Exploring the Open COVID Pledge in the fight against COVID-19: a semantic analysis of the Manifesto, the pledgers and the featured patents

Ginevra Assia Antonelli¹, Maria Isabella Leone²,* and Riccardo Ricci³

¹Department of Business and Management, LUISS University, Viale Romania, 32, Rome, 00197, Italy. gantonelli@luiss.it
²LUISS Business School, LUISS University, Via Nomentana, 216, Rome, 00162, Italy. mleone@luiss.it
³Instanttechnologies, Pesaro, Italy. r.ricci@instanttechnologies.com

Coronavirus disease-19 (COVID-19) has stimulated urgent innovative responses to tackle the current crisis and unveil new trajectories enabling recovery as early as possible. In the quest for solutions to the pandemic, organizations have been forced to join efforts with an unprecedented number of different stakeholders, including competitors, rising new appropriation-related challenges. To ease these issues and facilitate collaborative efforts, some initiatives have come into being to encourage the release of Intellectual Property (IP) rights to unlock new possibilities from their use and possibly foster the collective innovation process. The Open COVID Pledge (OCP) stands out as the most visible project that has gained momentum at the international level, as it has increasingly involved well-known top-patenting companies, willing to publicly commit to making their IP relevant to COVID-19 freely available. Drawing from all the available information (the World Wide Web, the participating companies’ press releases and official websites, and the documents of pledged patents), we propose a research design, applying a semantic method to allow an augmented understanding of the main characteristics of this pledge. Our findings point out that the OCP has got a great media resonance on the overall web, also thanks to the commitment of large top-patenting pledgers; results also show that while the official communications of the participant companies resemble very much the general OCP Manifesto of providing free access to their patent portfolio, the semantic analysis of the pledged patents unveils details on available technologies that mostly refer to the real-time search and analysis of information and devices for the detection of the diffusion of the virus. Overall, this analysis contributes to providing contextual information on the available IP, towards the desired direction of putting the pledge to work and have an impact on follow-on innovation, which represents the underlying rationale of the initiative in the fight against COVID-19.
1. Introduction

The coronavirus disease-19 (COVID-19) pandemic has affected not only countries’ health systems but also global economies, depicting times of high uncertainty (Chesbrough, 2020; Coccia, 2020a, 2020b; Wenzel et al., 2020). At the same time, however, the urgency to find means of enabling the recovery has forced and led to exceptional progress in innovation practices (Chesbrough, 2020). Firms have experienced that their survival and success are tied to the ability to navigate new opportunities, embracing a more collaborative attitude to unlock the collective innovation ability (Chesbrough, 2020; McGahan et al., 2021). Governments, scientists, educators and companies of different sectors have therefore committed themselves – sometimes for their first times – to global collaboration on an unprecedented scale to cope with the effects of the pandemic more efficiently and rapidly (Ratten, 2020; Younes et al., 2020). The efforts committed to the development of the COVID-19 Open Research Dataset, as well as the crowdsourcing-based industrial reconversion of many manufacturing firms, represent illustrative cases of this trend (Chesbrough, 2020). Overall, this evidence has shown ‘how a sense of urgency can truly fuel open innovation’ and stimulate the organizations to open their boundaries to jointly tackle societal challenges (Chesbrough and Di Minin, 2014; Chesbrough, 2020; McGahan et al., 2021).

Nevertheless, these extraordinary Open Innovation (OI) efforts have brought about new appropriation-related challenges, because organizations have found themselves collaborating with an unprecedented number of different stakeholders, including competitors (Heled et al., 2020; Moerchel et al., 2020a; Tietze et al., 2020a, 2020b). Facing these challenges, and to facilitate these collaborative efforts, organizations have been encouraged ‘to adopt an Intellectual Property (IP) perspective on the currently unfolding COVID-19 pandemic’ and re-design and increasingly apply IP management practices (Chesbrough, 2020; Tietze et al., 2020a, p. 2). For instance, at the company level, Medtronic has opened its IP rights (i.e. patents) to increase the production of efficient ventilators, and Isinnova patented its Charlotte valve, however, making it freely available to help hospitals. At a collective level, there has been an increasing adoption of patent pledges to make IP relevant to COVID-19 freely available to potential users. Among these, the Open COVID Pledge (OCP) has gained international resonance as it has attracted an increasing number of well-known innovative companies (such as Facebook, Intel, Microsoft and Amazon) that have publicly married the cause. Their commitment has spurred many complementary ‘similar programs and initiatives [which] align squarely with those reflected in the Pledge’, such as the World Health Organization Access to COVID-19 Tools Accelerator and the Open COVID-19 Declaration signed by a group of Japanese technology companies to allow the free availability of their IP in support of stopping COVID-19 (Chesbrough, 2020; Contreras et al., 2020; Cotè et al., 2020; Heled et al., 2020; Srinivas, 2020; Younes et al., 2020; Tietze et al., 2020a, 2020b).

Albeit patent pledges are not novel IP practices, the COVID pandemic has revitalized their adoption and diffusion, especially for those classified as ‘mission-oriented’, pursuing philanthropic objectives, such as the growth of social welfare through faster recovery from the crisis (Maggiolino and Montagnani, 2017; Contreras, 2018; Contreras et al., 2020; Tietze et al., 2020a, 2020b). Given the relevance of this large-scale collective pledge, leading scholars and practitioners have stimulated the debate about how to put this pledge to work, towards the desired direction to stimulate follow-on innovations and hence find factual solutions to the pandemic (Contreras et al., 2019; Chesbrough, 2020). In fact, related evidence suggested that simply publishing patent lists seldom results in follow-on innovations in the absence of contextual information on the complex technologies at stake (Contreras et al., 2019).

Inspired by this debate, the paper aims to provide an augmented understanding of OCP’s main characteristics, which may inform potential users. Aiming at this, we also contribute to responding to the call for dissemination of these emerging best practice actions to aid current and future efforts in the fight against COVID-19. To do so, by applying the text mining approach and semantic methods to all the available information on the OCP, we pursued a threefold study along the following directions of: (1) understanding how the overall web resonates with the Initiative and the main related concepts (OCP Manifesto Overview); (2) comprehending the nature of pledgers’ commitment (OCP Pledgers Overview); and (3) deep diving on the characteristics and contents of the pledged IP portfolio (OCP Patents Overview).

Based on the semantic analysis, we found that the OCP has attracted a huge amount of interest from the overall web and this is also confirmed by the globalization of the movement that has stimulated, and still does, an increased number of complementary efforts all around the globe from different types of organizations. What is also interesting is the bandwagon effect of some of the big companies, such as
Microsoft, Amazon, Seagate and Morgan Stanley, which catalyze most of the relations that have emerged to the surface. Second, our findings reveal that the pledgers’ participation statements sound very similar and broad, and the main words that emerged from the semantic analysis are all centered around the OCP Manifesto to make their IP freely available. Hence, the patent analysis has offered richer insights, as it allowed to understand the content of the pledged technologies, which overall seems to be related to the real-time search and analysis of information and devices for the detection of the diffusion of the virus.

The remainder of the paper is organized as follows: Section 2 provides the theoretical background of the study, recalling the extant literature on the OI and IP management practices, with a specific mention to patent pledges, concerning the pandemic. Section 3 introduces the OCP initiative as a setting of our study and describes the applied research methodology. Section 4 presents the discussion of the results of the analysis across the three studies (OCP Manifesto Overview; OCP Pledgers Overview; and OCP Patents Overview); finally, Section 5 finalizes the paper, highlighting the implications and limitations of the study and putting forward future avenues of research.

2. Theoretical background

As the OI principles are increasingly diffused, firms are more frequently engaged in collaboration activity with external and diverse partners; it, therefore, becomes imperative for them to decide whether and to what extent they should be open but still capable of capturing value from their internal R&D investments. The relevant literature has called this appropriation paradox, because of the inherent tension between the firms’ urgent necessity of sharing and the everlasting need of protecting the source of their competitive advantage (Bogers, 2011; Di Minin and Faems, 2013; Laursen and Salter, 2014; Arora et al., 2016; Leone, 2016).

Besides investigating the conditions under which is more severe, such as in the case of collaboration with universities or research organizations, authors have also suggested how companies could tackle the paradox, through the deployment of ad hoc practices to find the optimal balance and reap the best gains from the collaboration (Bogers, 2011; Di Minin and Faems, 2013; Laursen and Salter, 2014). One above all, the proactive management of IP rights has attracted the interest of scholars and practitioners. In this new perspective, IP rights are deemed to increase the effectiveness of R&D collaborations, enabling safer exchange, through the reduction of opportunistic behaviors (Bogers, 2012; Ritala and Hurmelinna-Laukkana, 2013; Hagedoorn and Zobel, 2015; Henttonen et al., 2015; Leone, 2016).

This new way of looking at IP rights as knowledge-sharing facilitators, rather than legal tools for exclusion, represents the underlying rationale of the design and adoption of patent pledges, which have recently taken hold in the innovation scene (Contreras and Jacob, 2017; Maggiolino and Montagnani, 2017; Contreras, 2018; Chesbrough, 2020; Kim, 2020). They can be defined as ‘a publicly announced intervention by patent owning entities (“pledgers”) to out-license active patents to the restricted or unrestricted public free from or bound to certain conditions for a reasonable or no monetary compensation using standardized written or social contracts’ (Ehnsperger and Tietze, 2019a, p. 6). Besides technology-standard setting dynamics and patent asserting behavior to avoid authorities’ unfavorable treatments, these voluntary private tools have also served other objectives such as open-source software development, green technologies and biosciences diffusion, and even the collective and philanthropic promotion of the common good (Contreras and Jacob, 2017; Contreras, 2018). An illustrative case is the Eco-Patent Commons, made by big businesses ‘to prove their green credentials by sharing environmentally friendly innovations with their competitors […] for mutual and wider social benefit’ (WIPO 15; Contreras, 2018; Contreras et al., 2019).

From an OI perspective, hence, patent pledges make the promise to be effective means for diffusing technology and promoting innovation, through sharing (Chien, 2015; Ehnsperger and Tietze, 2019b).

With the unfolding of the pandemic, a high number of OI initiatives have emerged globally, to ‘prevent duplication, reduce redundancy, and create synergies based upon specialization and labor division’ (Younes et al., 2020, p. 5), hence, proving the strategic role of openness also – or even especially – in the case of emergency (Chesbrough, 2020; Tietze et al., 2020a, 2020b; Younes et al., 2020). However, in this scenario, the ‘paradox of wanting to collaborate but also safeguard one’s own interest’ (Ratten, 2020, p. 5) has been exacerbated given the time constraints and the multitude of actors involved. Facing these new IP-related challenges, some authors have offered a multi-stakeholders framework to allow for more timely IP considerations (IP ownership, relevance, technological coverage, etc.), during a pandemic, to avoid obstacles in mobilizing resources needed for the development and mass manufacturing of Crisis-Critical Products (Moerchel et al., 2020a, 2020b; Ratten, 2020; Tietze et al., 2020a, p. 1;
Others have analyzed the voluntary pledges to make IP broadly available, suggesting that they can overcome the hurdles faced by more elaborate legal arrangements such as patent pools and be more widely accepted than governmental compulsory licensing (Contreras et al., 2020). However, the same ‘lightweight, self-executing and sometimes broad nature of pledges could, without ongoing stewardship and active assessment of the rights being made available, challenge users seeking to find specific pledged IP’ (Contreras et al., 2020, p. 1148). In fact, evidence on the Eco-Patent Common showed that only making available and listing these IPs was not enough to put the pledge to work as potential users needed contextual information and accessible understanding to find applications of the pledged patents (Contreras et al., 2019). Hence, making sense of the huge amount of IP knowledge to allow the potential user to ‘learn what IP are available’ is paramount to ensure that these large-scale collective pledges have an impact on the follow-on innovation process, based on the dissemination or use of pledged technologies, for the achievement of the societal goal of recovering from the crisis.

3. Research design

3.1. Case selection and description

The OCP initiative was launched in April 2020 with a call ‘on organizations around the world to make their patents and copyrights freely available in the fight against the COVID-19 pandemic’. In few months, the OCP has attracted an incredible number of companies, well known for their international reach and mostly for their intense patenting activity, and hence with the capacity to lead the way for other high-tech leaders to join this effort. As a result, it has started a global movement involving an increasing number of complementary initiatives all around the globe (Chesbrough, 2020; Contreras et al., 2020; Tietze et al., 2020a, 2020b; McGahan et al., 2021). The ‘openness’ of the OCP builds upon four main pillars: first, the pledge is open to all types of organizations who want to contribute to the fighting against COVID-19; second, it addresses the unrestricted public, interested to apply the available IP, but ‘solely for the purpose of diagnosing, preventing, containing, and treating COVID-19’; third, the participation scheme encompasses two types of commitment, either as pledgor or supporter. Only in the former case, there is a legal commitment to make the pledge and allow the free use of a portion of internal IP; and fourth, besides some possible personalization, the basic conditions of the pledge claim a ‘non-exclusive, royalty free, worldwide, fully paid-up license (without the right to sublicense)’ to the potential user.

As a preliminary analysis, we classify pledgors companies according to their size and type of commitment. We collected data on revenues from Orbis and Nexis Uni, and we enucleated firms’ statements of participation as taken from their press releases. We identified 11 main categories, ranging from more general statements to more specific ones (related to practice) (Figure 1). First, the picture shows an even distribution in terms of size, albeit many founding adopters are clustered on the left side of the chart representing very large companies. Regarding the type of commitment, most of the companies are clustered in the upper side of the figure, therefore being in line with the general intent of allowing free access to their portfolio relevant to fight COVID-19. This is especially true for the founding adopters, except for Microsoft that has communicated a specific focus on tracking technologies and IBM that focuses on...
medical patents; but it also applies to well-known pledgors that have joined later, like AT&T, Uber and Seagate. Different considerations can be brought forward if we look at the lower section of the figure, where we can detect a more specific type of commitment, both in terms of fields (medical, hardware and software) and in terms of applications (tracing, ventilator, toolkit, etc.).

As a second preliminary analysis, we described the 22 pledged patents showcased on the OCP website. We collected the available patent cards and complemented the information with the main patent statistics (IPC technological classes, claims, backward and forward citations) drawn from Google Patents and Espacenet. The table in Appendix A shows that the selected patents belong to four funding adopters (Facebook, Intel, IBM and Sandia National Laboratories) and five additional pledgors (AT&T, Mitsubishi Electric Research Labs, the New Jersey Institute of Technology, Uber and Fujitsu). Most of these patents represent very novel pieces of knowledge (five of them were granted between 2019 and 2020 and six are still pending), and they mostly refer to the G06-Computing; Calculating or Counting (seven patents) and H04-Electric Communication Technique (five patents) IPC classes. Besides, many of them report about 20 claims but show, as expected, a minimum number of forward citations (with some notable exceptions of Intel’s pending patent – US20200128006A1 – with 54 citations). On the contrary, most of the patents display an average of 25 citations (with a peak of 133 for AT&T’s patent, US7298836B2). This means that, albeit they were filed very recently, those patents do not represent novel knowledge in absolute terms, as they tap into a well-established state of the art, as also demonstrated by the scarce presence of non-patent/scientific literature (except for Sandia’s patent – US8163154B1 – with 22 references).

4. Research method

In this study, modern Innovation Management methods are used, according to the recent calls of top journals, to contribute to methodological diversity (Tseng et al., 2007; Choi et al., 2013; Ghazinoory et al., 2013; Lee et al., 2014; Han and Sohn, 2015; Arts et al., 2017; Moehrle et al., 2017; Antons et al., 2020; Faems, 2020; Ritala et al., 2020). More specifically, this study implements semantic methods to leverage the hidden potential of unstructured data to unveil original and novel data insights (Faems, 2020; Ritala et al., 2020). For what concerns the unstructured data related to patents, we applied IP Analytics, with specific references to text mining approaches and semantic methods (Aristodemou & Tietze, 2017, 2018).

The overall research method is represented in Figure 2.

4.1. Data collection

We collected data from multiple sources, at different levels (World Wide Web, pledgors companies and pledged patents), to build a comprehensive knowledge base to analyze the OCP initiative. In the first step, the automatic crawling system explored 1974 websites to extract and read their content. The same parsing process has been applied to extract textual contents from press releases and patent title and abstracts. Full details of the data collection sources are embodied in Appendix B.

4.2. Data analysis

We cleaned the information, by lowercasing the text, eliminating punctuation, useless and unrelated words and spelling mistakes; we processed the cleaned data concatenating the title and abstract words. We applied a proprietary semantic tool, named ‘TAG’, to analyze the information. It first splits all the sentences into periods, eliminates words that are not
significant for semantic interpretation (i.e. adverbs), simplifies the meaning of sentences and tokenizes them into significant words (TAG1). It, hence, selects the most relevant items for the following step, as follows: (1) by combining up to three adjacent significant words (input items); (2) by cross-referencing the input items with the AI-generated Database; (3) by ranking the topics corresponding to the input items, according to their relevance; and (4) by keeping only the relevant topics and the corresponding input items (TAG2). It finally correlates all the relevant input items (hereinafter simply item/words) with one another, based on the number of their links. All the correlations are therefore ranked for their relevance (TAG3).

4.3. Result visualization

We opted to use flow charts that enable us to represent the main links without considering the data with minor relevance. Starting from the main words with the greatest number of inbound links, we can easily visualize the links between them and related items.

5. Results and discussion

5.1. OCP Manifesto overview

In the first study, we investigated how the Web resonated with the OCP initiative by semantically analyzing all the relevant information on the web (1974 sites). The visual representation is shown in Figure 3.

The scanning of the World Wide Web has brought to the surface, as expected, the main word ‘Covid’ and the top linked words, such as ‘news’, ‘impact’, ‘response’, ‘crisis’ and ‘fight’, all in line with the OCP Manifesto (see also Appendix C for the list of the top 20 main words). Very counterintuitive, instead, it is the relevance of the word ‘market’ (with 1382 inbound links) that appears to be less in line with the aim of the initiative; however, it may foresee some potential trajectories for solutions development. This intuition might explain the evidence of the additional association between the word ‘market’ with ‘electronic automation’ and ‘electronic design’, both referring to possible fields of application of the pledged technologies. As we were interested to know the association between ‘covid’ and ‘patents’, we displayed the corresponding relation, which

![Figure 3. Open COVID Pledge Manifesto overview. Notes: The graph starts with the most relevant word in terms of inbound links from other words, and it shows the relation with the top linked words/couples of words in terms of outbound links. The number in brackets indicates the number of inbound links. Exceptionally, the graph includes the relation with the word ‘patents’ (which ranked very low with only 424 links) only because it is considered relevant for our interpretation. Source: Authors’ Elaboration (2021). [Colour figure can be viewed at wileyonlinelibrary.com]]
happened to be very weak, with only 424 links, albeit
the same word is ranked 9th in the list of the top 20
main words, (as detailed in Appendix C). As a final
remark, the visualization also reveals the names of
many pledgors involved, such as Microsoft, Amazon,
Seagate, Morgan Stanley, which therefore seem to
act as driving forces of the initiative great resonance.

5.2. Open COVID Pledge pledgors overview
In the second study, we investigated how pledgors
companies communicated their participation in the
OCP initiative, through the semantic analysis of
the contents of their official web pages and related
press releases. This analysis is meant to complement
the descriptive overview that we presented in para-
graph 3. The findings are depicted in Figure 4.

As for Figure 3, the main word is again ‘covid’
(with 2,947 inbound links) and its top linked words
are ‘open’, ‘pandemic’, ‘open covid’, ‘free’, ‘help’,
‘access’ and ‘fight’ and ‘property’ and ‘intellectual’,
which resemble the broader ‘types of commitment’
of the pledgor organizations. This is also visible in
the remaining displayed relations, which emphasize
the same word/couple of words. The semantic analy-
sis, therefore, suggests that, besides some exceptions
not semantically relevant, the main message commu-
nicated by the companies conforms pretty much with
the OCP’s general Manifesto.

5.3. Open COVID Pledge patents overview
In the third study, we pursued the semantic analysis
of all the available documents regarding pledged pat-
tents. We argue that this further step can enhance the
overall understanding of the pledgers’ commitment,
which is only synthesized in their official communi-
cation channels. Therefore, we applied the semantic
method to the available OCP patent cards, displayed
on the website in the ‘Featured IP’ section. The
results are shown in Figure 5.

In sum, the flow chart suggests that the showcased
patent documents semantically relate to the words
‘demand’ and ‘information’ with the words ‘man-
agement’, ‘real time’, ‘system’, ‘supply’, ‘provid-
ers’, ‘services’ and ‘request’ and ‘contextual’, ‘post’,
‘healthcare’, ‘access’, ‘systems’ and ‘network’, respec-
tively. Moreover, the relevance of these words is
also evident in the remaining set of portrayed relations,
with some specifications, such as ‘data’, ‘authentication’, ‘essential’, ‘social’, ‘resources’
and ‘devices’. Overall, these findings enrich the
descriptive analysis of featured patents exhibiting
the prevalence of the classes H04 and G06 and seem
to suggest that available technologies mainly refer
to the real-time search and analysis of contextual
information.

As the previous analysis was only based on a lim-
ited number of patent cards, we tried to enlarge our
potential pool of patent knowledge, and we retrieved
additional documents related to the OCP’s patents
through the AI-based search tool (IP Screener),39
available upon registration. Through the ‘AutoMatch
Technology’, this tool returns the top 25 patents
semantically associated with either the research ideas
proposed (first criterion) or the patents of interest
(second criterion). We applied the latter criterion, by
using the titles and abstracts of the featured patents,
and we extracted all the available information on the
related patents.40 By applying the semantic method
to this new set of patent documents and cross-
referencing the previous findings, we were able to
depict Figure 6.

Compared with Figure 5, we found, as expected,
that the range of domains and application is substan-
tially wider. Together with general words such as
‘systems’, ‘data’, ‘information’, which recall the
previous findings, the semantic analysis enucleates a full
range of new relations with the most relevant words
like ‘device’, ‘detection’ and ‘method’, which corre-
spond to a higher intensity of blue cells (about 88.9%,
which means eight out of nine pledgors’ showcased
patents display this word in the documents). Right
after, we found words like ‘medical’ (66.7%), ‘net-
work’ (66.7%), ‘input’ (66.7%), ‘detect’ (55.6%),
‘method’ (55.6%), ‘identify’ (55.6%) and ‘display’
(55.6%), which all suggest technologies related to
devices for the detection, display and monitoring of
the virus diffusion. In addition, the figure shows the
percentage of overlap between the OCP featured pat-
tents – belonging to the nine pledgors displayed in
the figure – and all the top-25 related patents. It is
interesting to note that the range varies substantially
among pledgors, with upper (71.1% of Mitsubishi
Electric Research Lab) and lower bound (7.9% of
NJIT).

6. Conclusion
We provide a semantic analysis of the available
information on the OCP, encompassing the general
overview of its Manifesto, the analysis of the pled-
gor companies and the investigation of their fea-
tured and related pledged patents. We proved the
great resonance of the initiative, which has started
an international movement of complementary efforts
all around the globe; we also emphasized the nature of participation of the founding adopters and additional pledgors, all very well-known companies with international reach and mostly with highly intense patenting activity. We enriched this analysis by deep diving into the content nature of the showcased patents and integrating these findings with the additional evidence on the related patents resulted from the employment of the AI-based search tool (IP Screener) available online. Overall, the findings suggest that the covered technologies refer to the real-time demand and search of contextual information and to the devices for virus detection. We, therefore, provide an enhanced understanding of the nature of the OCP in the direction marked by previous studies towards the need to provide contextual information, ‘ongoing stewardship and active assessment of the rights being made available’ (Contreras et al., 2020, p. 1148).

Despite this contribution, the inherent research design of the paper poses some relevant questions about the representative nature of our results. While the first two studies do not suffer from potential selection bias as we have collected all the available information related to the initiative at the broader level and the company level; the third study is driven, also in the case of the integration of the top 25 related patents, by the availability of information on the limited pool of pledged patents, whose cards were showcased in the official webpage of the OCP. As the available patent portfolios, sometimes encompass even thousands of patents, we are fully aware of the under-estimation that we might have made. Nevertheless, it is interesting to note that our evidence is perfectly in line with the declared ‘access rule’ limited solely to ‘the purpose of diagnosing, preventing, containing and treating COVID-19’. Hence, it seems that the featured IPs represent exemplary cases for potential users to learn what kind of IPs were mostly available. Another issue, which might undermine the representativeness of this study, is due to the great novelty of this OCP initiative – which is still undergoing and therefore attracting new partners and new IPs. Indeed, our results must be considered partial because they refer to the period ranging from April to August 2020. The evidence is also limited because it only refers to patents, while featured IP also encompasses other types of rights, such as copyright, that we did not include in the analysis. Besides potential bias and partiality of our findings, we should also consider that while patents are official documents, widely available and accessible (Choi et al., 2013), press releases and websites are drafted by the company press office for different purposes and are freely accessible to a wide audience (e.g. suppliers, customer and even competitors); hence, it is less likely that they contain competition-sensitive information. The edulcorated material available may represent a potential limitation of the analysis, in terms of the level of in-depth investigation that we
Figure 5. Open COVID Pledge featured patents. Notes: The graph starts with the most relevant word in terms of inbound links from other words, and it shows the relation with the top linked words/couples of words in terms of outbound links, which emerged from the semantic analysis. The number in brackets indicates the number of inbound links. Source: Authors’ Elaboration (2021). [Colour figure can be viewed at wileyonlinelibrary.com]

Figure 6. Open COVID Pledge showcased and related patents. Notes: Similarly, to Figures 3–5, the graph lists the most relevant word in terms of inbound links, and it shows the relation with the top linked words/couples of words in terms of outbound links, which emerged from the semantic analysis. Among the most relevant words, we listed only the top 38 that can also be found in the available document of OCP showcased patents. Hence, the intersection between the main words and the name of the company is colored in blue anytime the same word is also present in the available document of OCP showcased patents of that specific company, otherwise is left white. Source: Authors’ Elaboration (2021). [Colour figure can be viewed at wileyonlinelibrary.com]
could have eventually achieved. In fact, the second study based on press release and official websites of the pledgers companies was not so informative as it showed a high degree of isomorphism across organizations. Nevertheless, albeit limited in depth, the data available can be considered truthful, given the fact that companies with a high reputation, such as the OCP pledgers, are increasingly encouraged to ensure veracity and accountability in web-reported information. In addition, social scientists have recently proved the methodological relevance of web scraping and its robustness (Youtie et al., 2012; Arora et al., 2013; Gök et al., 2015). For instance, Gök et al. (2015) find that website data offer advantages in ‘coverage, currency, accessibility, quantity and flexibility’ (Gök et al., 2015, p. 668). Thus, we are confident that the combination of the data, the three levels of the study and the semantic method used overall allowed us to offer a comprehensive and real picture of the portrayed phenomenon.

For future research, we identified some potential trajectories that are worth pursuing given their impact at the single and collective level. From a company perspective, it might be interesting to understand the exact perimeter of the pledged IP portfolio, and eventually, the drivers for the selection of the IP included in the pledge. Do companies select the most or the less valuable IP to pledge? Do companies pledge the entire portfolio or do they select the IP most relevant for the achievement of the pledge aim? If the pledge encompasses only related patents, the decision burden is shifted to the participating company and, therefore, the search cost of the potential user is downsized, and this could eventually stimulate the use of the featured IP. However, this circumstance may limit the range of potential solutions that can be developed as the knowledge base available is much narrower. Same considerations apply if we consider the potential value of IP, which may not necessarily lead to valuable solutions depending on the type of users and scenario. From a collective perspective, all these questions address the relevant need to assess whether the pledge has an impact on follow-on innovations, especially in the case of ‘mission-oriented’ pledges, which are set to achieve social and philanthropic goals, such as in the pandemic. Moreover, answering these questions is also important to seize the impact of regular pledges, in comparison with other IP practices, such as patent pools and compulsory licensing.

Acknowledgements

This research has benefitted from the technical support of the innovative startup InstantTechnologies (https://instanotechnologies.com/), which has provided resources and tools to tackle the methodological challenges of this paper. We specifically thank Alessandro Paolini, Chairman and co-CEO of the company, and Marco de Biagi for copious and useful insights on data handling and analysis. Open Access Funding provided by Libera Universita Internazionale degli Studi Sociali Guido Carli within the CRUI-CARE Agreement. [Correction added on 3 June 2022, after first online publication: CRUI funding statement has been added.]

References

Amore, M.D., Schneider, C., and Žaldokas, A. (2013) Credit supply and corporate innovation. Journal of Financial Economics, 109, 3, 835–855.

Antons, D., Grünwald, E., Cichy, P., and Salge, T.O. (2020) The application of text mining methods in innovation research: current state, evolution patterns, and development priorities. R&D Management, 50, 329–351.

Aristodemou, L. and Tietze, F. (2017) A Literature Review on the State-of-the-Art on Intellectual Property Analytics. Centre for Technology Management (CTM) Working Paper Series, November 2017 (2), pp. 1–15, Cambridge, UK. https://doi.org/10.17863/CAM.13928

Aristodemou, L. and Tietze, F. (2018) The state-of-the-art on Intellectual Property Analytics (IPA): a literature review on artificial intelligence, machine learning and deep learning methods for analysing intellectual property (IP) data. World Patent Information, 55, 37–51.

Arora, A., Athreye, S., and Huang, C. (2016) The paradox of openness revisited: collaborative innovation and patenting by UK innovators. Research Policy, 45, 7, 1352–1361.

Arora, S.K., Youtie, J., Shapira, P., Gao, L., and Ma, T. (2013) Entry strategies in an emerging technology: a pilot web-based study of graphene firms. Scientometrics, 95, 3, 1189–1207.

Arts, S., Cassiman, B., and Gomez, J.C. (2017) Text matching to measure patent similarity. Strategic Management Journal, 39, 1, 62–84.

Bogers, M. (2011) The open innovation paradox: knowledge sharing and protection in R&D collaborations. European Journal of Innovation Management, 14, 1, 93–117.

Bogers, M. (2012) Knowledge sharing in open innovation: an overview of theoretical perspectives on collaborative innovation. In: Open Innovation in Firms and Public Administrations: Technologies for Value Creation. Hershey, PA: IGI Global, pp. 1–14.

Chesbrough, H.W. (2020) To recover faster from COVID-19, open up: managerial implications from an open innovation perspective. Industrial Marketing Management, 88, 410–413.

Bowman, J. (2009) The Eco-Patent Commons: Caring Through Sharing. WIPO Magazine.
Chesbrough, H. and Di Minin, A. (2014) Open social innovation. *New Frontiers in Open Innovation*, 16, 301–315.
Chien, C.V. (2015) Opening the patent system: diffusionary levers in patent law. *Southern California Law Review*, 89, 793.
Choi, S., Kim, H., Yoon, J., Kim, K., and Lee, J.Y. (2013) A SAO-based text-mining approach for technology road-mapping. *R&D Management*, 43, 1, 52–74.
Coccia, M. (2020a) Factors determining the diffusion of COVID-19 and suggested strategy to prevent future accelerated viral infectivity similar to COVID. *Science of the Total Environment*, 729, 138474.
Coccia, M. (2020b) An index to quantify environmental risk of exposure to future epidemics of the COVID-19 and similar viral agents: theory and practice. *Environmental Research*, 191, 110155.
Contreras, J.L. (2018) *The Evolving Patent Pledge Landscape*. Waterloo, CA: Centre for International Governance Innovation (CIGI). No. 166.
Contreras, J.L., Eisen, M., Ganz, A., Lemley, M., Molloy, J., Peters, D.M., and Tietze, F. (2020) Pledging intellectual property for COVID-19. *Nature Biotechnology*, 38, 1146–1149.
Contreras, J.L., Hall, B.H., and Helmers, C. (2019) Pledging patents for the public good: rise and fall of the eco-patent commons. *Houston Law Review*, 57, 61.
Contreras, J.L. and Jacob, M. (eds). (2017) *Patent Pledges: Global Perspectives on Patent Law’s Private Ordering Frontier*. Cheltenham, UK: Edward Elgar Publishing.
Coté, J.J., Haggstrom, J., Vivekanandan, R., Coté, K.A., Contreras, J.L., and Jacob, M. (eds). (2017) *Motives for Patent Pledges: A Qualitative Study*. Centre for Technology Management (CTM) Working Paper Series, October 2020 (1), pp. 1–54. https://doi.org/10.17863/CAM.58372
Di Minin, A. and Faems, D. (2013) Building appropriation advantage: an introduction to the special issue on intellectual property management. *California Management Review*, 55(4), 7–14.
Ehnsperger, J.F. and Tietze, F. (2019a) Patent pledges, open IP, or patent pools? Developing taxonomies in the thicket of terminologies. *PLoS One*, 14, 8, 1–18.
Ehnsperger, J.F. and Tietze, F. (2019b) *Motives for Patent Pledges: A Qualitative Study*. Centre for Technology Management (CTM) Working Paper Series, December 2019 (11), pp. 1–24. https://doi.org/10.17863/CAM.48822
Faems, D. (2020) Moving forward quantitative research on innovation management: a call for an inductive turn on using and presenting quantitative research. *R&D Management*, 50, 3, 352–363.
Ghazinoory, S., Ameri, F., and Farnoodi, S. (2013) An application of the text mining approach to select technology centers of excellence. *Technological Forecasting and Social Change*, 80, 5, 918–931.
Gök, A., Waterworth, A., and Shapira, P. (2015) Use of web mining in studying innovation. *Scientometrics*, 102, 1, 653–671.
Hagedoorn, J. and Zobel, A.K. (2015) The role of contracts and intellectual property rights in open innovation.
Han, E.J. and Sohn, S.Y. (2015) Patent valuation based on text mining and survival analysis. *The Journal of Technology Transfer*, 40, 5, 821–839.
Heled, Y., Santos Rutschman, A., and Vertinsky, L. (2020) The need for the tort law privileges of self-defense and necessity in intellectual property law. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3642833
Hentonen, K., Hurmelinna-Laukkanen, P., and Ritala, P. (2015) Managing the appropriability of R&D collaboration. *R&D Management*, 46, S1, 145–158.
Kim, Y.A. (2020) A critical appraisal of IBM’s patent pledge model: the impact of patent quality on open source software START-UP’s market entry decision. *World Patent Information*, 62, 101987.
Laursen, K. and Salter, A. (2014) The paradox of openness: appropriability, external search and collaboration. *Research Policy*, 43, 5, 867–878.
Lee, Y., Kim, S.Y., Song, I., Park, Y., and Shin, J. (2014) Technology opportunity identification customized to the technological capability of SMEs through two-stage patent analysis. *Scientometrics*, 100, 1, 227–244.
Leone, M.I. (2016) *Intellectual Property and Open Innovation. Unlocking the Value of Patents through Licensing*. Milan: McGraw-Hill Education.
Li, M., Liu, C., and Scott, T. (2019) Share pledges and firm value. *Pacific-Basin Finance Journal*, 55, 192–205.
Maggiolino, M. and Montagnani, M.L. (2017) Open innovation and patent pledges. In: *Patent Pledges*. Cheltenham, UK: Edward Elgar Publishing. https://doi.org/10.4337/9781785362491.00024
McGahan, A.M., Bogers, M.L., Chesbrough, H., and Holgersson, M. (2021) Tackling societal challenges with open innovation. *California Management Review*, 63, 2, 49–61. https://doi.org/10.1177/0008152520973713
Moehrle, M.G., Wustmans, M., and Gerken, J.M. (2017) How business methods accompany technological innovations – a case study using semantic patent analysis and a novel informetric measure. *R&D Management*, 48, 3, 331–342.
Moerchel, A., Tietze, F., Aristodemou, L., and Vimalnath, P. (2020a) *Unpacking Crisis-Induced Intellectual Property Challenges*. Innovation and Intellectual Property Management (IIPM) Laboratory. https://www.iipm.eng.cam.ac.uk/news/unpacking-crisis-induced-intellectual-property-challenges
Moerchel, A., Tietze, F., Aristodemou, L., and Vimalnath, P. (2020b) Identifying crisis-critical intellectual property challenges during the COVID-19 pandemic: a scenario analysis and conceptual extrapolation of innovation ecosystem dynamics using a visual mapping approach. Centre for Technology Management (CTM) Working Paper Series, October 2020 (1), pp. 1–54. https://doi.org/10.17863/CAM.58372
Pang, C. and Wang, Y. (2020) Stock pledge, risk of losing control and corporate innovation. *Journal of Corporate Finance*, 60, 101534.
Ratten, V. (2020) Coronavirus (COVID-19) and social value co-creation. *International Journal of Sociology and Social Policy*. https://doi.org/10.1108/IJSSP-06-2020-0237
Reitzig, M. (2004) Improving patent valuations for management purposes – validating new indicators by analyzing application rationales. Research Policy, 33, 6–7, 939–957.

Ritala, P. and Hurmelinna-Laukkana, P. (2013) Incremental and radical innovation in coopetition – the role of absorptive capacity and appropriability. Journal of Product Innovation Management, 30, 1, 154–169.

Ritala, P., Schneider, S., and Michailova, S. (2020) Innovation management research methods: embracing rigor and diversity. R&D Management, 50, 3, 297–308.

Srinivas, K.R. Intellectual Property Rights and Innovation in the Times of Corona Epidemic - Policy Brief., SSRN Electronic Journal, 89, 1–8. http://dx.doi.org/10.2139/ssrn.3586335.

Tietze, F., Vimalnath, P., Aristodemou, L., and Molloy, J. (2020a) Crisis-critical intellectual property: findings from the COVID-19 pandemic. Centre for Technology Management (CTM) Working Paper Series, April 2020 (2), pp. 1–19. 10.17863/CAM.51142

Tietze, F., Vimalnath, P., Aristodemou, L., and Molloy, J. (2020b) Crisis-critical intellectual property: findings from the COVID-19 pandemic. IEEE Transactions on Engineering Management.

Tseng, Y.H., Lin, C.J., and Lin, Y.I. (2007) Text mining techniques for patent analysis. Information Processing & Management, 43, 5, 1216–1247.

Wang, Q., Qiu, M., and Tan, W. (2020) Do insiders share pledging stifle innovation? Evidence from China. International Review of Financial Analysis, 72, 101570.

Wenzel, M., Stanske, S., and Lieberman, M.B. (2020) Strategic responses to crisis. Strategic Management Journal, 41.https://doi.org/10.1002/smj.3161.

Younes, G.A., Ayoubi, C., Ballester, O., de Rassenfosse, G., Foray, D., Cristelli, G., Pellegrino, G., van den Heuvel, M., Webster, E., Gaulé, P., and Zhou, L. (2020) COVID-19: Insights from innovation economists. Science and public policy. 47(5), 733-745. https://doi.org/10.1093/scipol/scaaf28

Youtie, J., Hicks, D., Shapira, P., and Horsley, T. (2012) Pathways from discovery to commercialisation: using web sources to track small and medium-sized enterprise strategies in emerging nanotechnologies. Technology Analysis & Strategic Management, 24, 10, 981–995.

Notes

1 Navigating opportunities for innovation and entrepreneurship under COVID-19, available at https://cmr.berkeley.edu/2020/06/innovation-entrepreneurship/, last accessed on July 2020.

2 The COVID-19 Open Research Dataset, aimed at publishing all of the known medical literatures on the coronavirus in a machine-readable format, has been generated through the collaboration of different partners, such as Semantic Scholar, the Allen Institute for AI and leading research groups. It is a free resource made available for the global research community, containing more than 280,000 scholarly articles on coronavirus.

The dataset is available at https://www.semanticscholar.org/cord19, last accessed on July 2020.

3 For a more comprehensive review, see Tietze et al. (2020a, pp. 4–5).

4 Medtronic Shares Ventilation Design Specifications to Accelerate Efforts to Increase Global Ventilator Production, available at http://newsroom.medtronic.com/news-releases/news-release-details/medtronic-shares-ventilation-design-specifications-accelerate/, last accessed on July 2020.

5 Emergency mask for hospital ventilators, available at https://www.isinnova.it/easy-covid19/, last accessed on August 2020.

6 Open COVID Pledge, available at https://opencovidpledge.org/, last accessed on July 2020.

7 The full list of Complementary efforts is also available at https://opencovidpledge.org/complementary-efforts/, last accessed March 2021.

8 The World Health Organization launched a voluntary COVID-19 product pool. What happens next? Available at https://www.statnews.com/pharmalot/2020/05/29/who-covid19-coronavirus-patents/, last accessed on August 2020.

9 Open COVID-19 Declaration, available at https://www.gckyoto.com/covid-2, last accessed on August 2020.

10 Putting pledged IP to work – identifying IP available under the Open COVID Pledge, available at https://opencovidpledge.org/2020/06/12/putting-pledged-ip-to-work-identifying-ip-available-under-the-open-covid-pledge/, last accessed in March 2021.

11 ‘This special issue aims to capture the evolving practice of such COVID-19 stimulated innovative efforts, to crystallize some of the lessons about the innovation approaches taken in the effort to prevent, mitigate and ultimately overcome the crisis. Through bringing together the reflections of the innovation community, firstly we strive to disseminate this emerging best practice actions to aid current and future efforts in the fight against COVID-19 and secondly, to understand how practice of these innovations may reshape the theories and approaches that our field has relied on over the last 50 years’. (R&D Management Special Issue call on ‘Providing solutions in emergencies: R&D and innovation management during COVID-19’), available at https://onlinelibrary.wiley.com/doi/abs/10.1111/1467-9310.RADM.2020.Special%20Issue.R&DM_CFP-1586946806403.pdf, last accessed in March 2021.

12 ‘The Open COVID movement goes global’, available at https://opencovidpledge.org/2020/05/21/the-open-covid-movement-goes-global/, last accessed in March 2021; ‘Internationalizing the Open COVID Pledge: Translations and Outreach’, available at https://opencovidpledge.org/2020/10/15/internationalizing-the-open-covid-pledge-translations-and-outreach/, last accessed in March 2021.

13 The literature on the topic of pledges involves different types of pledges, besides patents’ one, such as share and
Open COVID Pledge Patents to fight against COVID-19

Founding adopters are pledgors that have joined the cause in April 2020; the additional pledgors have married the cause in a later stage. As of the 20th of August 2020 – our cut-off point – there were 29 listed on OCP Official website.

For a comprehensive review of patent pledges, see [Open COVID Pledge, last accessed on September 2020](https://opencovidpledge.org/about/), latest accessed in March 2021.

OCL-P v1., available at [https://opencovidpledge.org/licenses__trash__v1-1-ocl-p/](https://opencovidpledge.org/licenses__trash__v1-1-ocl-p/), last accessed on August 2020.

The three options are namely Open COVID Standard Licenses (standard), Open COVID Compatible Licenses; and Open COVID Alternative Licenses. More information available at [https://opencovidpledge.org/licenses/](https://opencovidpledge.org/licenses/).

Collected data referred either to year 2019 or to year 2020, which is the latest available record on ORBIS or Nexis Uni dataset. For Unified Patents, Sandia National Laboratories, Nasa JPL, OVSI and Semantic Scholar, no information on revenues was found (n.a.).

Orbis (comparable data resource on private companies), available at [neworbis.bvdinfo.com/](http://neworbis.bvdinfo.com/); Nexis Uni (dynamic research tool connecting you to comprehensive content for accurate, targeted searches), available at [http://www.nexisuni.com](http://www.nexisuni.com). In particular, most data have been extracted from Nexis Uni relying mainly on Zoom Company Information.
For the sake of clarity, we select only the top linked words, but the overall knowledge base analyzed is available upon requests. Moreover, we provide the list of the top 20 main words with their top linked words, to allow a more comprehensive view of the findings of the semantic analysis. These tables, available for Figures C1–C3, included in Appendix C, should be read as companion documents for a complete understanding.

Those cards are created ad hoc for the initiative and translate the content of the patent documents into more friendly-to-use information, allowing for a more effective search of interested IP from outsiders. Full information is accessible at https://opencovidpledge.org/partner-ip/. For our research, the patent cards taken into account were those displayed until the 20th of August with a specific link to a well-defined patent (generic referrals to pledged technologies were excluded).

Search Open COVID Pledged IP, available at https://opencovidpledge.org/ip/, last accessed on September 2020.

Our analysis dates back to the 20th of August 2020, in line with other data extraction activities.

Amaz on, Facebook, Hewlett Packard Enterprise, IBM, Microsoft and Sandia National Laboratories join “Open COVID Pledge” to make patents freely available in the fight against COVID-19’, available at https://opencovidpledge.org/2020/04/20/amazon-facebook-hewlett-packard-enterprise-ibm-microsoft-and-sandia-national-laboratories-join-open-covid-pledge-to-make-patents-freeley-available-in-the-fight-against-covid-19-2/, last accessed in March 2021.

Ginevra Assia Antonelli is a PhD student and Research Assistant at Luiss University. Her research interests lie in Innovation Management and, specifically, in the intersection between Open Innovation behaviors and new Intellectual Property practices.

Maria Isabella Leone is Associate Professor of Innovation Management and Faculty Member of the PhD Program in Management at Luiss University. She acts also as the Academic Coordinator of the MBA programs, the Director of the Open Innovation and Intellectual Property Master and the Director of the Executive Flex Course in Venture Capital Dynamics and Startup Engagement at Luiss Business School. She is also a Certified Innovation Manager by the Ministry of Economic Development. She is one of the PhD Supervisors of the Early-stage researchers recruited within the ‘EINST4INE-European Training Network for Industry Digital Transformation across Innovation Ecosystems’ Project, funded under the EU Fund Horizon 2020, and she also co-leads two tasks on entrepreneurial spaces, start-ups and business development, within the ENGAGE.EU consortium, selected as one of the 2020 European Universities Alliances, funded under the Erasmus Plus and Horizon 2020 Program. In 2008, she obtained a PhD in Management from the University of Bologna. Her research focuses on Open Innovation practices, including (patent/trademark) licensing strategies, and on the interplay between Open Innovation and Intellectual Property rights.

Riccardo Ricci is Partner and CTO of InstanTechnologies and Head of AI. He is a pioneer in the semantic and artificial intelligence field. For 25 years, he has been developing software and algorithms in these areas.
APPENDIX A
Showcased OCP patents statistics

| Assignee   | Patent ID Number | Granted Year | Tech Class IPC | Claims | Patent Blw cites | Non-patent Blw cites | All Blw cites | Fed cites |
|------------|------------------|--------------|----------------|--------|-----------------|----------------------|---------------|-----------|
| AT&T       | US5795836B2      | 2007         | G06            | 19     | 133             | 133                  | 28            |           |
| AT&T       | US20190187436A1  | Pending      | G06            | 20     | n.a.            | n.a.                 | n.a.          | n.a.      |
| Facebook   | US20190163794A1  | Pending      | G06            | 20     | n.a.            | n.a.                 | n.a.          | n.a.      |
| Fujitsu    | US20200116962A1  | Pending      | G06            | 15     | 3               | -                    | 3            |          |
| Fujitsu    | US20190179909A1  | Pending      | G06            | 8      | n.a.            | n.a.                 | n.a.          | n.a.      |
| IBM        | US9682109B2      | 2017         | A61            | 22     | 11              | 11                   | 22           | 1         |
| IBM        | US9772714B2      | 2017         | A61            | 7      | 15              | 11                   | 26           | 7         |
| Intel      | US20200128006A1  | Pending      | G06            | 20     | 31              | 0                    | 31           | 54        |
| Mitsubishi Electric | US2018103116A1 | 2019         | H04            | 20     | 12              | 0                    | 12           | 1         |
| Mitsubishi Electric | US10514437B2 | 2019         | G01            | 20     | 19              | 5                    | 24           | 3         |
| Mitsubishi Electric | US10425915B1 | 2019         | H04            | 20     | 10              | 2                    | 12           | 2         |
| Mitsubishi Electric | US9282518B1 | 2016         | H04            | 12     | 18              | 0                    | 18           | 5         |
| Mitsubishi Electric | US8654246B2 | 2011         | H04            | 8      | 7               | 0                    | 7            | 24        |
| Mitsubishi Electric | US7729688B2 | 2010         | H04            | 9      | 3               | 4                    | 3            |           |
| NLT        | -                | Pending      | -              | n.a.  | n.a.            | n.a.                 | n.a.          | n.a.      |
| NTT        | Open Source      | -            | n.a.           | n.a.  | n.a.            | n.a.                 | n.a.          | n.a.      |
| NTT        | Open Source      | -            | n.a.           | n.a.  | n.a.            | n.a.                 | n.a.          | n.a.      |
| Sanda      | US9568667B1      | 2017         | B01            | 18     | 8               | 3                    | 11           | 2         |
| Sanda      | US18631545B1     | 2012         | B01            | 23     | 8               | 22                   | 30           | 5         |
| Sanda      | US7527977B1      | 2009         | G01            | 25     | 10              | 5                    | 15           | 15        |
| Uber       | US10563994B2     | 2020         | G01            | 20     | 9               | 1                    | 10           | 5         |
| Uber       | US10460411B2     | 2019         | G06            | 20     | 98              | 9                    | 107          | 4         |

Source: Authors’ Elaboration (2021)

APPENDIX B
Data source details

**Level of information**

| Data sources | Volume | Uris (latest accessed: 30th August 2020) |
|--------------|--------|----------------------------------------|
| World wide web | Websites | # 1974 web pages |
|              |         | https://www.clinicaltrials.gov/ct2/results?cond=Open COVID Pledge&term=COVID-19&cntry= &indpan= &status= &condIntxnType= &rank= &foc= &focType= | |
|              |         | https://www.research.gov/prime/results?cond=Open COVID Pledge&term=COVID-19&cntry= &indpan= &status= &condIntxnType= &rank= &foc= &focType= | |
|              |         | https://www.medicinenet.com/conditions-openCOVID-pledge.html | |
|              |         | https://www.gut.org/papers/ | |
|              |         | https://www.who.int/ | |
|              |         | https://www.clinicaltrials.gov/ct2/results?cond=Open COVID Pledge&term=COVID-19&cntry= &indpan= &status= &condIntxnType= &rank= &foc= &focType= | |
|              |         | https://www.medicinenet.com/conditions-openCOVID-pledge.html | |
|              |         | https://www.clinicaltrials.gov/ct2/results?cond=Open COVID Pledge&term=COVID-19&cntry= &indpan= &status= &condIntxnType= &rank= &foc= &focType= | |
|              |         | https://www.gut.org/papers/ | |
|              |         | https://www.who.int/ | |
|              |         | https://www.clinicaltrials.gov/ct2/results?cond=Open COVID Pledge&term=COVID-19&cntry= &indpan= &status= &condIntxnType= &rank= &foc= &focType= | |
|              |         | https://www.gut.org/papers/ | |
|              |         | https://www.who.int/ | |
|              |         | https://www.clinicaltrials.gov/ct2/results?cond=Open COVID Pledge&term=COVID-19&cntry= &indpan= &status= &condIntxnType= &rank= &foc= &focType= | |
|              |         | https://www.gut.org/papers/ | |
|              |         | https://www.who.int/ | |
|              |         | https://www.clinicaltrials.gov/ct2/results?cond=Open COVID Pledge&term=COVID-19&cntry= &indpan= &status= &condIntxnType= &rank= &foc= &focType= | |
|              |         | https://www.gut.org/papers/ | |
|              |         | https://www.who.int/ | |
|              |         | https://www.clinicaltrials.gov/ct2/results?cond=Open COVID Pledge&term=COVID-19&cntry= &indpan= &status= &condIntxnType= &rank= &foc= &focType= | |
|              |         | https://www.gut.org/papers/ | |
|              |         | https://www.who.int/ | |

Source: Authors’ Elaboration (2021)
| Rank | Main word (H1) | Inbound links | Rank | Main word (H1) | Inbound links | Rank | Main word (H1) | Inbound links | Rank | Main word (H1) | Inbound links | Rank | Main word (H1) | Inbound links | Rank | Main word (H1) | Inbound links |
|------|----------------|---------------|------|----------------|---------------|------|----------------|---------------|------|----------------|---------------|------|----------------|---------------|------|----------------|---------------|
| 1    | covid          | 1050          | 238  | computer       | 1581          | 270  | light          | 976           | 503  | hand-washing   | 213           | 541  | medical        | 176           | 568  | technology     | 307           |
| 2    | covid          | 976           | 239  | covid          | 866           | 280  | covid          | 970           | 505  | light          | 217           | 554  | medical        | 118           | 561  | technology     | 308           |
| 3    | computer       | 176           | 240  | covid          | 850           | 281  | computer       | 966           | 509  | hand-washing   | 213           | 567  | medical        | 116           | 560  | technology     | 306           |
| 4    | covid          | 118           | 241  | computer       | 853           | 282  | computer       | 965           | 510  | light          | 211           | 568  | technology     | 305           | 564  | technology     | 307           |
| 5    | computer       | 116           | 242  | covid          | 858           | 283  | computer       | 964           | 511  | hand-washing   | 211           | 569  | medical        | 115           | 561  | technology     | 306           |

Source: Authors’ Elaboration (2021)
### Open COVID Pledge Patents to fight against COVID-19

#### Figure C2

| Inbound links | Main word (M1) | Inbound links | Main word (M2) | Inbound links | Main word (M3) | Inbound links | Main word (M4) | Inbound links | Main word (M5) |
|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|
| 2550          | open           | 246           | patent         | 711           | pledge         | 701           | private        | 406           | protect        |
| 3120          | open           | 454           | patent         | 715           | pledge         | 724           | property       | 404           | protect        |
| 3120          | open           | 454           | patent         | 715           | pledge         | 724           | property       | 404           | protect        |
| 3120          | open           | 454           | patent         | 715           | pledge         | 724           | property       | 404           | protect        |
| 3120          | open           | 454           | patent         | 715           | pledge         | 724           | property       | 404           | protect        |
| 3120          | open           | 454           | patent         | 715           | pledge         | 724           | property       | 404           | protect        |

**Source:** Authors’ Elaboration (2021)
### Inbound Links

| Main word (H1) | Main word (H2) | Main word (H3) | Main word (H4) | Main word (H5) | Main word (H6) |
|---------------|---------------|---------------|---------------|---------------|---------------|
| demand        | services      | 182           | evaluated     | 154           | authentication|

**Figure C3**

---

**Source:** Authors’ Elaboration (2021)