of the 21st century – the data with added value – to obtain extraordinary profits.

Therefore, the legal framework for data use, governance and privacy needs to be improved and applied in the context of digital technologies, whether Agriculture 4.0, Agriculture 5.0 and its successive waves of technological advances, to regulate the legal relationships of the parties involved in the collection, the processing and analysis of agricultural data, in order to avoid or minimize the potential effects of inducing production and consumption behavior. The role of public agricultural research institutions,

such as Embrapa, is essential to promote a sense of balance in the availability and socialization of digital technologies, in order to promote technological equity among farmers and agricultural producers.

The perspectives for the world and for Brazil in relation to digital law as regards digitization of agriculture – envisioned by the authors of this chapter – are to expand and qualitatively advance the debate on the subject, to improve the regulatory framework of digital law, expand State incentives for scientific development, research, technological training and innovation, as recommended by the Brazilian Federal Constitution.

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