‘Interoperability’ and beyond: Mapping the needs from a regulatory perspective

Mehmet Bilal UNVER*

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* Lecturer in law, University of Hertfordshire; *e-mail address:* m.unver@herts.ac.uk.

Abstract

'Interoperability' means the ability for two different and independent information and communication technology (ICT) systems to exchange information and use that information. Interoperability is crucial for running ICT networks and services, serving as a central thread for meeting the ICT-inclusive needs of the society. It is remarkable that all the relevant disciplines i.e. intellectual property legislation, competition law and electronic communications regulatory framework (ECRF) in the EU law have embraced interoperability-based measures, within their respective domains e.g. based on various concerns like protecting competition or consumers.

Although interoperability has so far figured as one of the important policy items of the EU agenda, it has not been translated into the regulatory governance at the equivalent level. While the ICT-based transformation, which is sometimes echoed in the fourth industrial revolution or Web 4.0 paradigm, has unraveled new challenges e.g. Artificial Intelligence (AI), cloud computing, Internet of Things (IoT), these have yet to be resolved from a broader interoperability-based perspective. From this point of view, whether or to what extent interoperability needs to be regulated from a holistic perspective poses a compelling question for the policy makers.

Pursuing a holistic perspective means the ICT networks and services being considered not only from the technical or basic interoperability perspective but also from a future-proof regulatory viewpoint. Having said that, the current EU legal framework first needs to be evaluated from a multidisciplinary legal viewpoint incorporating the intellectual property rights (IPRs), competition law remedies and ECRF. Secondly, interoperability related concerns need to be revitalized reflecting on the current and emerging ICTs. Against this need, this study aims to explore the architectural underpinnings of cloud computing and the IoT considering these widely represent the emerging face of the ICT landscape with compelling interoperability needs and challenges.

Doctrinal analysis of the EU law, i.e. intellectual property legislation, competition law and ECRF denote a disaggregated body of rules for 'interoperability', along with partial solutions and shortcomings against the relevant concerns e.g. lock-in, switching problems, competition

constraints. Notwithstanding, based on examination of the cloud and IoT architectures, it is clearly seen that ICT interoperability cuts across the interdependent layers which mean building blocks for the underlying architectures. Not only the internal elements i.e. 'infrastructure', 'platform' and 'application' layers for the cloud computing as well as 'perception', 'access' and 'application' layers for the IoT, but also the external elements i.e. content layer entail a great many interdependencies. This means both 'competition' and 'cooperation' across the layers within many ICT settings such as in cloud ecosystems that are represented with 'coopetition'.

Against these findings, this study concludes that a model of a layered design, called 'layered regulatory model', is able to respond the ICT interdependencies and layers, embracing the regulatory concerns based on interoperability. In this regard, not only competition concerns but also techno-social concerns, echoed with discriminatory, biased and non-ethical online activities, often represented by algorithmic/AI-driven consumer manipulations, are elaborated as the underlying concerns, which are then synthesized under the concept of 'gatekeeping'. In other words, the concept of 'gatekeeping' has been revitalised and embedded into the proposed 'layered regulatory model' encompassing both competition and the so-called techno-social concerns.

It is considered the bottom-up, ex ante and holistic approach proposed under the layered regulatory model could deter the so-called gatekeeping activities, including the AI-driven manipulations that affect the consumers' behaviours and choices. The model based normative framework suggested here could then be translated into positive rules as demonstrated at the end of this study. As a key conclusion, it is suggested that the layered regulatory model replace the core principles of the ECRF with a set of principles i.e. transparency, fairness, accountability and corresponding remedies.

Key words: ICT, interoperability, competition, regulation, layering, gatekeeping, cloud computing, Internet of Things, artificial intelligence.

1. Introduction

'Interoperability' means the ability for two different and ICT systems to exchange information and use that information. Interoperability is crucial for running ICT networks and services, serving as a central thread for meeting the ICT-inclusive needs of the society. It is remarkable that all the relevant disciplines i.e. intellectual property legislation, competition law and ECRF in the EU law have embraced interoperability-based measures, within their respective domains, e.g. based on various concerns like protecting competition or consumers.

Each body of the legal regulations have different objectives and means to accomplish their respective objectives. For instance, pre-defined tools and mechanisms e.g. reverse engineering are acknowledged to ensure interoperability under the EU rules concerning IPRs which aim to encourage original creations, inventions or designs, generally speaking. EU competition law, on the other hand, focuses on consumer welfare and protecting competition most often by means of ex-post interventions, such as remedies addressing 'abuse of dominance'. As far as the ECRF is concerned, more specific objectives e.g. ensuring 'end-to-end connectivity' and obligations e.g. regarding network interconnection come out with ex ante powers used by the national regulatory authorities (NRAs). While EU competition law does not consider interoperability as a directly applicable principle or rule, ECRF acknowledges and mandates interoperability in a variety of situations, e.g. when necessary to ensure end-to-end connectivity.

Although interoperability has so far figured as one of the important policy items of the EU agenda, it has not been translated into regulatory governance at the equivalent level. While the ICT-based transformation, which is sometimes echoed in the fourth industrial revolution or Web 4.0 paradigm, has unraveled new challenges e.g. AI, cloud computing, IoT, these have yet to be resolved from a broader interoperability-based perspective. From this point of view, whether or to what extent interoperability needs to be regulated from a holistic perspective poses a compelling question for the EU policy makers.

Pursuing a holistic perspective means the ICT networks and services being considered not only from the technical or basic interoperability perspective but also from a future-proof regulatory

viewpoint. Having said that, the current EU legal framework first needs to be evaluated from the multidisciplinary legal viewpoint incorporating the intellectual property legislation, competition law and ECRF. Secondly, interoperability related concerns have to be revitalized reflecting on the current and emerging ICTs. Against this need, this study aims to explore the architectural underpinnings of cloud computing and the IoT considering these widely represent the emerging technologies with compelling interoperability needs and challenges.

Doctrinal analysis of the EU law, i.e. concerning intellectual property legislation, competition law and ECRF denote a disaggregated body of rules for 'interoperability', along with partial solutions and shortcomings against the relevant concerns e.g. lock-in, switching problems, competition constraints. These inherent concerns would need to be revisited in the face of the new and emerging technologies such as cloud computing and IoT. Serving as the gateways to consumers' online activities and ICT-inclusive needs, these technologies would pose potential challenges against the interoperability based problems.

As a matter of fact, it is seen after examination of the cloud and IoT settings that ICT interoperability cuts across the interdependent layers which mean building blocks for the underlying (cloud and the IoT) architectures. Not only the internal elements i.e. 'infrastructure', 'platform' and 'application' layers for the cloud computing as well as 'perception', 'access' and 'application' layers for the IoT, but also the external elements i.e. content layer mean a great many interdependencies. This entails both 'competition' and 'cooperation' across the layers within many ICT settings as manifested in the cloud ecosystems and often represented with 'coopetition'. Against this background, interoperability related concerns could be assumed to disappear; yet, the degree to what extent coopetition prevails in each industrial setting differs.

This study focuses on the question of how a regulatory system would effectively deal with the interdependent layers, which are key to ICT interoperability. Following on this discourse, the 'layering theory' has been examined and 'layering' as a concept is found to be able to respond the layer interdependencies for its very matching and adaptable nature. In this regard, the layers of the IP stack, from the bottom to the top, have been revisited, elaborated and then embedded into an ex ante regulatory model called 'layered regulatory model'.

According to this newly proposed model, the 'access', 'middleware', 'application' and 'content' layers build up the layout for the needed holistic (and technologically-neutral) treatment of interoperability related concerns. It is considered that this 'layered regulatory model' is fit-for-purpose in dealing with such concerns from a broadly minded vision all-encompassing the cross-layer problems and the activities depicted by the 'network gatekeeping'.

While 'network gatekeeping' is developed to mean "the process of controlling information as it moves through a gate (a network or its sections)",[1] the pervasiveness of gatekeeping activities across the interdependent layers compels the regulatory mindset to be expanded against the interoperability related concerns. Within this study, such concerns have been categorised as comprising; (i) competition concerns and (ii) techno-social concerns.[2] In this broadened vision of interoperability, the former focuses on consumer welfare from the perspective of competition law and policy, whereas the latter entails discriminatory, biased and/or non-ethical layer activities, often being represented by algorithmic/AI-driven manipulations.

The proposed 'layered regulatory model' is found to respond to the ICT interdependencies, having a forward-looking character against the abovementioned gatekeeping activities. By means of synthesizing 'gatekeeping' with 'layering' it is considered the 'layered regulatory model' will effectively deal with broadly minded concerns mentioned above, including the AI-driven online activities that potentially affect the consumers' behaviours and choices. To ensure such activities e.g. that are run by discriminatory, selective and/or unfairly arbitrarily algorithms are deterred, a bottom up perspective is upheld ending up a normative framework with the suggestion that the core principles of the ECRF be replaced with a set of principles and corresponding remedies based on the 'gatekeeping' concept.

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[1] Karine Barzilai-Nahon, 'Toward a Theory of Network Gatekeeping: A Framework for Exploring Information Control' [2008] 59(9) Journal of the American Society for Information Science and Technology 1493, 1496.

[2] 'Techno-social concerns' is one of the key concepts used in this study being inspired by the work of Frischmann, and Selinger who authored a book called 'Re-Engineering Humanity'. In his book, they define and frequently refer to the term of 'techno-social engineering'. According to their definition, techno-social engineering refers to "processes where technologies and social forces align and impact how we think, perceive and act" (Brett Frischmann and Evan Selinger, *Re-Engineering Humanity* (Cambridge University Press 2018) 4-5). Based on this definition, the term 'techno-social concerns' is used to mean the concerns mostly manifested in algorithmic/AI-driven software that manipulates online users affecting their behaviours and choices leading up to unfair outcomes and/or transformative effects.

Within the given context, the relevant bodies of the EU law, incorporating the IPR safeguards, competition law and ECRF are firstly analysed with a view to have an understanding of the available remedies and their shortcomings. This initial analysis is followed by examination of the cloud computing and IoT from an architectural point of view. This architectural analysis unravelling the interdependent layers and their interaction is combined and furthered with a research over the underlying concepts i.e. 'layering' and 'gatekeeping' under the following section. At the end, the study ends up with the construction of 'layered regulatory model' and the proposal of a set of positive rules to translate the model based normative framework.

2. Regulation of interoperability under EU law: *Status Quo*

With regard to interoperability, the distinct bodies of the EU law, i.e. IPR legislation, competition law and sector-specific regulations incorporate distinctive rules and measures in their respective domains. This results in a disparateness in terms of the prescribed goals and the instruments to achieve them. Below, these rules and measures are examined with a view to investigate whether the existing EU legal framework be sufficient to deal with the lack of interoperability and related concerns such as vendor lock-in, in the field of ICTs?

2.1. Intellectual property legislation

From the viewpoint of the IPRs, the interoperability debate revolves around rightsholders concealing the interface specifications, and using the legal mechanisms e.g. copyright, patent, and anti-circumvention laws to prevent any decryption or decompilation which aims at uncovering such specifications.[3] In each side of the Atlantic, interoperability needs of the software developers are acknowledged with a legal response in that exceptions are created under the copyright regimes both in the USA and the EU regarding the computer programs.

[3] Jonathan Band and Masanobu Katoh, *Interfaces on Trial 2.0* (The MIT Press 2011) 184.

In the EU, the copyright regime regarding the computer programs is governed by the Software Directive (Directive 2009/24/EC).[4] Under Article 6(1) of the Software Directive is acknowledged an exception to the copyright protection of the computer programmes known as 'decompilation' aiming at mutual functionality of non-interoperable computer programs. According to this provision, authorisation from the rights holder of a computer program is not required for reproduction or translation of the program in question, provided that these acts are "indispensable to obtain the information necessary to achieve the interoperability of an independently created computer program with other programs".[5] Another exception to the copyright protection of the computer programmes is the 'reverse engineering' as acknowledged under Article 5 of the Software Directive, where interoperability is not sought as a pre-requisite. Article 5(3) of the Directive allows any person to "to observe, study or test the functioning of the program in order to determine the ideas and principles which underlie any element of the program" without the authorisation of the rights holder. These exceptions under the Software Directive denote the limited circumstances under which certain acts i.e. decompilation are accepted to achieve interoperability within the prescribed boundaries, i.e. code not to be disseminated, alongside the idea-expression dichotomy and other rules regarding the copyrightability of software.

On the other hand, there is an ongoing debate over the 'functional' behaviours of a computer program that covers the APIs and whether such interfaces could be deemed as an exception, as ideas and/or principles underlying the computer program in question. This question is remarkably important as APIs would then be imitated or reproduced, if not copied, by third parties who could create derivative software on top of the existing ones.

Regarding this issue, the Court of Justice (CoJ)'s ruling in *SAS Institute Inc v World Programming Ltd (SAS v WPL)*[6] is a landmark decision, where the Court held that "neither the functionality of a computer program nor the programming language and the format of data files

[4] Directive (EC) 2009/24 of the European Parliament and of the Council of 23 April 2009 on the legal protection of computer programs [2009] OJ L 111 ('Software Directive').
[5] Software Directive, art 6(1).
[6] Case C-406/10, *SAS Institute Inc v World Programming Ltd* [2012] 3 CMLR 4 ('*SAS v WPL judgement*').

used in a computer program in order to exploit certain of its functions constitute a form of expression".[7] However, APIs were not classified as one of the non-copyrightable elements falling outside the remit of copyright protection for computer programs under EU law. Copyrightability of interfaces being left unsettled both under the Directive and the CoJ's jurisprudence, the functional character of APIs[8] and the merging of ideas and expression on them,[9] blurs the distinction based on the so-called dichotomy, with respect to the APIs which is of key importance as to interoperability.

Under EU law, patentability of software, including interfaces, is less controversial. Under the European Patent Convention (EPC) and relevant case-law, there is no bar to patent protection for the inventions that are implemented through computer programs, if that implementation represents the solution to a technical problem.[10] Given the fact that patents are application-specific, when access to the information contained in the interfaces does not imply the "making" or the "using" of the patented invention, there would be no patent infringement.[11] On the other hand, patent protection for a single software component could prevent the 'making' or 'using' of the whole of a complex program including the temporary uses required for decompilation or reverse engineering.[12] Given this fact, patentability of computer programs would have unpredictable effects of hindering interoperability. Moreover, within a computer program there often exists patented applications/inventions and copyrighted software elements. The more complex a program

[7] *SAS v WPL judgement*, para 39.
[8] See Simoneta Vezzoso, 'Copyright, Interfaces, and a Possible Atlantic Divide' [2012] 2 Jipitec 154, 159 <https://www.jipitec.eu/issues/jipitec-3-2-2012/3444/vezzoso.pdf> accessed 30 April 2020, reading; "…[t]he functional character of APIs, being even stronger than with computer programs in general, would very often place them well below the originality threshold, and the general support in favour of interoperability expressed by the Software Directive could possibly present a further counterargument [against copyrightability of interfaces]".
[9] See Begoña G. Otero, 'Compelling disclosure of software interoperability information: A risk for innovation or a balanced solution?' in G. B. Dinwoodie (eds), *Intellectual Property and General Legal Principles: Is IP a Lex Specialis*? (Edward Elgar 2015) 86, reading; "Since a computer program's form of expression is functional, variations of its expression will not matter because these possible variations come from utility reasons and not the 'aesthetic freedom' or whim of its developer. Therefore, expression and function merge. …".
[10] Nicolo Zingales, 'Of Coffee Pods, Videogames, and Missed Interoperability: Reflections for EU Governance of the Internet of Things', (2016) TILEC Discussion Paper (DP 2015-026), 9.
[11] Otero (n 9) 82-83.
[12] S. Weston, 'The Legal Regulation of Interoperability in an Oligopolistic Market' (PhD thesis, Bournemouth University 2015) 241.

is, the more difficult it will be to access interfaces through reverse engineering.[13] This complexity is augmented by subordinated IPRs such as *sui generis* databases, trade secrets, etc. which reside and operate collectively in the creation and implementation of the software.

From this point of view, overuse of copyright, patents and other IPRs might have hazardous effects on market competition and innovation, resulting in the potentially aggravated concerns regarding interoperability. While each of the IPR in question would pose some barriers against the ICT interoperability, their cumulative effect should also not be disregarded. Having said that, a doubt could be cast as to whether EU statutory rules well respond to interoperability related concerns, incorporating follow-on innovation, aftermarket competition and free flow of information.[14]

2.2. EU competition law

From the competition law perspective, the question turns into whether lack of interoperability in different settings e.g. unilateral, collaborative and concentrative acts would result in exclusion of the potential or actual competitors in a market. The pioneering concerns (or theoretical harms), as highlighted in many decisions of the Commission, signify the entry barriers or competition constraints created by the hindered, usually IPR-protected, APIs for the relevant markets. Concerning the likely anti-competitive effects, the Commission has intervened on the basis of Article 102 TFEU in various cases e.g. *Microsoft*[15] finding abuse of dominance for the hindered interoperability. In the EU precedents, the dominant firms were found to have abused their dominance for using the market power in a market e.g. client PC OS to leverage another e.g. server OS resulting in likely consumer harm against the withdrawn/hindered interfaces.

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[13] Pamela Samuelson, 'Are Patents on Interfaces Impeding Interoperability' [2009] 93 Minnesota Law Review 1943, 1961.

[14] Regarding the latter issue of free flow of information, see Niva Elkin-Koren, 'It's all about control: Rethinking copyright in the new information landscape' in N. Elkin-Koren and N. Weinstock Netanel (eds), *The Commodification of Information* (Kluwer Law International 2002) 79-106, where it is argued that "control rather than remuneration becomes the focus of legal disputes concerning copyright" (ibid, 84) and "this transforms copyright law from a law that sought to serve policy goals and secure incentives for creators into a law that facilitates control in information markets" (ibid, 106).

[15] Case COMP/C-3/37.792 - *Microsoft* [2004] OJ L 32/23 ('Commission's *Microsoft* decision'), upheld in Case T-201/04 *Microsoft v Commission* [2007] ECR II-3601 ('GC's *Microsoft* judgement').

Under the light of the case-law, i.e. *Magill,*[16] *IMS Health,*[17] *Microsoft*, for an antitrust liability, it is key to witness an extension of market power via hindrance of new (or improved) products that would otherwise be created in the downstream market. Despite some deviation under *Microsoft*, antitrust liability remains firm on the basis of two-tiered market approach along with other requisite elements i.e. indispensable input, elimination of effective competition, lack of objective justification[18] which constitute "exceptional circumstances" warranting an antirust obligation under Article 102 to mandate a dominant firm to disclose their interoperability information, i.e. APIs that close off the downstream market(s).

On the other hand, the so-called 'exceptional circumstances' test has posed uneven conditions i.e. throughout the case-law from *Magill* to *Microsoft*, and consolidation under the 2009 Commission's Guidance[19] does not seem to help from an overall perspective. Not only the uneven nature of the envisaged conditions for disclosure/access obligations, but also competition authorities often lacking capabilities for a timely, well-justified and holistic intervention would pose additional risks on part of the market players. The *Microsoft* case illustrates such an unbearably long and burdensome enforcement process, which lasted for nearly a decade subsequent to the Commission's decision, and only have had a binding effect on the related parties for the affected market(s).

On this note, it should also be noted that, as stated by a recent report,[20] EU competition law tools are not capable enough to cope with the digital era problems, as particularly manifested in relation to semi-structural, enduring gateway problems. This is more visible in interoperability related cases, often fraught with the slow or manipulated standardisation processes. Against this,

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[16] Joined Cases C-241/91 P and C-242/91 P, *Radio Telefis Eireann (RTE) and Independent Television Publications Ltd (ITP)* v. *Commission* [1995] ECR I-743, [1995] 4 CMLR 718 ('*Magill* judgement').

[17] Case C-418/01 *IMS Health GmbH & Co. OHG v NDC Health GmbH & Co KG,* Judgment of 29 April 2004, [2004] 4 CMLR 1543 ('*IMS Health* judgement').

[18] Mehmet Bilal Unver, 'Turning the crossroad for a connected world: reshaping the European prospect for the Internet of Things' [2018] 26(2) International Journal of Law and Information Technology 93, 105.

[19] Guidance on the Commission's enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings, C(2009) 864 final, OJ C 45, para 81.

[20] See Jacques Crémer, Yves-Alexandre de Montjoye and Heike Schweitzer, *Competition policy for the digital era* (A Report to the EU Commission Directorate-General for Competition, 2019) 44-46 <http://ec.europa.eu/competition/publications/reports/kd0419345enn.pdf> accessed 30 April 2020.

the Commission makes signals to exceed the established case-law not confining itself within the boundaries of 'exceptional circumstances' even the broadly formulated concept of 'consumer welfare', which requires finding consumer harm by weighing up benefits and costs. Increased regulatory tendency under the Digital Single Market (DSM) process through a number of additional safeguards i.e. regarding fairness and transparency for online intermediary platforms, demonstrates this inclination.

To sum up, both merger decisions and antitrust measures are only applicable to the related parties, and are usually designed from a narrow-minded market-oriented perspective. Furthermore, the requirement of having a dominance and high threshold of intervention tests i.e. 'exceptional circumstances' along with the lengthy enforcement processes would also make competition law remedies less appealing. Therefore, although having a pro-interoperability nature, the reach of competition law interventions falls limited against the ever fast changing ICT dynamics as well as being ineffective against the inherent semi-structural powers of the incumbent players.

2.3. Electronic communications regulatory framework

Ex-ante instruments placed under the ECRF for the achievement of interoperability add another important dimension to the debate over interoperability. This dimension is of a central importance given the role the ECRF plays to secure the well-being of the EU citizens and consumers in relation to the ever fast increasing usage of ICTs. Aiming at regulation of electronic communications network and services, the ECRF itself is originally structured and built on the premise of achieving interoperability between these networks and services from a consumer-oriented perspective.

This consumer-oriented perspective is well represented and embedded in the ECRF provisions regarding access and interconnection focusing on the end-to-end connectivity. For that purpose, 'interoperability' between the operators that interconnect their networks is secured by means of industry-wide usually de jure standards, e.g. SS7 protocols, and if necessary through obligations

imposed on the market players, sometimes regardless of their market power e.g. in the case of 'conditional access systems' (CAS) and 'interconnection'.

For instance, CAS obligation set out under the EECC specifies a regulatory solution by which all broadcasters are enabled to have their content received and viewed by the analogue TV users who rely on set-top boxes, namely the CASs.[21] This ECRF obligation contemplates an remedy with no burden of proof regarding anti-competitive behaviour or effect. Notably, this generic and symmetric obligation is applicable to all transmission providers, the technical platform, irrespective of their market powers.[22] This obligation is a remarkable example of an interoperability-based remedy, demonstrating the reach of the ECRF for other reasons than competition, i.e. media pluralism and cultural diversity.

'Net neutrality' also illustrates another example envisaged under the ECRF, denoting the extent of obligations with no primary intent of promoting competition. To guarantee net neutrality, the EU Regulation 2015/2120 symmetrically obliges the internet service providers (ISPs) to "treat all traffic equally, when providing internet access services, without discrimination, restriction or interference".[23] In a broader understanding, this would mean more than a simply ban of non-discrimination as the affected market(s) are related to not only 'transmission' but also 'content' side and the foreseeable impact extends beyond market competition involving the freedom to expression, innovation and flow of information through the net.

[21] See the Council Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code [2018] OJ L 321/36 ('European Electronic Communications Code' or 'EECC') art 62(1).

[22] Operators not enjoying significant market power (SMP) being covered by this obligation signifies the key role attributed to the CASs under the EECC, which explicitly acknowledges "Competition rules alone may not be sufficient to ensure cultural diversity and media pluralism in the area of digital television" (EECC, recital 159).

[23] Regulation (EU) 2015/2120 of the European Parliament and of the Council of 25 November 2015 laying down measures concerning open internet access and amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services and Regulation (EU) No 531/2012 on roaming on public mobile communications networks within the Union [2015] OJ L 310 ('EU Net Neutrality Regulation') art 3(3).

As exemplified above, interoperability arises as a key element of the ECRF although being contemplated as a subordinate obligation to achieve the envisaged regulatory objectives.[24] Notably, the underlying aim of interoperability obligations diverge from the premise of promoting competition by asymmetric regulation (focused on dominant/SMP players) and intersects with non-SMP obligations. In this regard, net neutrality needs to be emphasized having a wider reach being not limited to electronic communications networks and services. This is also noteworthy demonstrating the readiness of the EU authorities to regulate upper ICT layers where necessary by expanding the boundaries of conventional limits of the ECRF. Notwithstanding, it should be reminded that ECRF, even after the overhaul in December 2018, has a limited remit being focused on electronic communications and not having a holistic perspective.

3. Interoperability from a broader vision: Building up a new mind-set and perspective

There are several implications to be derived from examination of the EU legal framework regarding interoperability. First and foremost, 'interoperability' is regulated under the rules of each body of law in the EU legal system. While this risks some overlaps and gaps, the main shortcoming seems to be lack of a holistic regulatory approach against the ever fast changing ICT dynamics and usage. Related to this, 'interoperability' needs to be considered broadly and be secured via necessary safeguards against the broadly minded interoperability restrictions.

At this point, inspirational point(s) could be derived from the ECRF whereby some of the gatekeeping activities, i.e. discriminatory, non-transparent traffic management, are already banned, if not from a holistic viewpoint. Having said that, the consumer-oriented perspective which is surfaced under the ECRF would be upheld in building up a holistic approach. Although the remit of the ECRF is limited, the perspective underlying this regulatory framework could be

[24] Crucially, policy objectives of the ECRF have also been expanded with the enactment of the EECC, which stipulates that the competent authorities, e.g. NRAs and the Commission, shall:

1) promote connectivity and access to, and take-up of, very high capacity networks,
2) promote competition in the provision of electronic communications networks and associated facilities,
3) contribute to the development of the internal market, and
4) promote the interests of the citizens of the Union (EECC, art 3(2).

borrowed in a broader regulatory approach and design as intended in this study. Following this mindset, it would be possible to solve not only the competition related problems but also other problems involving traffic and data management - so to say all type of gatekeeping activities - that result in restricted consumer choices and freedom.

Notwithstanding, it should be born in mind that, ECRF rules and measures are mainly invoked to eliminate structural barriers so as to stimulate new entries to the market or broadly speaking ensuring competition with a focus on electronic communications. So often, regardless of the behavioural aspects, network components run by the incumbents are considered to affect would-be competitive services and consumer welfare unless they are made available to third parties under reasonable terms and conditions. Despite the plausibility of this approach, the infrastructure-intensive narrative would need to be challenged for it lacks an in-depth analysis with respect to the behavioural aspects.[25]

It should also be added that behavioural economics has an increasing role to play to explain the users' behaviours vis-à-vis their rational choices which are taken as the proxy for evaluations under competition law and policy, generally speaking.[26] By contrary, consumers' behaviours are not always explainable with their intent to maximise welfare particularly given the AI-driven manipulations. Having said that, not only quantitative evidence but also qualitative parameters that would affect the consumers' behaviours need to be taken into account while considering the so-called gatekeeping activities.

From this point of view, the emerging ICT landscape should be evaluated from the holistic perspective in that broadly minded interoperability problems need to be comprehended

[25] Since the decline of the Structure-Conduct-Performance paradigm in industrial economics, it is now recognized that non-strategic and strategic market failures are closely linked together and that structure influences conduct as much as conduct influences structure (Alexandre De Streel, 'Efficient Regulation of Dynamic Telecommunications Markets and the New Regulatory Framework in Europe' in Ralf Dewenter and Justus Haucap (eds), *Access Pricing: Theory and Practice* (Elsevier B.V 2007) 359).

[26] See Agustín Reyna, 'The psychology of privacy - what can Behavioural Economics contribute to competition in digital markets?' [2018] 8(3) International Data Privacy Law, 240-252.

comprising the gatekeeping activities – some of which are dealt with under the ECRF as explained above. Thus, there arises a need to adapt the perspective of the ECRF to a normative framework (or a regulatory model) so as to cope with both infrastructural and behavioural elements of the gatekeeping activities from the so-called consumer-oriented perspective.

Before any attempt to consolidate these elements under a normative framework, the architectures of cloud computing and the IoT are examined below to verify and enhance the findings, also with a view to seek additional inputs, where necessary, to build up an appropriate regulatory design. In other words, before delving into a normative framework applicable to the ICT landscape against the broadly minded interoperability problems, it is considered examination of these emerging technologies would forge new complementary inputs derived from the industrial settings.

4. An architectural outlook to the interoperability: Examples of cloud computing and the IoT

Interoperability, from an industry-specific perspective, is destined to be dealt with through standards. This approach is however deemed to be a narrow-minded one, although having its reflections in almost all the ICT industries including cloud computing and the IoT. Not delving into the standards setting organisations (SSOs) and their endeavours, this study rather aims to explore the underlying architectural components of these emerging technologies and their interplays, with a view to have a more in-depth view as to interoperability relations and gaps.

Architectural layers of the ICT systems constitute the gateways for the players, specifically from the interoperability perspective. For a successful and thriving ICT ecosystem, all the constituent layers and elements should interoperate with each other, broadly speaking. This equally applies to the cloud computing which relies on internal and external elements, as manifested in the figure below.

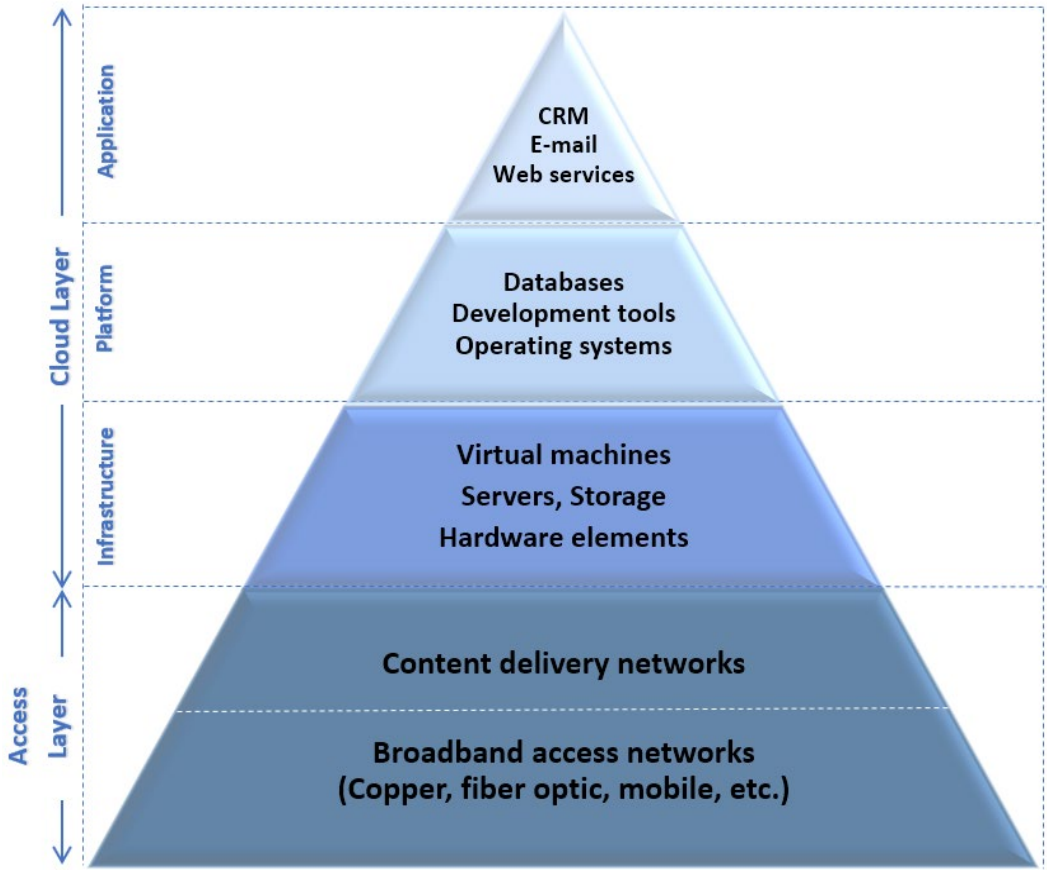


Figure 1: Cloud ecosystem (with internal and external elements)

Source: Constructed by the author

As manifested in Figure 1, not only the cloud components, namely the 'internal' elements themselves, but also the 'external' elements which constitute the 'access layer' denote a multi-layered structure. From this multi-layered viewpoint, every element, either internal or external, is interdependent/interlinked to each other both structurally and functionally. These inter-links within and across the cloud layers are achieved by means of 'interoperability', namely the 'interfaces' agreed upon between the players/stakeholders. Except with a few standard interfaces i.e. Open Virtualization Format (OVF) that ensure interoperability at the infrastructure layer, common standards do not exist in the cloud industry. Despite this fact, the industry-led findings and solutions to achieve interoperability, whether based on standardisation e.g. NIST's efforts to

create vendor-agnostic technologies, or architectural solutions e.g. microservices, containers, mitigate the problem of lacking standards.[27] To this, the fact that clouds serve as utility type networks along with the ever fast increasing cloud adoption, should be added.[28]

As far as the internal elements are considered, the interdependencies between the underlying layers becomes a matter of cloud governance. That is to say, all the internal elements are managed by the cloud provider in the organisational and technical sense. These interdependencies expand and enrich when the external elements are incorporated into the cloud setting. In this latter case, a single (cloud) management no longer exists as the outer boundaries often end up with the ecosystem features. Given this fact, interoperability within the cloud architectures should not be separated from, and need to be analysed with, the associated layers or external elements.

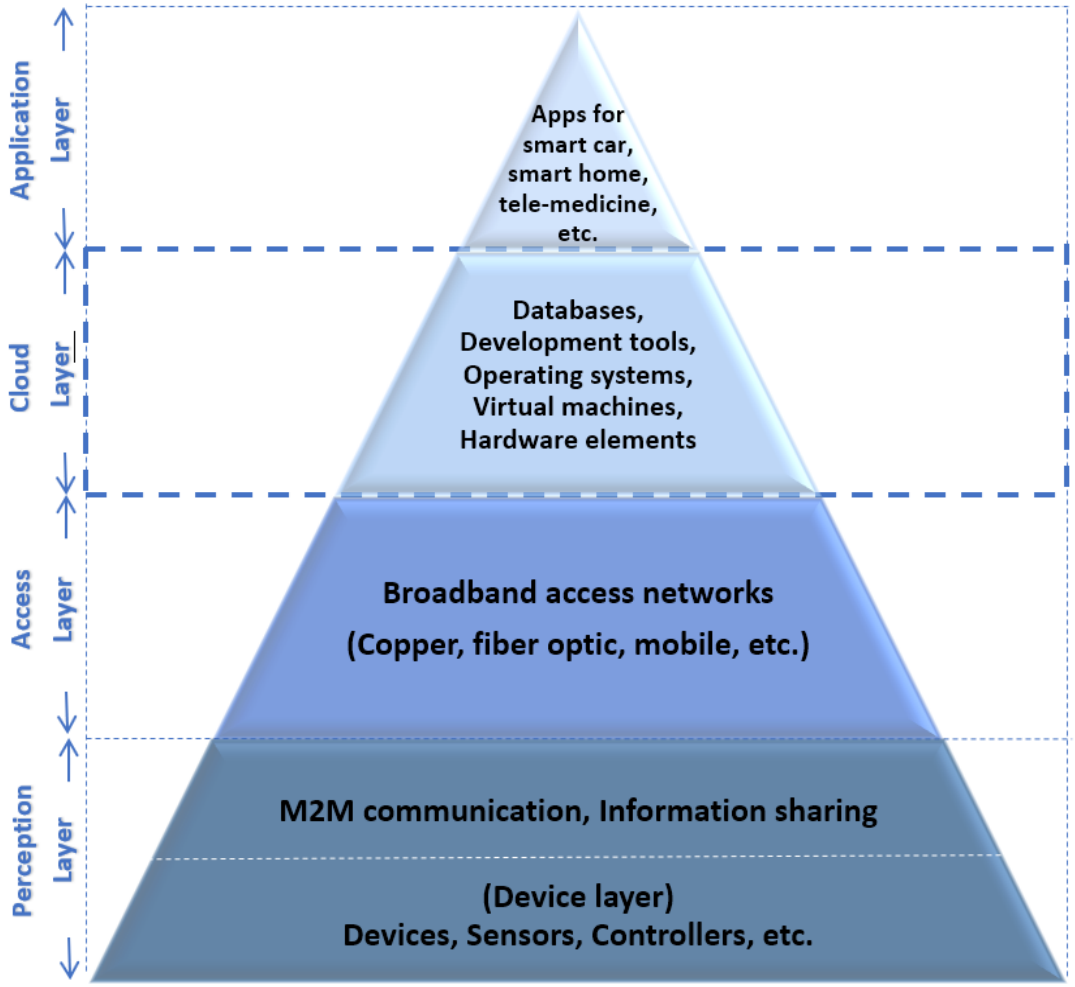
Along the same lines, IoT interoperability entails the products and services offered by the IoT stakeholders, i.e. manufacturers, software developers and sensor/chipset suppliers, operating in their respective marketplaces based on the mutually acknowledged protocols/standards towards the same goal of achievement. For instance, interoperability in the setting of smart 'home appliances' means lightbulbs, windows, thermostats and other smart appliances speaking to each other, even though they are produced by different manufacturers.[29] This means cross-layer interoperability for and within the IoT settings.

[27] See also Mehmet Bilal Unver, 'What cloud interoperability connotates for EU policy making: Recurrence of old problems or new ones looming on the horizon?' [2019] 43 *Telecommunications Policy* 154, 164-165.

[28] According to Cisco's forecast for the period of 2016 to 2021, global cloud IP traffic will account for 95% of total data center traffic by 2021, and will be more than triple (3.3-fold) over the next 5 years with a 27% increase rate (CAGR) (Cisco 2018 Global Cloud Index). Furthermore, 94% of workloads and compute instances will be processed by cloud data centres, whereas 6% will be processed by traditional data centres, according to the same forecast for the given period (Cisco, *Cisco Global Cloud Index: Forecast and Methodology* (2016–2021 White Paper, November 19, 2018) <https://www.cisco.com/c/en/us/ solutions/collateral/service-provider/global-cloud-index-gci/white-paper-c11-738085.html> accessed by 30 April 2020.

[29] This could be extended to the broader industrial settings like the 'connected (smart) home' market which includes not only connected appliances but also automated lighting, HVAC (heating, ventilation and air conditioning), entertainment and security (Michael E. Porter and James E. Heppelmann, 'How Smart, Connected Products Are Transforming Competition' (2014) Harvard Business Review <https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition> accessed 30 April 2020). In the broadest setting, which could be described

Underlying architecture of the IoT systems depends on widely acknowledged three layers. These interdependent layers are classified as (i) perception layer, (ii) network (access) layer and (iii) application layer[30] as illustrated below.



as a hyper-connected marketplace, smart homes and the integrated devices, appliances, etc. are supposed to be interoperable with the smart cars, smart city components etc.

[30] See Vivek Kumar Sehgal, Anubhav Patrick and Lucky Rajpoot, 'A Comparative Study of the Cyber Physical Cloud, Cloud of Sensors and the Internet of Things: Their Ideology, Similarities and Differences' (IEEE International Advance Computing Conference (IACC) 2014) 711-712; Elena de la Guía, María D. Lozano and Víctor M. R. Penichet 'Interacting with Objects in Games through RFID Technology' (2012) Intechopen <https://www.intechopen.com/books/radio-frequency-identification-from-system-to-applications/interacting-with-objects-in-games-through-rfid-technology> accessed 30 April 2020; Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra 'Distributed and Cloud Computing: Form Parallel Processing to the Internet of Things' (Elsevier 2012) 579.

Figure 2: IoT layers (with the cloud layer)

Source: Constructed by the author

Alike the cloud layers, the IoT layers across this architecture and the corresponding players rely upon each other to provide the relevant services. On the other hand, many IoT service providers and manufacturers build up a proprietary ecosystem by closing off their gateways (interfaces) to third parties, to maximise the profits to be reaped from an installed consumer base. As recently identified by the European project Unify-IoT, there are more than 300 IoT platforms in the marketplace, among which Amazon (AWS), Cisco (Jasper), IBM (Watson), Apple (HomeKit), Google (Brillo), Microsoft (Azure), and Qualcomm (AllJoyn) represent the forerunners.[31] There are currently many different OSs developed specifically for IoT devices such as Contiki, RIOT9, TinyOS and OpenWSN, each with several versions, to deliver services to users.[32] Likewise, Apple HomeKit supports its own open source language Swift, Google Brillo uses Weave, and Amazon AWS IoT offers SDKs for embedded C and NodeJS.[33] Each of these service or platform providers promotes their own IoT infrastructure, proprietary protocols and interfaces, incompatible standards, formats, and semantics which creates closed ecosystems or truly speaking 'walled gardens', sometimes called 'stove pipes' or 'silos'.[34]

IoT settings e.g. smart city, smart energy, public transport, telemedicine and industrial processes, being so diverse and fragmented, make the related SSO processes develop on an unintegrated basis. Furthermore, stakeholders are pushing their own standard and/or protocol for IoT systems, trying to gain a significant advantage from the potential markets. As a result, walled garden structures and vendor lock-in cases are far more confrontable in IoT settings, compared to the cloud settings. Along the same lines, coopetitive and symbiotic relationships could not be

[31] Mahda Noural, Mohammed Atiquzzaman and Martin Gaedke, 'Interoperability in Internet of Things: Taxonomies and Open Challenges' [2019] 24 Mobile Networks and Applications 796, 796.
[32] Ibid.
[33] Ibid.
[34] Ibid.

attributed to many IoT settings, e.g. transport, smart city and telemedicine, as opposed to the cloud settings. This, however, creates significant challenges for the emergence of IoT ecosystems in a true and broad sense.

While both cloud and IoT settings are fraught from the absence of multi-layered common standards, clouds are typified by utility and bottleneck characteristics, bridging the interoperability gaps as the major hubs for the ICT interconnectivity and usage. This and other aspects of cloud computing e.g. having close inter-relationship with the external elements e.g. CDN, broadband access networks, bring clouds closer to the characteristic features of ecosystems. In fact, ecosystem characteristics e.g. coopetition among the players (across the internal and external layers) as are visible in many cloud settings draw an important distinction between the IoT silos or walled gardens, broadly speaking.

Overall, in response to the diverse possible scenarios that would be faced up by the regulators, the legal system should be flexible enough to respond both ecosystem and non-ecosystem settings, in that cross-layer interdependencies are all-encompassed. While ecosystems ostensibly represent the widest organisational supply structure, other supply structures also need to be incorporated within a holistic regulatory design. From this viewpoint, technologically neutral and widely applicable layers would provide a well-functioning layout for construction of a holistically designed regulatory model.

5. Mapping and responding the relevant concerns: Building up a normative model

As implied above, ‘interoperability’ could be a source of a great many problems echoing in gatekeeping activities. While lack of interoperability arouses competition concerns e.g. based on vendor lock-in triggering the policy makers about the anti-competitive behaviours e.g. refusal to deal, such concerns represent one side of coin. On the other side of the coin exist other (techno-social) problems led or surrounded by traffic or data management which do not necessarily cause competition concerns, although being related to interoperability.

Against this background, the regulatory approach needs to be comprehensive and responsive enough to address all interoperability related concerns. In this respect, the abovementioned consumer-oriented perspective derived from the ECRF needs to be translated into a sustainable normative framework, also reflecting on the architectural inputs from the cloud and the IoT settings. That being said, below the discussion is taken further delving into the concepts of 'layering' and 'gatekeeping' based on the findings of the study so far.

5.1. Layering

As could be inferred from the cloud and IoT settings, the interdependent ICT layers mean an indispensable layout for the underlying activities. This structure, offering the building blocks for the IP (Internet Protocol) based activities, also helps reconsidering the industrial settings, either denoting ecosystem characteristics or not. While an ecosystem entails coopetitive relationships in itself, non-ecosystem structures involving certain architectural elements do not necessarily demonstrate same or similar characteristics although they still cut across the layers. Responding both type of structures, ICT layers not only constitute the building blocks of the IP stack[35] but also, they mean the interdependent value chains for the economic activities of the players.

The difference between the cloud and IoT settings could be reminded here in the sense that the interdependencies between the IoT players might (and usually are) not be equivalent to those of the cloud players. Notwithstanding the peculiar difference between them as to 'coopetition', the layered structure across these settings offers a common layout on which interoperability gaps and relationships could be worked out. It is also noteworthy that co-existence of both competitive

[35] The internet is standardised by the Internet Engineering Task Force (IETF), based on the TCP/IP stack, or simply saying IP stack, which relies on a unique 'protocol layering'. The "TCP" part of the TCP/IP stack governs the assembly and reassembly of the data at each end, including checking for errors such as missing data, whereas the "IP" part is responsible for routing data from one node to another. These elements of the internet enable a computer in one corner of the world to find a different computer in another corner of the world and exchange information that can be understood by the applications software loaded onto the computers at each end of the transmission (Jonathan E. Nuechterlein and Philip J. Weiser, *Digital Crossroads: Telecommunications Law and Policy in the Internet Age* (2nd edn, The MIT Press 2013) 167).

and co-operative relationships in the ICT landscape as demonstrated above makes it very difficult to define or demarcate the markets as opposed to the requirements of competition law.

Given this fact, the regulatory model would ideally build upon a layering based (or layered) approach, comprising both ecosystem and non-ecosystem relationships. Considering this, 'layering' needs to be elaborated further. As a baseline, the layering theory,[36] which was developed by the US scholars to deal with the market failures in ICT field, is worth exploring.

Layering theory was first intended as an instrumental tool for examining policy implications on technology and later evolved into a policy model intended to promote a technically neutral view of the various emerging network platforms. The layered approach is usually credited, as it allows that each module or layer of the whole ICT system could be analysed in a self-contained division, whilst acknowledging the interdependence among the layers,[37] namely the 'physical', 'logical', 'application' and 'content' layers, as widely accepted.[38] The main arguments of the policy proponents for layering models evolved on the; (i) differentiated treatment for each horizontal layer along with a lighter regulation in the higher layers and (ii) adoption of a more technology-neutral and refined regulatory treatment for the ICT networks and services.

[36] IP stack laid the ground for development of the 'layering theory', which generally means adapting the IP layers to policy and regulatory approaches. Particularly in the USA, layering theory was found to pave the way for an environment whereby regulatory rules against distinct networks, e.g. cable, the PSTN and services, for example VoIP and voice telephony, were to be filtered on the basis of convergence across the internet layers (TCP/IP) on a technologically neutral basis. See Rohan Kariyawasam, *International Economic Law and the Digital Divide: A New Silk Road* (Edward Elgar 2007) 87-117; Rohan Kariyawasam 'Defining Dominance for Bits and Bytes: A new Layering Theory for Significant Market Power?' [2005] 26(10) European Competition Law Review 581, 587; Kevin Werbach 'Breaking the Ice: Rethinking Telecommunications Law for the Digital Age', [2005] 4 Journal on Telecommunications and High Technology Law 59, 66-67; Kevin Werbach, 'A Layered Model for Internet Policy', [2002] 1 Journal on Telecommunications & High Technology Law, 39-54; Richard S. Whitt, 'A horizontal leap forward: formulating a new public policy framework based on the network layers model' [2003] 56(3) Federal Communications Law Journal, 587-672; Joshua L. Mindel and Douglas C. Sicker, 'Leveraging the EU regulatory framework to improve a layered policy model for the US telecommunications markets' [2006] 30 Telecommunications Policy, 136-148; D. Sicker and J. Mindel 'Refinements of a layered model for telecommunications policy' [2002] 1 Journal on Telecommunications and High Technology Law, 69-94.

[37] Nuechterlein and Weiser (n 36) 164; Whitt (n 36) 592.

[38] See supra note 36.

While these layers are acknowledgeable as the ground for building a model, the regulatory approach suggested in this study diverges from the previous ones with the proposed *homogenous regulatory treatment*, considering the need to a holistic design as well as to avoid a fragmented approach for the gatekeeping activities. From the holistic viewpoint, no differentiated approach should exist among the layers in terms of regulatory governance of the interoperability related problems within the meaning of gatekeeping activities. Hence, the concept of 'gatekeeping', representing another crucial part of the intended model, needs to build on a sound ground of reinterpretation.

In the past, the lower layer infrastructures were considered to pose greater threats in terms of new entries and market competition, whereas it was widely acknowledged upper layers should be immune from ex ante regulation. However, the shift of the locus of the economic activities from the bottom to the upper layers makes it inevitable to revisit this policy towards a more equivalent approach across the layers.[39] Although the upper layer activities have been subjected to a heightened antitrust scrutiny in the last decade or more, this trend does not change the fact that there is neither a harmonised nor a holistic regulatory treatment of the ICT layers under EU law.

From this vantage viewpoint, for a layered model to be adopted, both *competition* and the so-called *techno-social* concerns[40] need to be considered and responded. This is mainly to respond the restrictions to the consumers either in the form of anti-competitive behaviours or non-quantitative harm to the consumers while they are manipulated by an AI-driven programmes. Crucially, techno-social concerns co-exist with the competition concerns having a potential to guide the homogenously formulated (holistic) regulatory treatment across the ICT layers.[41]

[39] It appears that the locus where demand and supply meet is increasingly moving from the legacy telecommunications networks (lower layers) to 'digital platforms' or broadly speaking, upper layers. While IP convergence functions as the catalyst of both the demand and supply of ICT networks and services, minimised regulatory pressure over the supply of the upper layers could be said to have contributed to the so-called shift. Along the same lines, it could be advanced the upper layer companies have utilised the regulatory forbearance maximising the benefits to be reaped from the IP convergence so far.

[40] See supra note 2.

[41] Notably, against the ever fast changing ICT dynamics including the shifting locus mentioned above, the users are increasingly exposed to the techno-social problems, which do not necessarily have any competition dimension.

These concerns are not mutually exclusive and do complement each other as far as the ICT players' gatekeeping activities are concerned. While both types of concerns – or broadly speaking gatekeeping activities – are partially dealt with under the ECRF e.g. concerning net neutrality, techno-social concerns have not been highlighted sufficiently nor are demystified in a complete understanding against the multi-layered ICTs.

In fact, many of the online activities run by the ICT players might have discriminatory, biased and/or non-ethical elements, which are most often not captured by the competition law remedies. Whereas the upper layer services e.g. digital platforms create an online habitat for users, behind the scene is an opaque, largely unknown and sometimes dehumanizing architecture that creates path dependencies which might be unfairly selective, discriminatory or unethically designed. Through these digital gateways, underlying architectural designs and coding, i.e. based on AI, deep learning, manipulative/persuasive technologies, could affect consumers' freedom to choose, communicate and access to the information, along with far-reaching implications over the human dignity and autonomy including democratic culture.[42] Remarkably, such techno-social concerns do not necessarily overlap the elements that restrict competition in the relevant markets but do affect consumers' dignity and autonomy, most often through hidden ways of AI-based manipulation. Tackling both competition and techno-social concerns is highly important in the ultimate design and understanding of the proposed model, and for this purpose (of consolidation) the gatekeeping concept is of a crucial role to play in the 'layered regulatory model'.

5.2. Gatekeeping

'Gatekeeping' is a concept echoed with the widely used concept of 'network gatekeeping' that was first developed by Barzilai-Nahon to mean "the process of controlling information as it

[42] See D. Helbing, 'Societal, Economic, Ethical and Legal Challenges of the Digital Revolution: From Big Data to Deep Learning, Artificial Intelligence, and Manipulative Technologies' in D. Helbing (eds.), *Towards Digital Enlightenment: Essays on the Dark and Light Sides of the Digital Revolution* (Springer 2018) 47-72; L. Royakkers, J. Timmer, L. Kool and R. Van Est, 'Societal and ethical issues of digitization' [2018] 20 Ethics and Information Technology, 127-114.

moves through a gate (a network or its sections)".[43] Traditionally, in scholarly discourse, two major types of gatekeepers can be roughly distinguished: (i) gatekeepers which control access to information and (ii) gatekeepers which have a facilitating role through control of critical intermediary resources or services that are necessary to link users and content, to mediate between the different players in the information chain, to produce, transport and distribute content, etc.[44] While the former is represented by those who are in the position to have an editorial control over the information to be published either online or offline, the latter means more structural network gatekeepers i.e. cable or set-top box (CAS) providers, or the ISPs that control the means of access to the information.

Here it is important to remind that techno-social concerns complement and are coupled with the competition concerns portraying the ICT players' cross-layer practices, potentially gatekeeping activities. At this point, it becomes also necessary to look at the interoperability related problems from a broadly figured gatekeeping concept. 'Gatekeeping' has therefore a key role within the proposed normative framework under which a regulator has to designate and assess the gatekeepers' cross-layer practices that arouse abovementioned concerns.

It is considered that, whereas the ICT layers represent the value chains as well as underlying software (architectural) codes, gatekeepers are in the position to allow or deny access to such architectural gateways. Crucially, this understanding is embedded in the 'layered regulatory model' so as to capture broadened elements of AI reflecting on the techno-social concerns. Hence, while gatekeeping means controlling access and interoperability through these gateways, restrictive acts against third party access and interoperability are, and should be, deemed unacceptable representing a gatekeeping activity.

While 'gatekeeping' or 'network gatekeeping' is not surfaced as a technical term within the EU legislation or precedents, this term appears to have been considered as quite instrumental to

[43] Barzilai-Nahon (n 1) 1496.
[44] Natali Helberger, Katharina Kleinen-von Königslöw and Rob van der Noll, 'Regulating the new information intermediaries as gatekeepers of information diversity' [2015] 17(6) Info 50, 52.

define or approach to a range of controlling powers in the ICT landscape so far. Particularly in relation to regulation of digital platforms, this concept has been underpinned by the EU authorities in the legislative processes[45] as well as by the scholars[46] in highlighting certain problems including network effects, control the access to data and technology, consumer lock-in, etc. These (mainly competition) problems, being highlighted with the term 'gatekeeping', seem to have driven the EU Commission towards legislative efforts to facilitate access to informational and infrastructural resources, particularly under Digital Single Market (DSM) process.

From a broader perspective, a wide spectrum of gatekeeping activities would take place within this context incorporating discriminatory, biased non-ethical or unfair treatment of the consumers, which potentially have a restrictive nature on consumers' freedom to access to the information and/or underlying apps, services, products, etc.[47] Such access/interoperability restrictions would incorporate either software e.g. middleware, including search engines, application stores and browsers, or infrastructural elements e.g. hardware interfaces. Having said that, ICT players' activities having such a restrictive nature is key to defining a gatekeeping role, no matter they distort competition (leading to losses in consumer surplus) or harm consumers in the sense that their autonomy and dignity are affected.

[45] European Parliament, Directorate General for Internal Policies Policy Department: Economic and Scientific policy, Challenges for Competition Policy in a Digitalised Economy (A Study for the ECON Committee) <https://www.europarl.europa.eu/RegData/etudes/STUD/2015/542235/IPOL_STU(2015)542235_EN.pdf> accessed 30 April 2020.

[46] Peter Alexiadis and Alexandre de Streel, 'Designing an EU Intervention Standard for Digital Platforms' (EUI Working Paper RSCAS 2020/14) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3544694> accessed 30 April 2020.

[47] Google's discriminatory ranking in online shopping comparison services, as was found as an 'abuse of dominance' by the EU Commission, illustrates such restrictive practices. In June 2017, Google was fined 2.4 billion EUR for abusing its dominant position in the 'online search' market, to hamper the competition 'online shopping comparison' market during the years between 2008 and 2013. Google thereby was ordered by the Commission to ensure "equal terms" for all competitors in the online shopping comparison market based on the fact that they favoured their own services with the result being restricting the users' freedom to choose among the available options. (See European Commission, Press release, 'Antitrust: Commission fines Google €2.42 billion for abusing its dominance as a search engine by giving an illegal advantage to its own comparison shopping service', 27 June 2017 <http://europa.eu/rapid/press-release_IP-17-1784_en.htm> accessed 30 April 2020).

Hence, every ICT player that operates in one or more of the layers would be deemed to have a *gatekeeper role* if they are positioned to (be able) restrict choices of the consumers affecting their autonomy and dignity and/or their welfare from the competition law understanding. This role would often mean a gatekeeper leveraging their gatekeeping position to another layer, although same-layer (gatekeeping) activities could also pose equivalent restrictions.

Notably, competition concerns would arise should such restrictions have a long arm reaching out to the competitors. On the other hand, in case of techno-social concerns, the restrictive act in question would not necessarily have an anti-competitive effect but often results in 'unfair outcomes' or 'transformative effects' as framed by Mittelstadt et al.[48] Although it is widely acknowledged that algorithmic/AI-based transformation comes up with a number of concerns,[49] the referred two normative categories ('unfair outcomes' and 'transformative effects') well and broadly explain the so-called techno-social concerns.

According to the framework put forward by Mittelstadt et al, *unfair outcomes* mean the consequences brought by the actions driven by the algorithms that can be assessed according to numerous ethical criteria and principles, and are found to have an unfair nature.[50] Within this, not only indirect discrimination but also unfavourable results against neutrality and independence are included. If considered broadly, non-neutral activities performed by the ISPs involving throttling, delaying and prioritising the net traffic with unfavourable results to certain users/content providers fall in this category, and upper layer manipulated activities such as Google's discriminatory ranking,[51] could be compared to this. Considering broadly,

[48] See Brent Daniel Mittelstadt et al 'The ethics of algorithms: Mapping the debate' July-December 2016, Big Data & Society 1, 4.
[49] See Karen Yeung, 'Why worry about decision-making by machine?' in K. Yeung and M. Lodge (eds) *Algorithmic Regulation* (OUP 2019) 21-48; Teresa Scantamburlo, Andrew Charlesworth, and Nello Cristianini, 'Machine decisions and human consequences' in K. Yeung and M. Lodge (eds) *Algorithmic Regulation* (OUP 2019) 49-81; S. C. Olhede and P. J. Wolfe, 'The algorithms ubiquity of algorithms in society: implications, impacts and innovations' Phil. Trans. Royal Society <https://dx.doi.org/10.1098/rsta.2017.0364> accessed 30 April 2020.
[50] Mittelstadt et al (n 48) 5 and 8.
[51] See supra note 47.

contradictory outcomes against the ethical criteria and principles which are recently echoed in several official documents[52] could also be reminded here within the context of this category.

When it comes to *transformative effects*, two challenges emerge:

(i) *challenges to autonomy* in the sense that (often personalisation) algorithms reduce the diversity of information user encounters by excluding content deemed irrelevant or contradictory to the user's beliefs. The subject can be pushed to make the institutionally preferred action rather than their own preference.

(ii) *challenges for informational privacy* in the sense that the individual's informational identity is breached by meaning generated by algorithms that link the subject to others within a dataset.[53]

'Gatekeeping', entailing both unfair outcomes and transformative effects, builds on the architecturally designed key positions held by the ICT players, from the bottom to the top layer. In view of the illustrative net neutrality and CAS obligations, such positions do not necessarily mean holding an essential facility or a market power,[54] rather it implicates various means to control user activities via prioritisation, manipulation and/or discrimination and/or unfair treatment. Given this fact, every ICT player would be deemed to be a 'gatekeeper' regardless of

[52] The EU has recently adopted 'Ethics Guidelines for Trustworthy Artificial Intelligence' incorporating a number of soft law principles or requirements that AI systems should meet in order to be deemed trustworthy. (European Commission, 'Digital Single Market: Ethics guidelines for trustworthy AI' (8 April 2019) <https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai> accessed 30 April 2020). Similarly, 'Montreal Declaration for a Responsible Development of Artificial Intelligence' that has been adopted in 2018 includes 10 principles developing an ethical framework for the development and deployment of AI (See 'The Montréal Declaration for a Responsible Development of Artificial Intelligence' <https://www.montrealdeclaration-responsibleai.com/> accessed 30 April 2020).

[53] See Mittelstadt et al (n 48) 9-10.

[54] See also Orla Lynskey, 'Regulating 'Platform Power' (2017) LSE Law, Society and Economy Working Papers, 1/2017, 10 <http://eprints.lse.ac.uk/73404/1/WPS2017-01_Lynskey.pdf> accessed 30 April 2020; D. W. Edwards, 'Circulation Gatekeepers: Unbundling the Platform Politics of YouTube's Content ID', [2018] 47 Computers and Composition 61, 66.

their market power. For instance, at the infrastructural or bottom layer a gatekeeper e.g. an ISP can perpetrate non-neutral and discriminatory activities, e.g. delaying, blocking or throttling. Going to the upper layers, gatekeeping activities would change their form, often manifested in the AI-driven algorithms serving to dehumanise the users in their usage of ICTs with the afore mentioned restrictive outcomes/effects.

Conversely, such upper-layer activities reach out to the consumers in ways they would hardly realise, like in the way they would be captured via personalised recommendations, prices, customised products, etc. In the end, 'consumer welfare' seems unharmed, whereas the access and interoperability channels get restricted and the consumers' dignity and autonomy affected. Therefore, as opposed to the legacy understanding (of competition law), gatekeeping roles and functionalities would have a different nature than abusive or anti-competitive practices. As mentioned above, the same gatekeeping activity could come up with techno-social concerns alongside or regardless of the competition concerns.

Gatekeepers could potentially emerge across (one or more of) the ICT layers by revealing certain restrictions on consumers' choices and behaviours along with the so-called outcomes/effects. The table below illustrates the gatekeeping activities that are potentially perpetrated by the gatekeepers at each layer.

Layers	**Potential gatekeepers**	**Potential gatekeeping activities**
Content	Content providers	Providing premium content to affiliated ISPs, CAS or platform providers e.g. in exchange for priority placement.
Application	App providers	Developing apps to interoperate only with certain OSs, browsers, search engines, etc.
Middleware	Search engine providers	Selective ranking favouring subsidized content, ads or web services.
	OS providers	Discriminatory supply of certain functionalities for the affiliated CPs, app providers or network operators.

	App store providers	App prioritisation, delaying or blocking based on the app or app type.
	Browser providers	Selective or strategic browsing favouring certain web sites, their ads and/or ad-blocking apps, etc.
Access	CAS providers	Denial of access to several set-top boxes, including APIs and EPGs, or discrimination in the ranking of the access-authorised content.
	ISPs	Blocking, throttling and delaying certain or unaffiliated content.
	Network operator	Refusal to supply network e.g. NGN interfaces with the competitive service providers.

Source: Constructed by the author[55]

Table 1: Potential gatekeepers and gatekeeping activities across the layers

6. Conclusion: Building up positive rules on the normative ground

This study proposes the 'layered regulatory model' against the interoperability based problems and concludes that this model can effectively cope with the related concerns, namely competition and techno-social concerns, from a consumer-oriented perspective. Hereby, interoperability is broadly minded cutting across all the ICT layers and reaching out to the revitalised 'gatekeeping' activities. The proposed model is thus built on two key concepts: (i) layering and (ii) gatekeeping. While 'layering' provides the necessary layout for the regulatory oversight, the 'gatekeeping' refers to the activities that cause 'competition' and 'techno-social' concerns that need to be tackled from a regulatory viewpoint.

While it is suggested that the ECRF-inspired consumer-oriented perspective be upheld against the abovementioned concerns, effective regulatory tools also need to be embedded into the normative framework drawn up above. That is to say, positive rules need to be adopted to translate the given normative framework into an enforceable regulatory action.

Along the same lines with the ECRF, adoption of ex ante regulatory approach seems to be persuasive considering the shortcomings of competition law mechanisms as well as IPR safeguards against the interoperability problems. Given the ineffective and lengthy responses taken from the competition law remedies as well as IPR safeguards, the proposed layered regulatory model could be more responsive and effective should the model be of an ex ante nature. On this basis, certain safeguards need to be put into place ensuring a holistic and homogenous regulatory treatment across the layers, as shown below.

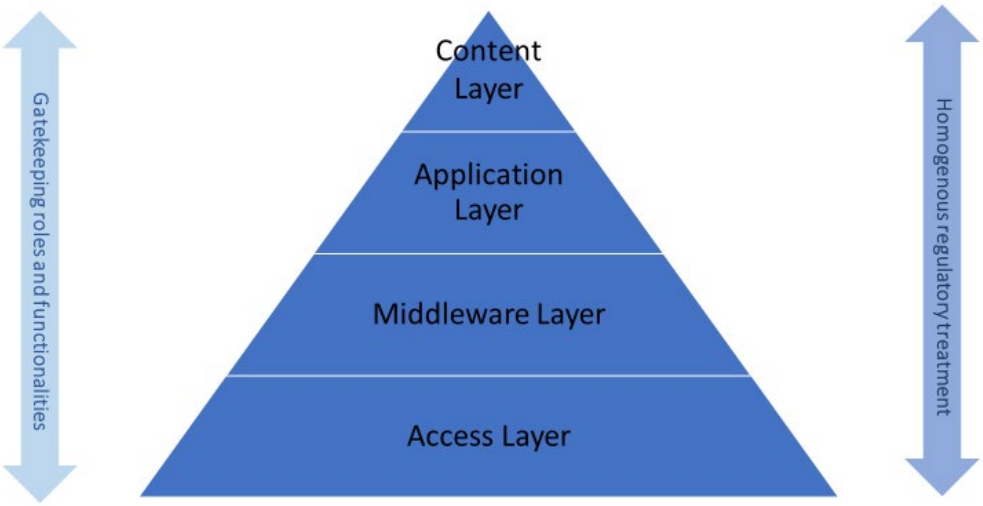


Figure 3: Main features of the layered regulatory model

Source: Constructed by the author

Against this background, it is considered that a *bottom up* approach based on adoption of *four principles* would be the baseline for the intended regulatory oversight over the so-called gatekeeping activities. As explained above, depending on the key position(s) created by the digital gateway(s), 'gatekeeping' denotes an ability to exploit such a position at the

[55] Partly inspired by Robert Easley, Hong Guo and Jan Kraemer 'From Network Neutrality to Data Neutrality: A Techno-Economic Framework and Research Agenda' (SSRN, 8 March 2017) 26 <https://ssrn.com/abstract=2666217> accessed 30 April 2020.

infrastructural and/or informational level, based on the traffic and data management. From an ex ante, holistic and multi-layered perspective, a strong likelihood that the underlying traffic/data management would result in interoperability problems based on the so-called (competition and/or techno-social) concerns is required for a 'gatekeeping' role. Based on this premise, the gatekeepers must:

- not restrict access and/or interoperability at the expense of limited consumer choices (access and interoperability),

- report their management of data and traffic across the layers to the regulator(s) (transparency),

- refrain from biased or unfairly selective supply of services unless justified on an objective ground of reasoning (fairness), and

- ensure that the software management e.g. AI-driven processes underlying the services supplied by them rely on ethical, accountable and democratically justifiable reasons (accountability).

Crucially, these principles mean the key requirements which all the gatekeepers should adhere with. Accordingly, there is no need for a gatekeeper to have a market power to be subjected to these principles which are generic and ex ante. As long as these principles are complied with, there would be no need to intervene on the part of the regulatory authority, namely European Commission at the EU level and NRAs at the national level. Conversely, in circumstances where the principles are breached and are followed by certain restrictions over the consumers' behaviours and choices, additional safeguards would need to be enforced. Appropriate obligations might thus need to be imposed on the gatekeepers by the regulator(s), to ensure the

governing principles stated above are respected with by the players. Following on the given principles, it is suggested that the potential obligations include, but not limited to, the following:

- Access and interoperability: Consumers' access to infrastructural/informational resources might be affected when a gatekeeper denies or delays the demands for access to and interoperability with the (access, middleware/logical, application and content) layers controlled by themselves. In that case, access and interoperability remedies might be imposed on the gatekeeper(s) to make available the relevant layers or layer elements to the competing undertakings.

- Transparency: A gatekeeper might be subject to transparency obligations when the same-layer or cross-layer operations carried out by them reveal a gatekeeping activity, e.g. involving unfair outcomes and/or transformative effects, in view of the affected consumer behaviours and preferences, particularly as a result of hidden aspects of underlying software and algorithms.

- Fairness: In case certain restrictions by means of discrimination and bias e.g. selective ranking, filtering, prioritising take place across certain layer(s) resulting in a gatekeeping activity e.g. involving unfair outcomes and/or transformative effects, the gatekeeper could then be ordered to carry out their activities in an unbiased and ethically justifiable manner.

- Accountability: In the case of consumers being manipulated towards certain content, apps, services, e.g. involving unfair outcomes and/or transformative effects, the gatekeeper involved in that activity might be required to redesign their underlying software and algorithms in relation to the pertinent layer(s).

Within this framework, it is expected this regulatory process is to unravel the gatekeeping activities and the necessary safeguards addressing these. Under this light, the extent to which the gatekeepers will be exposed to the given obligations would ideally be determined according to their adherence to *governing principles*. According to this bottom-up approach, gatekeepers' collaboration with the regulator(s) as well as among themselves is of key importance. Having said that, as long as a self-regulatory ecosystem structure exists within particular layer(s), this would result in alleviation of follow-up process along with the minimised access/interoperability remedies applicable to such layer(s). Nevertheless, transparency, fairness and accountability obligations would still be applicable even if the access and interoperability relationships or rules are widespread and an access/interoperability obligation is obviated. Remarkably, ecosystem players could meet at an equilibrium point where they could continue non-transparent, unfair and non-ethical activities. Thus, attention should be paid to every kind of gatekeeping activities, no matter interoperability gaps and problems are diminished through self-regulatory ecosystems or principles. Sequential steps envisaged in the overall process are manifested in the figure below.

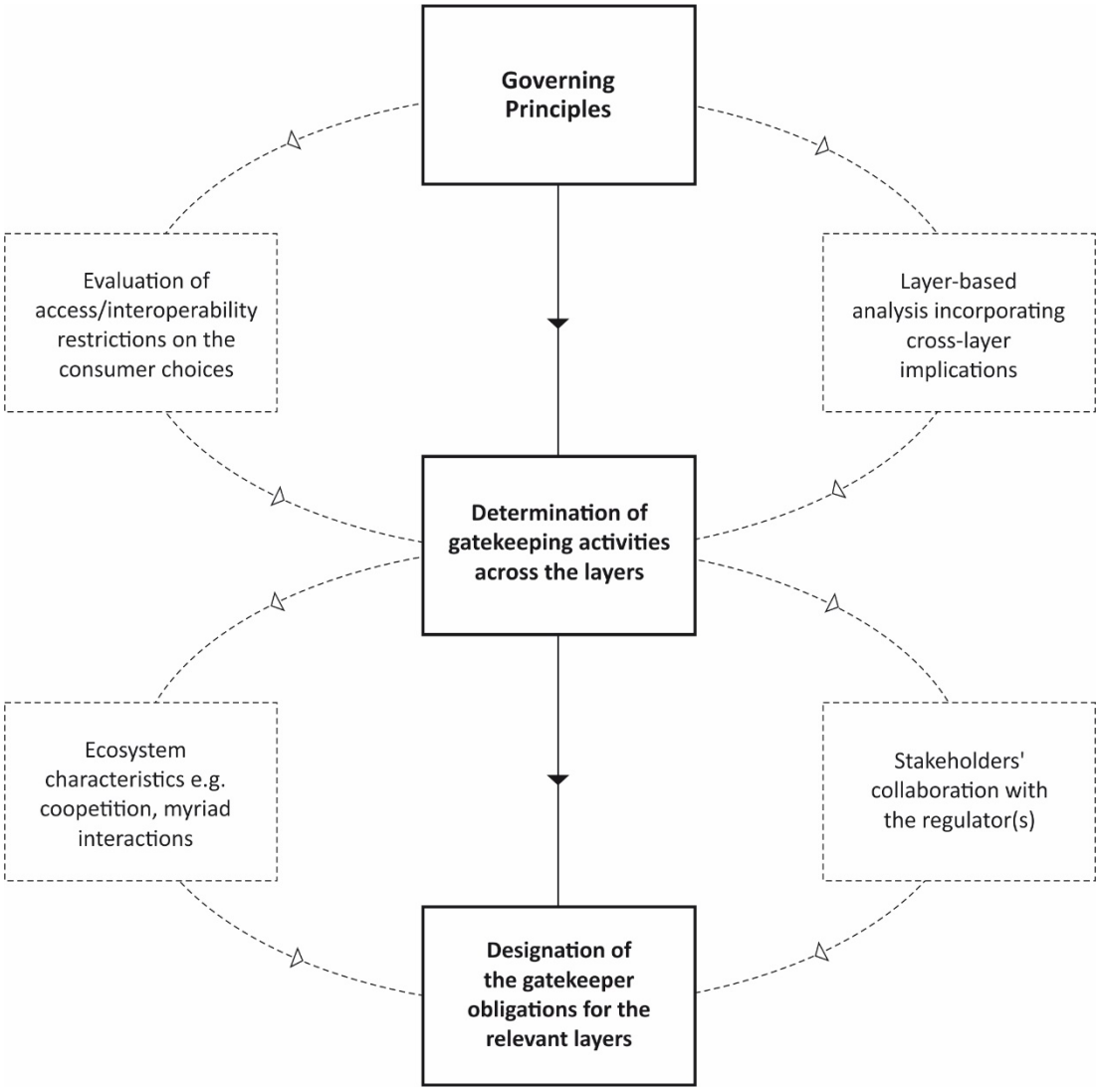


Figure 4: Key stages of the layered regulatory model

Source: Constructed by the author

As could be seen above, the proposed model has a dynamic and evolving nature. For the well-functioning of the overall model, top-down measures should be avoided at all. Given the underlying consumer-oriented perspective, holistic and multi-layered nature of the proposed model, there would be no longer a need to the existing access and competition measures e.g. SMP remedies placed under the ECRF. Therefore, it is suggested such measures be replaced with

the layered regulatory model, as the proposed principles and remedies meet the pertinent goals of the ECRF.

Notably, the proposed model responds not only competition concerns but also techno-social concerns based on the broadly formulated interoperability principles and obligations. That being said, the layered regulatory model would offer a simplified yet effective response to the interoperability based problems, going beyond the more technical and narrow-minded European perspective that incorporates the competition law, ECRF and IPR rules. Notwithstanding, the ECRF would be the ideal starting point for the integration of this model into the EU legal system for the underlying ex ante and consumer-oriented viewpoint. This integration which means replacement of the core (SMP oriented) principles of the ECRF would give way to far-reaching implications in terms of regulatory governance e.g. concerning structures, principles and institutions. These issues would be subject matter of further research which is always welcome for furthering the findings of this research.

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