Digital News Media as a Social Resilience Proxy: A Computational Political Economy Perspective

Paško Bilić
Department for Culture and Communications
Institute for Development and International Relations
Lj. F. Vukotinovića 2
10000 Zagreb
Croatia
pasko@irmo.hr
https://irmo.hr/djelatnici/pasko-bilic/

David Dukić, Lucija Arambašić, Matej Gjurković, Jan Šnajder
Faculty of Electrical Engineering and Computing
University of Zagreb
TakeLab
Unska 3
10000 Zagreb
Croatia
{david.dukic,lucija.arambasic,matej.gjurkovic,jan.snajder}@fer.hr
https://takelab.fer.hr

1 Introduction

In this paper, we argue that the digital news media can serve as a proxy for evaluating social resilience during the COVID-19 pandemic. News media deliver meanings that frame the perception of relevant issues in the public sphere. Mediated public sphere can best be described as "a network for communicating information and points of view (i.e., opinions expressing affirmative or negative attitudes)" in which streams of communication are "filtered and synthesized in such a way that they coalesce into bundles of topically specific public opinions" (Habermas, 1996a, p. 360). Agreement on issues and contributions in the media emerges as "the result of more or less exhaustive controversy in which proposals, information, and reasons can be more or less rationally dealt with" (Habermas, 1996a, p. 362). However, in the last thirty years the concept of an agreement-based public sphere (Calhoun and McCarthy, 1992; Habermas, 1987, 1991, 1996a,b) was re-considered, re-framed, and rejected ad nauseam. List of factors limiting the public sphere includes fragmentation (Dahlberg, 2007), media concentration (Baker, 2006; McChesney, 2013), commodification (Calabrese and Sparks, 2003; Mosco, 2009), social media (Fuchs, 2014), digital intermediaries (Mansell, 2015a,b), automation (Pasquale, 2017), post-democracy (Crouch, 2016, 2019), fake democracy (Fenton, 2018), and disinformation (Iosifidis and Nicoli, 2020; Pickard, 2019). While political and economic realities of contemporary public spheres are far removed from Habermas' consensus ideal, the COVID-19 emergency painfully exposed the need for just such a rational space in which citizens could find information on how to cope, adapt and overcome a health crisis. When physical mobility was limited, the media served as a focal point for understanding social relations affected by the pandemic. We observe the produced news content from a political economy perspective. More precisely, we look at journalism and news as outcome of specific market and governance structures. To this end, we turn to computational analysis methods, which provide us with the ability to process vast amounts of news data. On the scale of almost one million articles, the manual analysis from a political economy perspective would be infeasible. Therefore, it seemed logical to pair the computational methods of natural language processing with minimal human effort to conduct such research.

2 Social Resilience

Resilience was first introduced in the 1970s in discussions of non-linear dynamics of natural ecosystems (Holling, 1973). Ecosystems are cyclical and exhibit multiple stable stages. The level of their resilience depends on how they are able to absorb changes and disturbances. The concept has since evolved to address social-ecological systems, adaptations of humans to nature, and social transformations in the face of global change (Béné et al., 2012; Keck and Sakdapolrak, 2013; Lorenz, 2013; Obrist et al., 2010; Voss, 2008). As a multi-layered phenomenon it consists of enabling factors and capacities operating at different levels of the environment-society relation (Obrist et al., 2010). Coping capacity encapsulates how people cope with and overcome immediate threats with the resources that are available to them. It indicates the ability to restore one's well-being immediately after a critical event. Adaptive capacity includes "pro-active" mechanisms that people employ in order to sustain their present level of well-being in the face of future risks. The difference between coping and adaptive capacities is temporal. The former refers to a short-term rationale and tactical planning while the latter involves long-term and strategic thinking. The third dimension comprises transformative capacities or "participative capacities" (Lorenz, 2013), which focus on people's ability to access assets and assistance from the wider socio-political arena, such as governmental organizations and the civil society sector. This includes the ability to craft institutions that enhance people's well-being for dealing with future risks.

The concept of social resilience is becoming increasingly complex and is being used in a variety of developmental and policy debates. Yet the question of how we define the social system, whose resilience is in question, needs to be further addressed. Since we are focusing on the mediated public sphere, we are looking at a, primarily, profit-oriented industry that speeds up the circulation of capital by absorbing advertising investments (Bilić et al., 2021). Resilience, therefore, becomes an issue of sustainability of capitalism (Chandler, 2020; Fernando, 2020b,a; Hornborg, 2021) in light of environmental, biological harms. Social resilience implies resilience of highly commercialized communication systems in which mediated public spheres and public communication are embedded.

3 Digital News Media and the Public Sphere in the Platform Economy

Research on digital newsrooms gained comparatively less attention when studying the digital public sphere than internet technology in general, and social media in particular. Yet, regardless of the digital distribution mechanism, newsrooms can still perform traditional news production practices and should, in principle, be able to adhere to traditional norms and professional standards when framing public issues. As Habermas pointed out, journalists "collect information, make decisions about the selection and presentation of "programs," and to a certain extent control the entry of topics, contributions, and authors into the mass-media dominated public sphere. (. . .) These selection processes become the source of new sort of power (Habermas, 1996a, p. 377). Journalism can be considered a public good (Pickard, 2013, 2015) and even as a public sphere in itself (McNair, 2018). Yet, in highly commercialized media systems, journalism is often in crisis (McChesney, 2003; McChesney and Pickard, 2011; Pickard, 2019; Russial et al., 2015).

The "digital crisis" is structurally tied to the platform economy (Jin, 2015; Kenney, 2016; Kenney and Zysman, 2019; Langley and Leyshon, 2017; Montalban et al., 2019; Srnicek, 2017). It displaces mass media as central institutions addressing large audiences, which has far-reaching consequences. First, as companies offering search, access, and sharing of content establish dominant businesses, and the market offers few alternatives, user practices become patterned and predictable. "Side-door" access to news via social media, search, mobile alerts, aggregators, or email is becoming dominant (73%) worldwide (Newman et al., 2021). Companies offering access frame user activities instrumentally through "technological forms" that commodify usage data and grow profits (Bilić et al., 2021). Second, as users become tied to access services, advertising industry follows suit and a "new advertising food chain" emerges (Couldry and Turow, 2014; Turow, 2011). The end result is that Google and Facebook capture a vast majority of internet advertising investments worldwide (Bilić et al., 2021; Bilić and Primorac, 2018; McChesney, 2013; Pickard, 2022). In such market conditions digital newsrooms struggle to establish viable business models based on advertising. They easily turn to lighter topics, short-term thinking, and chasing

scandals to draw attention from their audiences. Third, public governance structures of the digital public sphere are weak and inconsistent. Platform regulation is slowly gaining more attention from a wide array of scholars (Flew, 2021, 2022; Winseck, 2020). Yet normative standards for regulating the internet are still unclear (Tambini, 2021). Public policies are nascent and underdeveloped in areas ranging from privacy protection and media pluralism, to taxation, merger rules, and competition policy.

4   The Context of the Pandemic in Croatia

Previously mentioned trends are clearly recognizable in Croatia. Between 2017 and 2020, digital news audiences preferred (69.6%) side-door access to news (i.e., through social media, search engines, news aggregators, and mobile notifications) (Peruško and Vozab, 2021). According to academic estimates (Bilić et al., 2021; Bilić and Primorac, 2018), Google and Facebook duopoly captured 76 percent of the digital advertising market in 2017. In 2020, the digital market value was 77 million €[1] (Europe, 2021). Governance structures for regulating platforms and the digital public sphere are weak and underdeveloped. There is no taxation of the platform economy.
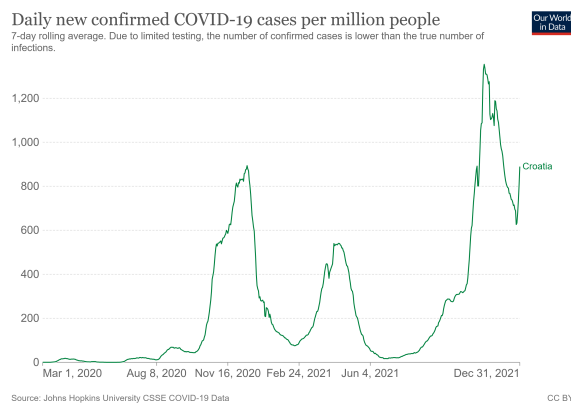

Figure 1: Daily new confirmed COVID-19 cases.

However, an institutional mechanism for supporting media pluralism and diversity online exists. The Croatian Radio-television (HRT), the public service medium, is funded through a license fee.[2] A legally defined and fixed percentage (3%) of the fee is directed to the so-called Fund for the pro-

motion of pluralism and diversity of the media, managed by the Agency for Electronic Media. The Fund is one of the main sources of income for non-profit media in Croatia publishing critical pieces on human rights, democracy, gender equality, migration, political corruption, ecology, and other topics relevant to the public. In this study, we analysed commercial, public service, and non-profit digital news media to capture a wide spectrum of private and public governance structures shaping available news in the public sphere.
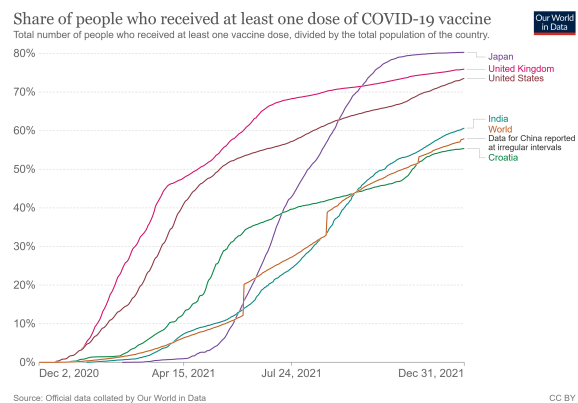

Figure 2: Share of people who received at least one dose of vaccine.

To capture the dynamic between the social and biological system in line with theories of social resilience, we used the data on daily new confirmed (7 day rolling average) COVID-19 cases (Figure 1). The fluctuation of new cases in 2020 and 2021 can be roughly divided into four waves. During the first wave (1 January 2020 - 30 September 2020), the Minister of Health declared the pandemic on 11 March 2020, 15 days after the first case was recorded. The Government soon formed the Civil Protection Headquarters (CPH) responsible for introducing lockdowns, mandatory face masks, and other measures. In late March, the Scientific Council (SC) was formed to advise the Government. Strict lockdown and mobility restrictions kept the number of infections under control. Public debates focused on the impact on the health sector, hospital capacity, the economy and the tourism industry. In September 2020, a "Festival of freedom" was held in Zagreb with protests against measures imposed by the CPH. During the second wave (1 October 2020 - 28 February 2021), a conflict within the SC occurred. Some argued that strong measures and lockdowns are essential before a successful vaccine is approved and rolled out. A minority

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[1]The biggest market in Europe is the UK which was 22.58 billion € in 2020.

[2]A small percentage (around 10 percent) of its annual budget is from advertising.

argued for a flexible and open approach, relativizing the pandemic. While the first wave introduced strict measures, the second wave, despite an obvious increase of daily cases and deaths, was less strict. On 6 December, scientists (some from the SC) signed an appeal to the Government demanding stronger measures. In December, first vaccines arrived (Pfizer and Bio NTech).
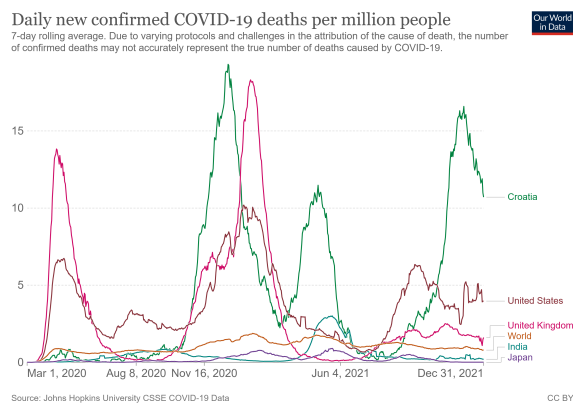

Figure 3: Daily new confirmed deaths per million.

The third wave (1 March 2021 – 31 July 2021) was marked by a slow increase of vaccinated people. Mass vaccinations started in the capital city of Zagreb in April. The public debate focused on the effectiveness and potential side-effects of different vaccines, especially Astra Zeneca. The Government announced the roll-out of digital COVID certificates in June to allow international travel and access to public institutions. Certificates took effect in July 2021 for the entire European Union. Conflicts within the SC were becoming more emphasized as some members were questioning the effectiveness of the vaccine in slowing the pandemic. In late July 2021, the Croatian Medical Chamber and the Croatian Association of Hospital Doctors requested for controversial members of the SC to be removed. During the fourth wave (1 August 2021 – 31 December 2021), the biggest anti-vaccination and anti-mask protests were held on 20 November 2021 in Zagreb. Right-wing political parties organized the collection of signatures in December 2021 to open a referendum against COVID certificates and the CPH.[3] By the end of 2021, Croatia was ranked below the world average (Figure 2) of the share of people who received at least one dose of vaccine (55.3%). At the same time, the daily new confirmed COVID-19 deaths

per million people (Figure 3) was well above the world average (10.71).

5 Methodology

We conducted the analysis of the news articles with the natural language processing methods in four stages:

1. Gathering the articles and their metadata from Croatian news portals,

2. Manual coding of a representative sample drawn from collected article corpora,

3. Development of three predictive statistical models (classifiers) of different complexity that rely on the coded samples to draw patterns and make inferences from the data, and

4. Application of the developed classifiers onto entire collected news corpora.

The 985,850 news articles from 21 Croatian news portals for 2020 and 2021 were collected using a web-scraping system called "TakeLab Retriever", developed at the University of Zagreb, Faculty of Electrical Engineering and Computing. After the article data and metadata were gathered, the coding process started. Further, because not all gathered articles pertained to the coronavirus pandemic, we needed a way to filter out those that did not. Since scaling to many documents was a necessary step, we needed to train our first classifier to discriminate between coronavirus articles and the rest. A stratified sample was drawn from collected articles based on the published date and portal information and coded with "coronavirus yes/no" labels to provide data for training the binary classifier. The coding process was carried out by three coders using a machine learning-powered annotation system Alanno.[4] The coded sample of around 2,000 articles was used to train the binary coronavirus classifier. Data pre-processing pipeline included lowercasing and lemmatization. The model that performed best on the held-out portion of labeled data was a TF-IDF vectorizer combined with a support vector machine (SVM) model (Boser et al., 1992). The TF-IDF vectorizer works by converting each term in the article document into a real-valued number, calculated as a product of the term frequency (TF) and the inverse document frequency (IDF). The product of these terms measures how

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[3]The Constitutional Court rejected the initiative in 2022.

[4]https://alanno.takelab.fer.hr/

relevant each term is for discriminating the article in question from the rest. The TF-IDF scores for each term are then concatenated into a vector and fed into the SVM classifier. The application of the classifier onto assembled article corpora resulted in N = 147,050 "coronavirus yes" predictions equal to 14.9% of all collected news articles.

We trained two more classifiers for further analysis of the coronavirus articles from the perspective of the topics and resilience. For this purpose, a random sample of coronavirus articles was coded with topic and resilience labels. Both types of codings were limited to assigning only the one label that is dominant in the article. To classify each coronavirus article into five predefined topics ("politics", "economy", "science", "statistics", and "society"), we developed a topic classifier with FastText Croatian word embeddings to represent each article as a vector.[5] Then, an ensemble of logistic regression (LR) and SVM was trained on the labeled data set to enable the prediction of topics on coronavirus article data. Given the nature of news articles, which can discuss multiple topics in one article, and the fact that the coders picked the dominant label, the topic prediction was made by splitting articles by words into four[6] equal parts and then predicting the topic for each split. Afterward, the majority topic was picked as the topic of the entire article.

The last model we developed was used to classify each article into one of three resilience classes ("coping", "adaptation", and "transformation"). We used the BERT model, a large deep learning model imbued with linguistic information, pretrained on news articles written in Bosnian, Croatian, Montenegrin, and Serbian (Ljubešić and Lauc, 2021). We then fine-tuned the model on the labeled resilience data.

According to the task difficulty, the developed classifiers were of different complexity that gradually increased from the coronavirus classifier to the resilience classifier. The binary coronavirus classification task was the simplest and could be solved with traditional statistical models. On the other hand, topic and resilience classification problems proved to be more complex and required the models to exploit the semantic properties of news articles. This was enabled by FastText embeddings and the BERT model for topic and resilience classifiers, respectively.

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[5]https://fasttext.cc/
[6]Splitting the article into four parts gave the best performance.

After the training was completed, topic and resilience classifiers were applied to all articles obtained with the coronavirus classifier. The resilience classifier was not applied to the articles labeled with the topic "statistics". These articles report daily new infections and deaths and therefore do not convey any resilience information.

6 Results

This section presents the classification results with percentages of data for each predicted class grouped by four waves.

Table 1: Percentage of coronavirus articles per portal (total number of detected articles in corpus was 147,050).

Portal	Percentage	Media type
index.hr	14.25%	private
tportal.hr	14.20%	private
direktno.hr	10.73%	private
hr.n1info.com	8.46%	private
slobodnadalmacija.hr	7.99%	private
dnevno.hr	7.09%	private
hrt.hr	6.60%	public
novilist.hr	5.39%	private
net.hr	5.05%	private
glas-slavonije.hr	4.87%	private
vecernji.hr	4.05%	private
jutarnji.hr	3.39%	private
dnevnik.hr	2.92%	private
rtl.hr	2.27%	private
24sata.hr	1.68%	private
telegram.hr	0.51%	private
tris.com.hr	0.31%	non-profit
lupiga.com	0.10%	non-profit
h-alter.org	0.08%	non-profit
forum.tm	0.03%	non-profit
crol.hr	0.01%	non-profit

In the first wave (1 January 2020 - 30 September 2020) the main topic covered by all news media was politics (29.9%, see Table 2a), mostly related to mobility restrictions, legal justification for lockdowns and other measures, establishment of the CPH, institutional mechanisms for declaring the pandemic, and so on. Other covered topics were society (25.2%) and the impact of the pandemic on everyday life; economy (21.0%) and effects of lockdown on the GDP, public finances, and public health services; science (14.6%) and research on the virus and the vaccine; and statistics (9.3%) on new infections and deaths. If we look at resilience in general (see Table 2b), news focused on

Table 2: Topic and resilience prediction results for all available portals.

(a) Percentage of articles per topic per wave.

topic	wave 1	wave 2	wave 3	wave 4
politics	29.9%	26.9%	27.6%	28.5%
society	25.2%	17.7%	15.0%	13.8%
economy	21.0%	19.0%	18.0%	14.1%
science	14.6%	25.6%	30.3%	34.7%
statistics	9.3%	10.8%	9.1%	9.0%

(b) Percentage of articles per resilience per wave.

resilience	wave 1	wave 2	wave 3	wave 4
coping	64.1%	51.6%	38.8%	38.3%
adaptation	33.2%	43.1%	47.8%	40.6%
transformation	2.7%	5.3%	13.3%	21.1%

Table 3: Topic and resilience prediction results for privately owned portals.

(a) Percentage of articles per topic per wave.

topic	wave 1	wave 2	wave 3	wave 4
politics	30.3%	26.6%	27.3%	28.3%
society	24.6%	17.8%	15.0%	14.1%
economy	21.4%	19.4%	18.3%	14.2%
science	14.7%	25.4%	30.2%	34.4%
statistics	8.9%	10.8%	9.2%	8.9%

(b) Percentage of articles per resilience per wave.

resilience	wave 1	wave 2	wave 3	wave 4
coping	64.1%	52.5%	40.0%	38.7%
adaptation	33.2%	42.2%	46.3%	39.7%
transformation	2.7%	5.3%	13.7%	21.6%

Table 4: Topic and resilience prediction results for articles from public portals.

(a) Percentage of articles per topic per wave.

topic	wave 1	wave 2	wave 3	wave 4
society	37.9%	16.1%	14.8%	10.1%
statistics	19.5%	11.6%	9.0%	10.0%
politics	19.1%	27.6%	29.9%	30.1%
economy	11.8%	14.9%	15.4%	12.6%
science	11.7%	29.9%	30.9%	37.3%

(b) Percentage of articles per resilience per wave.

resilience	wave 1	wave 2	wave 3	wave 4
coping	65.1%	38.8%	28.7%	32.8%
adaptation	34.0%	56.9%	62.1%	53.1%
transformation	0.9%	4.3%	9.2%	14.2%

the coping capacity (64.1%), or dealing with immediate threats with available resources, adaptation (33.2%), and transformation (2.7%). This is not

Table 5: Topic and resilience prediction results for articles from non-profit portals.

(a) Percentage of articles per topic per wave.

topic	wave 1	wave 2	wave 3	wave 4
politics	39.2%	42.6%	39.3%	46.5%
society	22.6%	18.5%	22.3%	7.9%
economy	19.4%	17.8%	12.5%	6.1%
science	18.8%	16.4%	25.9%	38.6%
statistics	0.0%	4.7%	0.0%	0.9%

(b) Percentage of articles per resilience per wave.

resilience	wave 1	wave 2	wave 3	wave 4
coping	52.2%	54.8%	30.4%	36.3%
adaptation	27.4%	31.5%	33.0%	28.3%
transformation	20.4%	13.7%	36.6%	35.4%

Table 6: Co-occurrence of topics with resilience predictions per waves for all available portals.

(a) Politics

resilience	wave 1	wave 2	wave 3	wave 4
coping	62.1%	52.3%	38.5%	40.3%
adaptation	35.5%	43.2%	47.4%	38.4%
transformation	2.3%	4.5%	14.1%	21.3%

(b) Society

resilience	wave 1	wave 2	wave 3	wave 4
coping	90.1%	86.4%	77.5%	78.5%
adaptation	9.8%	13.0%	19.8%	17.1%
transformation	0.2%	0.7%	2.7%	4.3%

(c) Economy

resilience	wave 1	wave 2	wave 3	wave 4
coping	48.4%	47.5%	35.9%	37.2%
adaptation	46.6%	47.1%	51.6%	47.4%
transformation	5.0%	5.4%	12.5%	15.4%

(d) Science

resilience	wave 1	wave 2	wave 3	wave 4
adaptation	49.3%	60.9%	59.9%	48.9%
coping	45.8%	29.7%	21.7%	21.0%
transformation	4.8%	9.4%	18.4%	30.1%

surprising given non-existing medical treatments. From Table 6 can be seen that politics (62.1%), society (90.1%), and the economy (48.4%) mostly co-occur with coping capacity. Science (49.3%), on the other hand, was primarily connected to the adaptive capacity, which means "pro-active" mechanisms and strategic thinking to sustain the present level of well-being. Looking at the governance structures, private news organizations (Table 3) published mostly on politics (30.3%) as a topic and coping (64.1%) as a capacity; public service

media (Table 4) on society (37.9%) and coping (65.1%); and non-profit media (Table 5) on politics (39.2%) and coping (52.2%).

In the second wave (1 October 2020 - 28 February 2021), politics (26.9%) remains the main topic covered by all news media, closely followed by science (25.6%). Coping capacity is generally discussed (51.6%), although to a lesser degree compared to the first wave. As first vaccines arrived, adaptive capacity became more emphasized (43.1%). Politics (52.3%), society (86.4%), and the economy (47.5%) co-occur with the coping capacity, although adaptation in connection to these topics is also on the rise. Adaptation is primarily connected to science (60.9%). Private media still focus on politics (26.6%), closely followed by science (25.4%). Resilience is discussed through coping (52.5%) and adaptive (42.2%) capacity. Public service media shifted focus from society to science (29.9%) in the second wave, also discussing adaptation (56.9%) resilience. Non-profit media saw a slight increase in their focus on politics (42.6%) and coping (54.8%) capacity.

In the third wave (1 March 2021 – 31 July 2021) science (30.3%) becomes the main topic of discussion for all news media. With mass vaccinations in April, adaptation (47.3%) becomes the main focus of social resilience. Society (77.5%) is still co-occurring with the coping capacity, although now to a lesser degree. Politics (47.4%) and the economy (51.6%) are connected with the adaptive capacity. During this time, key events were preparation of the COVID digital certificates, and the upcoming tourist season. The national GDP fell by 8.4% in 2020, primarily because of mobility restrictions which had a strong effect on the service sector and international tourist arrivals. Science (59.9%) is still discussed as a primary topic connected to the adaptive capacity. Private media focused primarily on science (30.2%) and the adaptive (46.3%) resilience capacity. Public service media focus on science (30.9%) and predominantly on the adaptive capacity (62.1%). Non-profit media still focus on politics (39.3%) but have started discussing transformative resilience capacity (36.6%). Transformative capacity relates to long-term thinking, "participative capacities" and the ability to craft institutions that enhance people's well-being for dealing with future risks. While transformative resilience was to be expected in the third wave, as multiple vaccines and institutional mechanisms for

tackling the pandemic were available, mainstream media did not provide such a discussion. Non-profit media focused on resilience of political institutions and ecological issues. But they only contributed with 0.53% (see Table 1) of the total volume of COVID-19 related news in 2020 and 2021.

In the fourth wave (1 August 2021 – 31 December 2021), science gains more emphasis (34.7%) along with adaptation (40.6%) for all media. Politics (40.3%) and society (78.5%) are co-occurring with coping capacity, economy (51.6%) and science (48.9%) with adaptive capacity. Science is now more closely related to transformation (30.1%) than in the previous waves. However, discussions were dominated by natural sciences. Social sciences and humanities were much less prominent during the entire course of the pandemic. Private news media focus on science (34.4%) and adaptive resilience (39.7%), closely followed by coping (38.7%). The focus on science (37.3%) is slightly more emphasized with public service media. Public media predominantly discuss adaptive resilience (53.1%). Non-profit media continue to focus on two topics: politics (46.5%) and science (38.6%). Resilience is mostly focused on coping (36.3%) and transforming (35.4%). The continued focus on politics is the result of critical pieces written on government policies and decisions in managing the pandemic.

7 Discussion

By the end of 2021, Croatia was a country with a low vaccination rate and high COVID-19 death rate. There was limited media discussion of transformative resilience, especially in private media that contributed with the biggest content share (92.85%, see Table 1). Most news were reactive, not proactive. The debate focused on keeping the status quo through coping mechanisms, or returning to pre-pandemic conditions through adaptive mechanisms. Discussions on how to protect human rights in future crisis situations, how to make the economy resilient to future shocks, how to make the economy less dependent on the service industry, how to strategically improve hospital capacity for treating pulmonary problems, how to improve financing and management of essential public services, were rare. When they did occur, they were addressed more by marginal non-profit and public media. Yet the media do not make decisions on policies and measures to manage the crisis. The

Government, Ministry of Health, CPH, and the SC were discussing and introducing measures depending on the spread of the virus and performance of the economy. Policy clearly shifted from protecting health in the face of an unknown threat, to protecting the economy before higher vaccination is reached. The main strategy was to distribute the vaccine, without effective participation of citizens in the process of protecting collective health. Government media campaigns were nothing more than top-down catchphrases and short videos.

Starting with the second wave, discord within the SC made anti-vaccination sentiments a legitimate position in media debates. Short-term topics and quick publication turnaround by private media, presenting "different sides of the story" as antivaccination sentiments grew on social media, indirectly contributed to disbelief in science and scientific consensus. Privatized communication structures proved unable to contribute to a resilient response to COVID-19. In the context of the platform economy, when citizens access news via search and social media, they expose themselves to untrustworthy sources. As advertising migrates towards platforms, and not towards the news industry, quality journalism becomes difficult to sustain economically. Well-developed news pieces require time and funding. The role of public policy is not (only) to promote media literacy that helps citizens detect quality content by themselves. It is also to promote communication structures with a normative focus on collective public interest. Unfortunately, the pandemic did nothing to change this structural weakness.

Acknowledgements

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