

A visual analysis of the literature on Internet neutrality

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Abstract

Internet neutrality – a principle against the discrimination between Internet data packages – has been one of the most debated Internet regulation policies in the last decade. However, this debate seems to be very fragmented and there is not a global comprehension of the direction of it. In this paper we try to fill this gap circumscribing the literature on Internet neutrality. Through the open-source software VOSviewer we provide a visual analysis of the relationship between the 50 most relevant words occurring in the abstracts of scientific publications on the topic in the last 15 years.

Keywords: *Internet, Literature Analysis, Net Neutrality, VOSviewer.*

1. Introduction

Internet (or net) neutrality has been the most relevant Internet regulatory policy of the last decade (Jacobides, 2020). The principle of net neutrality requires that all Internet data packages, regardless of their content, origin, destination, or type of equipment used, should be equally treated. (Wu, 2003). In general terms we can say that the debate on the need to set the obligation of net neutrality is between: on the one hand the Content Providers with strong market power (e.g. Amazon, Google, Meta, Netflix) which defend it under the argument of maintaining Internet as an open and global network that fosters innovation; and on the other hand the Internet Service Providers (e.g. Orange, Movistar, TIM, Vodafone) which argue that net neutrality discourages investments in maintenance and extension of network capacity because free rider behavior from the Content Providers side is allowed.

The academic results about the argument are often inconclusive and the regulatory policy sometimes contradictory¹. In other words, the literature about Internet neutrality seems to be very fragmented and there is a lack of comprehension of its global direction. Therefore, the inconsistency between the results often obtained in different fields of literature may explain the contentious and polemic debate that still continues on whether net neutrality is necessary and how to enforce it.

In this paper, through an analysis of the words occurring in the abstracts of scientific publications, we provide a global snapshot of the academic literature on net neutrality. We show that the debate is very interdisciplinary, involving law, economics, engineering and political sciences. However, in our analysis we found two dominant macro-areas of study in the literature: the economic debate and the legal perspective. We interpret this compartmentalization of fields as an absence of synergy between economic and legal outcomes, which adds complexity and generates confusion in the net neutrality debate.

In Section 2 we present the methodology employed to provide a visual analysis of the net neutrality literature. Section 3 presents the main results. Finally, conclusions are provided.

2. Method

On the database Web of Science² we looked for scientific publications which had the locution “internet neutrality” or “net neutrality” either in the title or in the abstract section.

¹ In 2015, the European Union incorporated regulations on net neutrality like the one established in the US between 2015 and 2017. In the European Union, since 2016, it is the Body of European Regulator for Economic Communications BEREC that manages the guidelines about net neutrality. In general terms, BEREC prohibits any type of quality discriminatory practice such as prioritization. However, certain financial discrimination practices such as zero-rating are allowed on a case-by-case basis. More recently, in September 2021, the Court of Justice of the European Union, by analyzing the cases of Vodafone and Deutsche Telekom in Germany, decided that zero rating offers (use of applications without data consumption) violate the net neutrality principle. This is a clear signal about how still confusing and hectic the debate is.

² Entered the 15th of February 2022.

This search produced a total of 368 available contributions, of which 264 articles, 52 proceeding papers and 26 book chapters. Only 296 publications resulted supplied with an abstract field³. For our analysis we focused on the co-occurrences of words within the abstracts.

Using a minimum threshold of occurrence of 10 times – counting also if a word appeared more than once within the same abstract – we identified a total of 175 possible relevant terms. Starting from that list of words we brainstormed and selected the most important ones given the context, that is Internet neutrality, according to standard procedures in the field (Caputo et al. 2021 and Donthu et al. 2021). Thus, even if some terms occurred very frequently, we excluded from the visual analysis 92 words which had no relevance given the context or which had a too general or ambiguous meaning, in the sense that they could be easily coupled with several other words in several different ways. For instance, we excluded words such as “analysis”, “content”, “decision”, “internet”, “issue” or “paper”.

In a second stage of refinement of the remaining 83 terms left we grouped the words with a coincidental or identical meaning. For example, we merged “commission” and “fcc” with “federal communications commission”, “Europe” with “European Union” and “law” with “legislation”. In the same way we decided to merge “costumer”, “consumer”, “end user”, “internet user” and “user” into one single category. This further refinement left us with 48 unique words with no ambiguity or synonyms plus other 10 words derived from merging 35 similar terms.

For the visual analysis of the network between the identified words we used the open-source software VOSviewer (van Eck and Waltman 2010, 2014).

3. Results

We first start with some general indexes and then we move to the network analysis.

3.1 General bibliometric indexes

Figure 1 shows the publication and citation history of the 368 contribution identified on Web of Science starting from 2006. As it is possible to notice from the bar chart, the literature on Internet neutrality constantly grew until 2018, when we can observe the pick for both the mentioned variables. Furthermore, the scientific production on the theme had a significant drop during the Covid years. On the one hand this is might be a natural trend of many fields of research, because the focal center moved on the health emergency. On the other hand, this conspicuous drop is surprising given the importance that Internet had

³ Since the number of abstracts was relatively low we decided not to exclude any publication from the following analysis.

during the lockdown periods to carry out fundamental socio-economic activities and the consequent increase in traffic volumes (Feldmann et al. 2021).

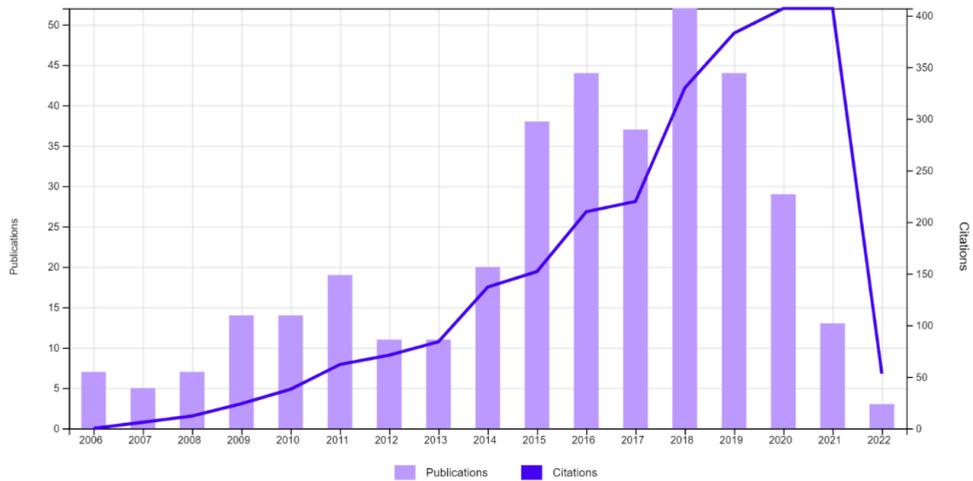


Figure 1. Publications and citations over time, 2006-2022. Source: Web of Science, Citation report

Table 1 summarizes instead the main fields of literature of the publications according to the Web of Science categorization⁴. The research fields that mostly engage with the Internet neutrality debate are communication, telecommunication, information science, law, economics. Other 57 categories were present, but only less than nine contributions per category belonged to those areas. Therefore, they are not shown in Table 1.

3.2 Visual analysis of the network

Focusing on the relationship between the words present in the abstracts of the identified publications, we can notice (Fig. 2)⁵ that already after the first round of refinement – that is the elimination of non-significant words – we obtain a clear split of the 50 most relevant words in two macro-clusters (areas of research), mainly connected through the very central node represented by the term “neutrality”.

⁴ One publication can belong to more than one field, so there is the possibility of multiple counting.

⁵ For this visualization we used a binary counting of words, which counts only the number of documents in which a term occurs. The double or triple appearance of the same word within the same abstract is counted as one. Out of the 66 total words so identified we selected the 50 most relevant.

Table 1 – Web of Science main categories of the identified contributions

Field	Times
Communication	70
Telecommunications	66
Information Science Library Science	62
Law	60
Economics	49
Engineering Electrical Electronic	42
Computer Science Information Systems	33
Computer Science Hardware Architecture	27
Computer Science Theory Methods	23
Computer Science Software Engineering	20
Management	19
Political Science	13

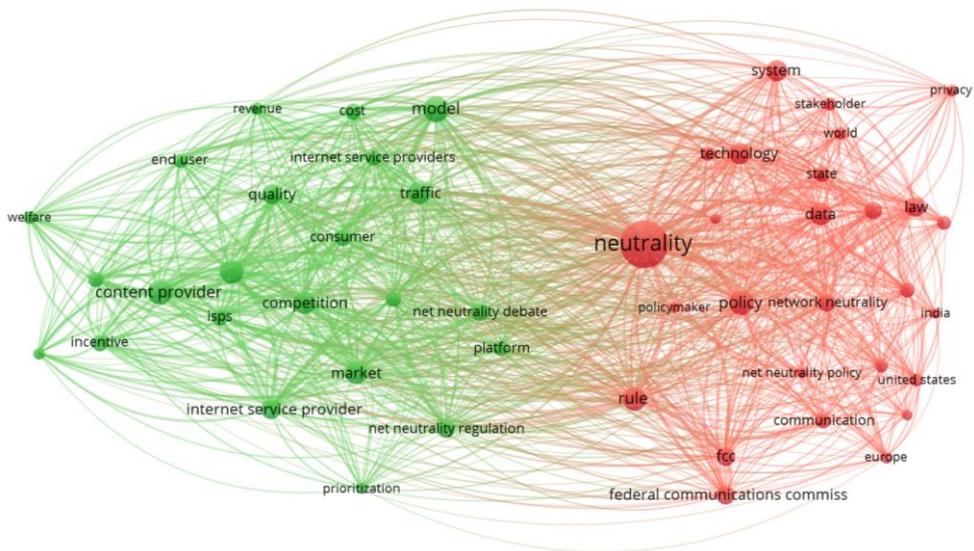


Figure 2. Network visualization of the 50 most relevant words, no merge of synonyms. Source: VOSviewer

The left cluster (green) contains words like “content provider”, “internet service provider(s)”, “market”, “model” and “competition”. This is a clear indication that one important part of the literature on Internet neutrality is basically focused on the normative (meant in an economic sense) configuration of the Internet market and the economic relationship between the main market actors. This is confirmed also by the co-presence of

words like “end user” or “consumer” and “welfare”, that refer to the idea of the impact of different market structures on the aggregate welfare in general and on the Internet costumers in particular and by words like “cost”, “revenue” and “incentive” that refer to a strict economic perspective. For an extensive review on the economics of net neutrality we readdress to Lee and Wu (2009), Schuett (2010), Krämer et al. (2013), Greenstain, et al. (2016), Krämer and Peitz (2018).

The right cluster (red) of Fig. 2 contains terms like “state”, “federal communication commission”, “law” and “policy”, indicating that another part of the literature has been so far focused on the legal equilibrium, that is the enforcement of the principle of Internet neutrality. However, there are still some words like “technology” or “stakeholder” that, despite having some intrinsic meaning in the Internet context, do not have a clear collocation within the network. For an extensive review on regulatory instruments and competition law linked to net neutrality we readdress to Owen (2014), Ohlhausen (2016), Maniadaki (2019) and Comeig et al. (2022).

Furthermore, analyzing the 10 strongest links within the network of Fig. 2 we observed that the central node of the network is exactly the word “neutrality”, and this mainly occurs together with very significant terms like “market” and “policy”.

After the second stage of refinement – that is the merge of synonyms – we can observe from Fig. 46 how the network becomes subject to a more detailed interpretation.

As before (Fig. 3) we can still observe a clear split between the economic and the law perspective, with “service provider” and “regulation” constituting a sort of focal points of an ellipsis around which all the other words are distributed: the two focuses are indeed connected by the strongest link in the whole network. We interpret this in a straightforward way: the literature on net neutrality mainly deals with the regulation of Internet Service Providers, seen as the issue. However, compared to Fig 2, in Fig. 3 a new cluster is formed (light blue). The latter, together with some words in green and red – like “cost” or “infrastructure” –, indicates in our opinion that there is also a part of the literature focused on the technological and infrastructural dimension of Internet neutrality, probably a reflection of the research categories listed in Section 3.1.

⁶ For this visualization we used a full counting method of words, includes the total number of occurrences of a term within all the documents, even if it appears multiple times within the same abstract. Out of the 58 total words that respected our criteria, we selected the 50 most relevant. We added the further filter of having a minimum cluster of five words.

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