

# Access to Scientific Information and Knowledge: A Matter of Democracy

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**Abstract.** This paper investigates how institutions can promote access to knowledge, especially scientific knowledge, both to Academia and to citizens, protecting rights and freedoms of those involved, avoiding the risk of manipulation of democracy. The digital revolution is having a huge impact on the production and dissemination of knowledge, such that it has identified the shift towards a new paradigm of science, represented by the paradigm of Open Science. In this scenario, three levels of problems that institutions must face in order to design a clear and effective policy have been identified: (1) the infrastructural, technological layer; (2) the governance layer; and (3) the legal layer, inherent to the legal institutions involved. This research is embedded in the debate on the role played by institutions in ensuring access to information and knowledge, in accordance with fundamental rights guaranteed at European and international level.

**Keywords:** Knowledge, Information, Scientific Research, Democracy, Open Science.

## 1 Introduction

Today, a simple Internet connection and a device allow access to an endless number of information and knowledge of any kind: Internet has completely disrupted access to knowledge. The same individuals who, a few years ago, consulted heavy and cumbersome encyclopedias, today entrust the search for the answer to their doubts to efficient search engines, which provide millions of pieces of information in a few seconds. In this scenario, characterised by an informational *surplus*, the issue of information reliability becomes crucial. In a 2018 EU consultation on the dissemination of fake news [1], 37% of respondents said they encounter misleading news and not trusted information every day.

But what happens when the reliability of information and knowledge<sup>1</sup> resulting from scientific research is questioned? In other words, what happens when citizens

have access to information and knowledge that is called scientific, but in fact is not? What occurs to scientific results once they come out of the narrow scientific community?

Nowadays, on the one hand we rely more and more on technology and scientific progress, getting on high speed trains able to reach 250 km/h or having a neuro-prosthesis implanted in our body that can facilitate the nervous system and, on the other hand, people that are critical towards science and its results increasingly arise, for instance, think about the movement of the so-called "no-vax", and its strong and blind fight against vaccines. Never as in these times, however, a dissemination of reliable scientific information and knowledge has been sought and demanded: the COVID-19 pandemic has undermined our claims to knowledge by placing us in front of an unprecedented enemy, and it has increased the need to access scientific knowledge and its results, even among citizens, in order to allow a greater understanding of what was happening around us.

In this scenario, the institutions play a central role, basically pursuing two aims and fighting a risk: if, on the one hand, the institutions must promote, as much as possible, the access and sharing of scientific information, not only in academic circles, but also among citizens, guaranteeing that the fundamental rights at stake are balanced and protected, on the other hand, it is necessary to avoid the risk that shared knowledge may be not trustworthy and a vehicle of false information. This danger, in the long run, may imply an irreversible damage to democracy, causing forms of manipulation<sup>2</sup>.

In this way, therefore, a strong link between access to knowledge, especially scientific knowledge, and the protection of democracy is highlighted: as Stefano Rodotà, brilliant jurist and former President of the Italian Data Protection Authority, wrote, starting from the assumption that knowledge must be considered as a common good, "The interweaving of common goods and fundamental rights produces a concrete enrichment of the sphere of personal powers, which, in turn, create the necessary preconditions for effective participation in the democratic process. (...) Knowledge is powerfully confirmed as the foundation of the democratic decision-making process and as a precondition for participation and control" [2].

It is absolutely relevant to wonder how the digital revolution we are experiencing has transformed the relation between the access to knowledge, especially scientific knowledge, and the protection of democracy. Taking, then, the institutional perspective, it is worth wondering: in this hitherto unseen scenario, outlined by the technological revolution, how can institutions pursue the aforementioned purposes of promoting access to knowledge, protecting the fundamental rights and freedoms involved, avoiding the risk of manipulation of democracy?

This paper will first untangle what is meant by knowledge and information, and in particular scientific information (Section 2.1), in order to deepen the link between the

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<sup>1</sup> The concepts of information and knowledge are certainly different and involve a set of partially different issues. Please refer to paragraph 2.1 for a more precise distinction.

<sup>2</sup> The fact that the control of information, even of a scientific nature, as well as the diffusion of erroneous scientific knowledge can lead to the manipulation of democracy is a proven fact in history: for instance, the totalitarianisms that characterized the twentieth century are full of sad cases in which scientific research became an *instrumentum regni*, to the acclaimed detriment of democracy.

fundamental right to knowledge and the principle of democracy (Section 2.2). Once the general outline of the issue under investigation have been clarified, Section 3 will set out how access to information and knowledge has been transformed in the scenario of the digital revolution. Finally, some characterising aspects of the topic, which the institutions must necessarily take into consideration in the attempt to foster the access to knowledge, especially of a scientific type, will be scrutinized. They can be summarized in three macro-levels: (1) the infrastructural and technological layer; (2) the governance layer and (3) the legal layer, inherent to the legal institutions involved (Section 4). The last considerations, in Section 5, are intended to draw some conclusions in the light of the findings of the previous sections, illustrating the open questions regarding access to scientific knowledge and how the institutions can promote it.

## 2 The access to information and knowledge

In order to fully understand how the digital revolution and technology have transformed the access to and distribution of knowledge, it is necessary to focus on the concept of information and knowledge, specifically the one resulting from scientific research. Then, it is worthwhile to dwell on knowledge as a fundamental right, analyzing the role it can play as a means to promote democracy.

### 2.1 The concept of Scientific Information and Knowledge

Although many scholars have explored the concept of information in Literature (*ex multis*, [4] [5]), the definition provided by Floridi [6] will be adopted to proceed with the analysis:

Intuitively, ‘information’ is often used to refer to user-independent, declarative (i.e. alethically qualifiable), factual, semantic contents, embedded in physical implementations like books, databases, encyclopedias, websites, television programs, and so on (...), which can variously be produced, collected, accessed and processed.

Furthermore, if we intend to consider specifically the concept of scientific information, we must necessarily refer to the information that is the result of the scientific method attributed to Galileo Galilei, i.e. the methodology by which science usually proceeds, through the presentation of models and the verifiability of results.

The concept of information, then, leads to the one of knowledge. Despite, for some scholars, it is an accumulation and stratification of information [7], Floridi, in his theory of knowledge, distinguishes it from a simple accumulation of information and defines knowledge as a set of information, inserted within a network of questions and answers, bringing out its organisational aspect [6] [8] [29].

A fundamental aspect of knowledge is the fact that it embodies all the characteristics of a commons, i.e. non-rivalry and non-exclusivity: knowledge is not a rival good because it can be enjoyed by several individuals at the same time, which means the consumption of one individual does not preclude or limit in any way the consumption of the same object by another individual simultaneously; and it cannot be exclusive

because the use by one individual does not preclude its use by another, thus identifying a widespread ownership, making it impossible for some not to enjoy it [2] [9], “as he who lights his taper at mine, receives light without darkening mine”, as Thomas Jefferson said in a famous 1813 quote [10].

In the light of this brief overview about the concepts of information and scientific knowledge, it can be seen that the very nature of commons of knowledge leads to the identification of a related fundamental right, as enshrined in the aforementioned art. 27 of the Universal Declaration of Human Rights.

## 2.2 Knowledge as a fundamental right and a vehicle for democracy

Article 27 of the Universal Declaration of Human Rights [3] contains the so-called cultural rights, identifying, in its two paragraphs, two different aspects.

The first paragraph states that:

Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits.

It should be noted that this paragraph takes into account both the individual aspect of participation in cultural life, enjoyment of art and sharing scientific developments, and the social aspect of collective right referring to a community.

The second paragraph, on the other hand, states:

Everyone has the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author.

This paragraph refers to a different aspect, namely the production of knowledge, representing an individual right of the author. It provides the legal basis for the different forms of protection of intellectual property, which find diverse legal frameworks in different countries<sup>3</sup>.

These cultural rights are human rights, as stated in art. 5 of the 2001 UNESCO Declaration on Cultural Diversity [11]: “Cultural rights are an integral part of human rights, which are universal, indivisible and interdependent”. The same Declaration, in art. 6, enshrines another important principle, stating that: “While ensuring the free

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<sup>3</sup> As regards the complex legal framework in the field of Intellectual Property in Europe, despite the different regulations at national level, in accordance with art. 114 and art. 118 TFEU, “to provide uniform protection of intellectual property rights throughout the Union and for the setting up of centralized Union-wide authorization”, it is noted: Regulation (EU) 2017/1001 of the European Parliament and of the Council of 14 June 2017 on the European Union trade mark, OJ L 154, 16.6.2017, p. 1–99 (ELI: <http://data.europa.eu/eli/reg/2017/1001/oj>); the Directive (EU) 2019/790 of the European Parliament and of the Council of 17 April 2019 on copyright and related rights in the Digital Single Market and amending Directives 96/9/EC and 2001/29/EC, OJ L 130, 17.5.2019, p. 92–125 (ELI: <http://data.europa.eu/eli/dir/2019/790/oj>); Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases OJ L 77, 27.3.1996, p. 20–28 (ELI: <http://data.europa.eu/eli/dir/1996/9/oj>); Regulation (EU) No 1257/2012 of the European Parliament and of the Council of 17 December 2012 implementing enhanced cooperation in the area of the creation of unitary patent protection, OJ L 361, 31.12.2012, p. 1–8 (ELI: <http://data.europa.eu/eli/reg/2012/1257/oj>).

flow of ideas by word and image care should be exercised so that all cultures can express themselves and make themselves known. Freedom of expression, media pluralism, multilingualism, equal access to art and to scientific and technological knowledge, including in digital form, and the possibility for all cultures to have access to the means of expression and dissemination are the guarantees of cultural diversity". In this way, a bond between freedom of information and knowledge dissemination and access – whether artistic, scientific or technological – is identified.

If we consider, then, the Charter of Fundamental Rights of the European Union (hereinafter, the Charter) [12], we point out that art. 13 enshrines the freedom of the arts and sciences and then, separately, in art. 11 we find the freedom of expression and information. This wording on the freedom of expression includes two aspects: (1) freedom of opinion and (2) freedom to receive and communicate information and ideas. It is central to underline that the Charter adds an important condition for the exercise of this right: the absence of interference by public authorities. Thus, the negative aspect of the action of public authorities, namely not acting, is emphasized. This, however, does not exclude the possibility for public authorities and institutions to be able to engage in active behavior, in order to promote the freedom of expression in its two meanings of freedom of opinion and freedom of access to information.

It becomes clear from the above-mentioned background that access to knowledge is a fundamental right and this configuration brings with it some important consequences, which should be stressed.

In the first place, as accurately described by Rodotà [2], fundamental rights, today, pursue two major purposes: on the one hand, they represent an essential contribution to defining the human condition and, on the other hand, they illustrate the way legal systems operate. This statement remarks the active role of fundamental rights within our societies, not only as inspiring principles, abstract and detached from everyday reality, but as pillars of the legal apparatus and cornerstones of societal development. As a result, the immutability of these principles has been emphasized: their ability to withstand different political will and market changes and their ability to adapt – flexibly – to the needs of society.

Secondly, access to knowledge necessarily implies a redistribution of power: if the access to different forms of knowledge is widened, the means to limit it (such as copyright), are strengthened accordingly. Moreover, since knowledge is a common good, as well as a fundamental right, it implies "(...) a concrete enrichment of the sphere of personal powers, which, in turn, create the necessary preconditions for effective participation in the democratic process" [2].

Finally, in the light of the aforementioned connection between access to knowledge, as a fundamental right, and democracy, a further consequence needs to be emphasised: manipulating information and knowledge can easily become a mean for manipulating democracy. The unreliability (or even just the fear of unreliability) of shared information or knowledge triggers an existential fear is generated among citizens: this fear can be easily exploited to the benefit of the most varied forms of populism and nationalism.

Once defined the reference framework, within which the investigation is developing, and after having analyzed the relevance of the right of accessing knowledge, with

particular regard to democracy, it is now important to dwell on the analysis of how access to knowledge, including scientific knowledge, has changed in the digital revolution scenario we are currently experiencing.

### **3 Production and Dissemination of Scientific Knowledge in the Digital Age**

The impact of the digital revolution, which is changing every aspect of our lives, is also reshaping scientific knowledge, from two points of view: on the one hand the production and, on the other, the diffusion of and access to knowledge produced by the scientific community.

Firstly, the remarkable and accelerated technological development is impacting on scientific production. Universities and research centers are not immune to this change that is permeating the whole society. Innovation has invested not only scientific research itself (for instance, among several examples, consider the wide use of Big Data analysis techniques in biology or the application of 3D technologies to medicine), but also organizational aspects related to the functioning of traditional research environments. Several examples can be provided: for instance, think about MOOC courses (Massive Open Online Courses); or, especially during the lockdown for the COVID-19 pandemic, universities used technological tools to remotely reconvert lectures and exams, making them accessible online for students; then, more and more frequently, researchers hold crowdfunding campaigns to fund research projects [13]; and, also, universities and research centers are equipping themselves with social media managers to follow their official social network pages. This undeniable change has opened the doors to a new paradigm of science, the so-called Open Science, namely a new way of conducting science, oriented to the openness of every phase of the research cycle [14]: an open collection of scientific data; the use of open methodologies and open source tools for data analysis; the publication of scientific articles in open access journals; and also open educational resources. This new paradigm based on openness is made possible thanks to the use of digital tools, new technologies and the Internet, pursuing the goal of making scientific research more open, global and collaborative, closely related to society. The European Commission has defined Open Science as "(...) a key feature of Member States' policies for responsible research and for open innovation" [15].

Secondly, the digitalization has a huge impact on access to and dissemination of scientific knowledge. Today, with a few clicks, you have the possibility to access a huge amount of data, information and knowledge, on the most disparate disciplines: although Literature does not totally agree [16], we can generally say that the Internet has become one of the main access points to knowledge, at least the most immediate, so close and familiar, that we always carry it in our pockets, thanks to our smartphones. This applies to researchers and students, who primarily consult the online databases provided by their universities before going to libraries; but it also applies to citizens, who now have easier access to scientific literature than in the past. Although there is still some stakeholders anchored to outdated business models be-

longing to the past [17], the established trend is the openness – obviously a controlled openness, able to balance opposing interests, according to the principle "as open as possible, as closed as necessary", also stressed by the European Commission in the recent "European Strategy for Data" [18].

This wider accessibility to resources, by means of technology, has even led to an increased number of actors involved in the production of knowledge: in line with the interactivity brought by Web 2.0 onwards, researchers are flanked by collaborators of various kinds, so that in Literature there has been discussion of "mass intellectualism" [9]. On this basis, scientific knowledge is no longer exclusively reserved to researchers and Academia, but can become a generalized interest of citizens, fostering a more flourishing development and, at the same time, strengthening the democratic process.

After clarifying the scenario in which we live, it is now time to understand the major problems institutions must face in pursuing their aims of promoting public access to information and reliable scientific knowledge and protecting the fundamental rights of those involved: at this point, attention should be drawn to the issue of knowledge. In the past years the focus of the debate has been mainly represented by information and less by knowledge but, as has been widely argued by Lynch [16], the issue of knowledge is absolutely crucial, starting from the assumption that a greater diffusion of information does not mean, *ipso facto*, greater diffusion of knowledge.

#### **4 Knowledge and Technologies: three-layers issues**

The problems that institutions face in promoting access to knowledge, especially scientific knowledge, both within the research community and externally, i.e. towards citizens, are manifold. In order to offer a structured approach and to allow the development of a clear policy design by the institutions [19], the issues identified have been summarized in three macro-levels: (1) the infrastructural, technological layer; (2) the governance layer and (3) the legal layer, inherent to the legal institutions involved.

The infrastructural, technological layer represents, substantially, a prerequisite for the spreading of knowledge, especially scientific knowledge, and is connected to the phenomenon of the digital divide: there are many individuals who, today, do not have the devices and the Internet connection or the necessary digital skills to access the resources available. The issue of the digital divide is closely connected to the principle of equality: in light of the benefits associated with a greater diffusion of knowledge through new technologies, admitting that such access is usual for part of society, and is factually impossible for others, leads to the identification of a human divide, creating new forms of colonialism or apartheid [20]. The problem of the digital divide has been investigated for years, but the emergency situation due to the COVID-19 pandemic made it clear, if not exacerbated. If previously the digital divide could be perceived as a secondary problem, linked to the guarantee of further well-being in the life of individuals, with the pandemic and the obligation of lockdown, access to the online resources has become a primary good: being disconnected represents a considerable damage to the exercise of the right to work, or to the exercise of

the right to education, due to the online transformation of work and school lessons. It is worth mentioning that both are fundamental rights enshrined, respectively: in art. 15 and 14 of the Charter of Fundamental Rights of the EU [12], in the Declaration of Philadelphia concerning the aims and purposes of the International Labour Organization, signed on 10 May 1944 [21]; and art. 26 of the Universal Declaration of Human Rights [3], regarding the right to education. Therefore, although the qualification of the access to Internet as a 'basic right' can be debatable, (considering that "rights are basic (...) only if enjoyment of them is essential to the enjoyment of all other rights" [22]), it is certainly qualifiable as a means to avoid serious forms of discrimination.

The second layer, in which is articulated the analysis of the conditions to promote access to and dissemination of knowledge, including scientific knowledge, is defined by governance issues: the global dimension of the phenomenon, the terms of services for access and the reliability of shared information.

Against this framework, the institutions must necessarily understand that the phenomenon under investigation transcends national borders, since we are dealing with a global problem: an emblematic example is, once again, the emergency of COVID-19 pandemic that we are experiencing and, specifically, the efforts being made to find a vaccine, carried out through the action plan "ERAvsCORONA" which provides for the close cooperation of multiple Countries [23]. More generally, it is necessary for the Institutions to become aware of the increased complexity of the scenario, made even more evident by the current pandemic. In the legal and political analysis of the impact of the COVID-19 crisis, in Literature, Pagallo [24] clarifies this aspect: the three features, highlighted by the pandemic, that characterise, from a legal and political perspective, our information societies are precisely the complexity, the transnational dimension and the dependence on design mechanisms in ICTs. Acting at national level very often weakens the effectiveness of the action, if not even leads to fragmentation. In this case, the General Data Protection Regulation (GDPR), the European regulation on the protection of personal data [25], offers an interesting example. Although this regulation takes credit for having unified the discipline of data protection at European level, replacing the previous Directive 95/46/EC (which caused widespread fragmentation due to its national implementations), the situation is different with regard to the protection of personal data in the field of scientific research. The GDPR, in fact, provides that the Member States can address certain aspects of the protection of personal data in scientific research: in other words, some profiles of the processing of personal data carried out for scientific research purposes hold different disciplines, among the different Member States [26].

Secondly, starting from the configuration of knowledge as a common good, it seems fair to admit that the institutions take distance from a centralized approach. The aim should be to enforce the principle of freedom [2]: the dissemination of knowledge on the Internet might be obtained thanks to the definition of terms of service, which allow openness as much as possible, with the required balance of opposing interests involved. Thus, the issue of the access to knowledge is related to the shift from the proprietary model to the accessibility model [27]. Consider, also, that, from an economical point of view, the proprietary model was justified by the costs that had to be sustained to determine the access to a material good [28]: the transformation towards



the immaterial, that has been affirmed for a greater number of goods, is more suitable to the determination of the conditions of access and use, rather than to the transfer of ownership of the good (think, for instance, about the difference between a paper book and the e-book, i.e. its digital equivalent).

This point is linked to the last aspect inherent to the issue of governance, namely the reliability of knowledge. The problem is extremely complex, both from the point of view of the production of news and false information online (the phenomenon of the so-called “fake news”) and the issue of the verifiability of the results of science, made more complex by the use of Big Data and encrypted data [29]. This paper does not aim to analyse all aspects of the enormous debate in progress, but it will be limited to note that this issue is closely related to the role of one of the fundamental actors in this scenario: the intermediaries. Firstly, as regards the reliability issue, two distinct concepts should be distinguished: the access to truth and the *existence* of truth. Secondly, the reliability should be strictly related to what has been defined as “filters of relevance and trustworthiness” [30]. These filters are mechanisms suitable for the production or selection of precisely relevant and reliable information, to such an extent that it is brought to the attention of citizens and, consequently, disseminated. In other words, starting from 2006, year identified as the tipping point [31] due to the success of Web 2.0 (the participatory web), the resulting decentralisation of the Internet has led to what Durante calls “a gradual mechanism of disintermediation” [32], causing, on the one side, a weakening of the “filters of relevance and trustworthiness” and, on the other side, the emergence of new intermediaries: the owners of the digital platforms, which mainly aim at making profits, rather than sharing reliable contents. Addressing the issue of knowledge diffusion and promoting its dissemination necessarily implies that institutions must take into account all the actors involved, keeping in mind the role that each actor plays in relation to different aspects, such as the reliability of knowledge.

The third layer of issues, which need to be taken into account when identifying policies to support the dissemination of knowledge, concerns the legal institutions involved in access to and dissemination of scientific knowledge. In the light of what has been described so far, in particular in relation to the issues of the governance layer, there is a clear need to reconsider a number of legal instruments traditionally involved. *A fortiori* in the dialectic between law and technology, the alleged immutability of certain legal institutions should not be misleading: the fact that they appear to be unchangeable, because they have persisted for years or for a few generations without modifications, does not mean that they cannot be transformed again to meet the new needs of society, perhaps inspired by technology [28]. Think, for example, of academic copyright. Among scholars [32] it is argued that two of its fundamental components, the paternity right and the economic rights, are subjected to a substantial deformation: the right to paternity would be damaged by a system of evaluation of science, which does not respect the principles of democracy and autonomy of research, but which, on the contrary, is centralised, authoritarian and bound by the market needs, represented by the well-known formula “publish or perish”; while the economic rights no longer represent incentives to the diffusion of knowledge, but instruments of a monopolistic power system, which is the result, paradoxically, of the orig-

inal decentralised nature of the Internet [30] [32]. Although the European law-makers have recently amended the discipline of copyright, with the Directive (EU) 2019/790 [33], a further revision of the copyright in the EU would be desirable, in order to take into account the functions of the academic copyright, namely the safeguard of the freedom of expression and the protection of the scientific integrity, as well as the guarantee of the greatest possible spread of scientific publications.

## 5 Conclusions

This paper investigated how institutions can promote access to knowledge, especially scientific knowledge, protecting the rights and freedoms of those involved, both in Academia and in society, avoiding the risk of manipulation of democracy. A fundamental aspect to bear in mind is the impact that the digital revolution has on the production and dissemination of knowledge, that is represented by the Open Science Movement, which aims to describe and embody the paradigm shift.

In this scenario, three levels of problems that institutions must face in order to design a clear and effective policy have been identified: (1) the infrastructural, technological layer; (2) the governance layer; and (3) the legal layer, inherent to the legal institutions involved.

The role played by the institutions, especially at the European level, may become crucial in this field: the awareness that the business model established in the last decade (i.e. the concentration of power in Internet) has a remarkable impact also on the access to knowledge and, as shown above, on the phenomenon of the reliability of information and knowledge. In this scenario, the opportunity for institutions, especially of EU institution, has been outlined: they have the chance to impose an alternative model, that of Open Science, which, marked by openness, limits European dependence on non-EU intermediaries, in line with the concept of “digital sovereignty”, recently widely discussed [34] [35]. This should represent an expression of a democratic approach to data governance, supported by citizens' participation, in which technology stands as a tool for the benefit of individuals and for the progress of society.

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