Review Paper

Data Journalism Practice in Indonesia

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Abstract: Data journalism in Indonesia has been evolving rapidly, with practices and challenges that are unique to the region. This article aims to provide an overview of the current state of data journalism in Indonesia, its potential for growth, and the barriers that need to be overcome. This article uses literature review method focusing on 11 publications relating to data journalism practice in Indonesia ranging from year 2018 to 2024. It shows that (1) the availability of open access data from Indonesian government that has some data credibility issues such as less integrated data, lack of raw data and digital divide of internet availability and coverage in some Indonesian region; (2) journalists' competence of data skills from gathering to displaying (3) decision of building data journalism team is from top authority (4) good narrative enhances news values and audience engagement, (5) data journalism interconnect with news ecosystem in terms of news production and dissemination collaboration. This study underscores the importance of enhancing the competency of Indonesian journalists, particularly in the realm of data journalism. To address this need, developing targeted training programs that improve data literacy and bolster newsroom data journalism teams is crucial. Additionally, future research should explore the impact of data journalism on audience engagement within the Indonesian news media ecosystem, providing insights into how different media platforms can better connect with their audiences. Furthermore, examining the ethical implications of data journalism, including transparency and validity in news production and dissemination, is essential to ensuring that innovation in this field aligns with journalistic integrity.

Keywords: Data Journalism; big data; journalist competency; audience engagement; news ecosystem

Introduction

Journalism is an activity that involves covering, processing, and disseminating accurate information about an event to the public. Journalism is not just about writing news, but more about a journalist's ability to pursue actual and important news sources. Therefore, journalism can be defined as a journalist's activity in searching, collecting, and processing data to produce interesting news. These journalistic activities are then continued by disseminating them to the community through print, electronic, and digital media (Marhamah, 2021).

Data journalism practices, in particular, help to reduce the distance between news organizations and users by allowing users to participate in the information gathering stage and provide feedback on data analysis, visualization, and data opening. Television networks produce diverse content with the assistance of specialized departments and staff members because they recognize the importance of data journalism. However, very little

theoretical research has looked at how data journalism practices are portrayed in television news because very few studies have looked at the characteristics and news forms of data news content from television networks in different countries. Due to its high visual appeal, data news might be considered an ideal form of television news (Lim, 2019). A study from Hidayat & Hidayat (2020) suggests that there should be other researches on how media implement data journalism including the process and interaction in the newsroom.

As stated in Coddington (2015) data journalism is the closest we have come to combining professional journalism with open-source and computational principles and data journalists' assertions that traditional reporting, narrative, and storytelling are still essential components of good data journalism closely align each other with the predominant professional view of journalism. By restating the urgency of traditional journalistic work, they require to ensure that their own work is conducted by professional journalism—that they are seen as continuing its practices, rather than harming them.

Advances in information technology in the last two decades brought a wave of major changes to the media industry, the press and journalism. Internet technology has given birth to online media which is a threat to conventional media. Advances in information technology also gave birth new challenges and opportunities for activities in journalism. Some of them are related to the enormous amount of processed data availability for news. In the digital age, data is not only a complement or just to give the context of the news, but it can also become news itself considering its ubiquity.

Data journalism is an intriguing discipline that merges traditional reporting with data analysis to reveal and narrate stories. It has become a crucial component of the media landscape, improving the production and consumption of news. However, data journalism in Indonesia is still underexplored, with most publications confined to conference proceedings and unpublished manuscripts (Roza, 2022). Has data journalism been developed in Indonesia? What are the obstacles, challenges and opportunities to be able to support and colouring the press media business (Nuh, 2019). This article aims to describe the practice of data journalism in Indonesia.

Methodology

A review paper, also known as a literature review, is an academic article that summarizes and evaluates existing research on a particular topic. Unlike original research papers, review papers do not present new experimental results. Instead, they provide a comprehensive overview of the current state of knowledge, highlighting key findings, trends, and gaps in the literature (Popenoe et al., 2021). There are some steps conducted in this review process such as formulating research topic, study design, sampling, data collection and data analysis. Formulating a research topic includes selecting and narrowing down a particular subject or question to explore and it can be established by clear goals for the review and clearly defines the specific research questions or hypotheses to be explored (Palmatier et al., 2018). This paper research topic is about data journalism in Indonesia.

Study Design outlines key issue of paper topic—inclusion Data Journalism, Practice and Indonesia. Academic articles were chosen using keyword searches (Nazir, 2014) such as data journalism, jurnalisme data, data journalism in Indonesia, and data journalism practice, with a publication date range of the last five years, from 2018 to 2024 and a total of 11 articles relevant to the research objectives were selected in order to obtain recent finding and method (Notar & Cole, 2010). Sampling of this paper is selected by relevant published article about practice data journalism in Indonesia from open access scholarly journal database such as Google scholar and Portal Garuda—an Indonesian comprehensive academic article journal database.

Data Collection is conducted by determining relevant articles meeting the requirement as identified in the third step which is sampling, the author can assess whether each study satisfies the eligibility criteria established in the second step (study design). For studies that meet the criteria, data is extracted and recorded using standardized templates (Palmatier et al., 2018). Data Analysis is the stage in the data processing process where data is transformed into information through interpretation and analysis to produce categories of findings from the article review, ultimately leading to conclusions and recommendations (Palmatier et al., 2018).

Findings and Discussion

Data journalism, also known as data journalism, is an emerging discipline that brings together knowledge from several disciplines, including journalism, social sciences, information science, data and computer sciences, data analytics, information design, and storytelling (Heravi & Lorenz, 2020). Data journalism can be viewed as a process of refinement, where raw data is transformed into something meaningful. As a result the value to the public grows, especially when complex facts are boiled down into a clear story that people can easily understand and remember.

Defining data journalism and related fields, including computer-assisted reporting and computational journalism, Coddington (2015) offers a typology to evaluate the epistemological and professional dimensions of these domains/terms/forms. He categories these three forms according to "their orientation toward "professional expertise or networked participation, transparency or opacity, big data or targeted sampling, and a vision of an active or passive public". He characterises these three journalistic forms as "related but distinct approaches to integrating the values of open-source culture and social science with those of professional journalism". In this work, Coddington applies the term data-driven journalism in addition to data journalism, but he does not clarify their distinction. To the reader, it seems that he either uses data-driven journalism interchangeably with data journalism, or as an umbrella term that covers the other three terms: data journalism, computer assisted reporting (CAR), and computational journalism (Coddington, 2015).

Data journalism is most often expressed through visualization-related themes such as data visualization, web design, and interactive layouts. Second, in the field of data journalism, there are nomenclature norms; in most newsrooms, data journalism takes the shape of a visualization team. Several significant conventional news organizations have developed news teams or divisions that use advanced digital media technologies, and the spread of front-end technology mirrors the trend of designers taking the lead (Zhang & Chen, 2022). Data journalism has been affecting the interactions inside the newsrooms. If in the past journalists were the highest editorial authority, the role started to be reduced because of following examples; a grapher requests to cut the script because it is considered to reduce the space for creativity news visualization and search engine optimization officer changes news title to be more eye-catching to facilitate the speed of news dissemination. Such a drastic change in journalism work especially to some journalists who were brought up in the tradition of conventional journalism. It takes time for legacy media to change work culture and practice data journalism. Television as a mass media must adopt the practice of data journalism in order to survive in the world of journalism with online media competitors, which are far away faster adopting data journalism and online media able to move more agile because of the organization's small. relatively small scale of new media organizations. Furthermore, journalists in online media are dominated by young journalists who are more familiar with various devices and technology applications (Roza, 2022).
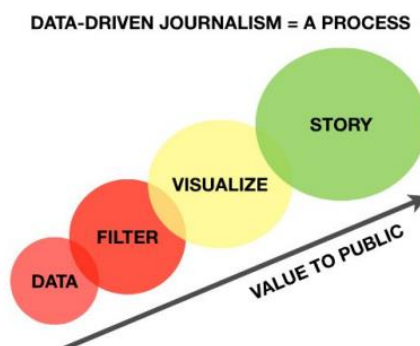

Figure 1. Data driven journalism process
Source: Lorenz (2010)

The two distinct areas of data journalism are combined with data-driven practices: journalism and computer science (Lim, 2015). Information news coverage merits interest from the insightful local area as

well as news organizations for two reasons. First, journalists face an information environment with a lot of data. Instead of working as gatekeepers for traditional news media, journalists need to look at how data works (Bradshaw, 2018). Second, according to Lim (2015), data journalism has emerged as an alternative to traditional journalism that is capable of overcoming declining credibility and generating revenue.

Data journalism is perceived to be a tool for creating better journalism with the help of statistical methods, visualisation and interactive means of presenting information. Journalists see data journalism as a way to find hidden stories—stories that wouldn't otherwise get told. News organisations hope to serve public interest better with data journalism and, thus, have a positive impact on society. Furthermore, data journalism is perceived as a way to expand transparency in journalistic processes. This transparency potentially increases trust in journalism and the media, given that the sources of information in stories are open for anybody to access (Aitamurto et al., 2011).

In Indonesia, the practice of data journalism has been carried out several decades ago, such as those carried out by Prisma Magazine, Harian Kompas, and Tempo Magazine. Research team and the development of Kompas Daily, for example, began conducting election polls in the 1970s. Both Tempo and Kompas still practice this with the same organizational structure: research team and editorial team. Kompas Gramedia and Tempo Inti Media are also embracing a strategy of platform convergence. Tempo magazine, initially established as a publicly-owned company focusing on print media, has evolved into a bastion of bold journalism in Indonesia, challenging the authority of Suharto's New Order regime. Presently, it operates TempoTV, Tempo Interaktiv, the daily newspaper Koran Tempo, and a citizen journalism platform for iPhone users. In 2015, it began experimenting with a unified newsroom model. On the other hand, Kompas Gramedia, which originated with the Indonesian-language broadsheet Kompas under Jakob Oetama's ownership, has diversified its offerings to include KompasTV, Kompas.com (an online news platform), various radio stations, and a blogging platform called Kompasiana.com (Tapsell, 2014).

At the beginning of the emergence of online media in Indonesia, journalism practices were not adopted because they were considered to be contrary to the core of journalism online which prioritizes speed while in data journalism, the process of collecting and analyzing data takes longer. However, Katadata.co.id, which was established in 2012, has an editorial team and data team. The editorial team does field reporting and news writing while the data team processes the data into various forms, both in the graphs that appear in news narratives, or in special sections such as Analysis and Data Talk. Data team are not required to interview sources and carry out the reporting process. Meanwhile, Katadata.co.id has a data aggregation portal, namely Databoks, which compiles various data from various sources and present it in the form of interactive graphs. In 2016, Tirto.id appeared, which is based on articles and infographics. Like Katadata, Tirto.id also has a research and editorial team structure (Widiantara, 2021).

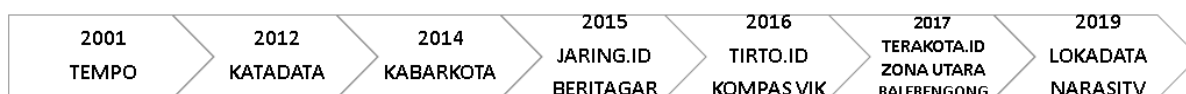| 2001	2012	2014	2015	2016	2017	2019
TEMPO	KATADATA	KABARKOTA	JARING.ID BERITAGAR	TIRTO.ID KOMPAS VIK	TERAKOTA.ID ZONA UTARA BALEBENGONG	LOKADATA NARASITV

Figure 2. Data-journalism-based media
Source: Adapted from Muthmainnah et.al (2022) and Kusumawati (2023)

Numerous national-scale media outlets in Indonesia have utilized data journalism, particularly on digital platforms like Tempo, Kompas, Katadata, Beritagar, Narasi TV, Kumparan, and Tirto.id. The use of data journalism is used to explain a variety of quantitative data-based information, such as the percentage increase or decrease in currency values, the criminal rate that results from the release of the police, or the violence rate against children and women from NGOs. However, aside from special investigative news, Indonesia has not yet fully entered the high level of analysis.

Tempo is a well-known Indonesian media outlet for using investigation-based data journalism techniques. The Panama Papers case is a large-scale international investigation into criminal tax evasion and corruption committed by celebrities, top government officials, and fugitives. In the "Panama Papers:" preface written by Luje Harding, according to "Breaking the Story of How Rich and Powerful Hide Their Money,"

almost 400 journalists were involved in the case in 2016 and secretly worked to uncover it (Obermaier & Obermayer, 2017). Tempo is the only Indonesian media outlet to participate in this international collaboration.

In this instance, it used 2.6 terabytes (TB) of files, including 4.8 emails; 2.1 million PDF documents and 3 million databases; 1.1 million images, 320,000 text files, and thousands of other files. Veglis, et.al (2022) cited Kitchin (2014) proposed definition of big data as datasets of immense volume (ranging in terabytes or petabytes), characterized by high velocity (generated in or near real-time), diverse in variety (comprising structured and unstructured data), exhaustive in scope (aiming to encompass entire populations or systems), fine-grained in resolution, uniquely indexical in identification, relational in nature (containing shared fields facilitating the combination of disparate datasets), and flexible (capable of expansion and extension. To support big data analytic, there are wide array of tools , data accessibility, data availability, and data analytic techniques for data manipulation and publication (Lewis & Westlund, 2014). News organizations and journalists strive to understand, take action, and derive value from big data through exploration in the fields of algorithms, computing, and quantification (Badri, 2017).

Table 1. Overview of data journalism practice in Indonesia

No	Author (s) Year Of Publication	Media Observation	Highlight
1	(Zuhra, 2018)	Mainstream & Digital Media	The urgency of data journalism training for journalist and barriers in practising data journalism in Indonesia such as limited of data access from government and limited skill in big data analytic
2	(Sanusi, 2018)	Digital Media	Some challenges in data journalism practice include the minimal competence and quantity of data journalists, the need for longer time in data journalism work methods, difficulties in accessing data and information from official data sources (government), as well as the uneven speed and coverage of internet access in various regions of Indonesia.
3	(Asprilla & Maharani, 2019)	Media Network	Data journalism is implemented for investigative journalism as it strengthens news quality and accuracy. However, the current challenge for the investigative team lies in the initial stages, namely the sporadic availability of data from external sources and the difficulty in obtaining valid data. In its future prospects, Tempo also plans to involve the public in the data journalism process.
4	(Hidayat & Hidayat, 2020)	Traditional & Digital media	Big data analytic as source of data journalism and the importance of improvement for big data analytics skill such as qualitative enrichment and visual quantification.
5	(Arief & Muthmainnah, 2021)	Data-journalism-based Media	Satu Data Indonesia (SDI) established by Indonesian government as part of implementing the principle of open government. However, data journalists seldom use data from SDI for fundamental issues including the absence of available data, relevance of data, difficulties in accessing data, the lack of data updates, and concerns about data reliability.
6	((Muthmainnah et al., 2022)	Data-journalism-based Media	The integration of Indonesian government's open data remains inadequate and lacks a standardized benchmark for joint utilization. Consequently, data journalists must exercise caution in the gate-keeping process to uphold the quality of their news output. Typically, journalists verify information by tracking raw data, reaching out to data-providing institutions, and evaluating the reputation of these sources. Nonetheless, there's a risk that data journalists may overly rely on official sources and shield themselves behind the credibility of these sources.

7	(Indah & Hasanah, 2022)	Data-journalism-based Media	Statistical type data is used in producing news about Covid-19 which in line with data journalism work systems that seek to process data into informative narratives in infographic form.
8	(Hasanah & Indah, 2023)	Data-journalism-based Media	Data visualization with good narrative enhances news value along with creating audience engagement.
9	(Kusumawati, 2023)	Mainstream Media	Practicing data journalism as innovation adoption is under editor-in-chief decision is somewhat between early to late majority as data journalism adoption is a response of digital disruption.
10	(Fajarlie & Monggilo, 2023)	Digital Media	Data journalism is adopted for investigative journalism requiring various data from publicly accessible data, which is derived from social media and official government websites.
11	(Yusuf & Ahmad, 2024)	Digital Media	Data journalism news production about the COVID-19 pandemic is formed based on data availability and free software. It is suggested an investment on data literacy training in the newsroom to ensure journalists' skills in interpreting and reporting data accurately and interestingly for readers.

Source: Own elaboration

1. Data Source Availability

Certain well-established media organizations like Tempo Media and Kompas Gramedia in Indonesia are recognized for their sophisticated big-data frameworks, which have evolved over decades, making them exemplary models of big data media institutions (Hidayat & Hidayat, 2020). Beyond just technical details, big data also encompasses the processes involved in handling data and the resulting products that provide information about numerous people, places, and things, in addition to the sheer volume of data itself (Lewis & Westlund, 2014). In Indonesia, big data are acquired from open access (1) government such as Satu Data Indonesia, Badan Pusat Statistik (Indonesia Central Bureau of Statistics), other government official websites (2) social media (3) crowd-source (Arief & Muthmainnah, 2021; Asprilla & Maharani, 2019; Fajarlie & Monggilo, 2023; Hidayat & Hidayat, 2020; Indah & Hasanah, 2022; Muthmainnah et al., 2022; Sanusi, 2018; Yusuf & Ahmad, 2024; Zuhra, 2018).

In 2014, Indonesia introduced the Indonesian Data Portal (data.go.id), recognized as the country's official open data portal. The One Data Indonesia initiative mandates that all public sector information be published on this portal as open data. Additionally, both citizens and businesses have the option to upload their data to the portal. All data must be provided in an open format and can be freely accessed and used by anyone, with the only requirement being source attribution (Indrajit, 2018).

As open access data provided by Indonesia government are main sources in data journalism practice there are some disadvantage performances in terms of data availability and validity (Asprilla & Maharani, 2019), inaccurate and outdated data (Zuhra, 2018), digital divide—internet speed and coverage (Sanusi, 2018), limited data access (Sanusi, 2018). However, Muthmainnah et.al (2021) stated that open access data availability is adequate though some data are in raw format so that the journalists obtain processed data not raw data. By granting access to raw data, it becomes feasible to engage individuals beyond the newsroom in the news production process through crowd-sourcing, where volunteers collaborate on analysis. This approach has the potential to streamline research efforts, saving both time and resources (Baack, 2011). Moreover, Muthmainnah et.al (2021) also stated that open access data from government is less integrated concerning data validity leading to longer data validation process. Significant tasks in journalism involve data validation, both in terms of parameters or indicators established based on journalistic ethics and internal structure, encompassing methodologies and outcomes. The practices of data journalism in Indonesia demonstrate that data validation is crucial and should be incorporated in all media. While quantitative statistical data are vital, the visual elements need to be harmonized with the qualitative aspects (Hidayat & Hidayat, 2020). However,

the use of big data in journalism introduces specific ethical challenges compared to traditional journalistic values such as minimizing harm from the uncontrolled spread of information (Veglis et al., 2022).

Unlike traditional journalism that disconnect journalism and community, data journalism uses the participation of social media users in news production or citizen journalism(Krumsvik, 2017). Social media became an integral part of the daily routines for monitoring and sourcing potential news, yet skepticism carried on regarding the reliability of information from various social media platforms and considering whether it could match traditional reporting practices in terms of quality sourcing. Likewise, although the promotional advantages of sharing news on social media were widely acknowledged, the potential for audience engagement in the reporting process had not yet been fully developed (Bossio & Bebawi, 2016).The tendency of social media to be the basis for information retrieval is very dominant in the newsroom such as trending topics retrieving from media algorithmic engine as it benefits the media in order to form news production process in newsroom although it has some consequences in source credibility, confidentiality and ethical consideration (Hidayat & Hidayat, 2020).

Advancements in media and communication technology have not only transformed the media industry but have also provided the public with greater opportunities to participate through the internet and social media. The internet has emerged as a significant public space where citizens can communicate freely. The spread of information on social media has been so impactful that it rivals traditional mainstream media. As a result, the internet has become a crucial infrastructure for the Indonesian media industry to address the new challenges of convergence and digitalization (Sukmayadi, 2019). This phenomenon leads to news ecosystem shift that data journalism has contributed dynamic process in news production and dissemination for mainstream media and digital media.

2. Journalists' Competency on Data Journalism
The development of communication technology presents a challenge for the practice of journalism, one of which is the need for specific competencies for journalists (Mustaffa et al., 2017). The advancement of data journalism still requires strong competence in data journalism. Regardless of whether a journalist possesses skills in processing, analyzing, and visualizing data, they must not forget the fundamental principles of journalism, which prioritize facts, truth, and clarity. Therefore, the challenge in data journalism lies in journalists' ability to process quantitative data and their skills in presenting information visually using application technologies (Sanusi, 2018; Zuhra, 2018). Hidayat & Hidayat (2022) states that big data analytic competence in newsroom and research support division still requires some improvement. Thus, data journalism intensive training is compulsory for journalism practice in Indonesia.

In the past ten years, data journalism has carved out a distinct place in the field and has proven itself as a valuable resource in many traditional newsrooms (Stalph & Borges-Rey, 2018). Bell (2017) in Stalph & Borges-Rey (2018) stated data journalism skills requires data analysis, programmatic thinking, machine learning, natural language processing, network analysis, data scraping, and extracting sense or objects for reporting from large datasets. Kusumawati (2023) found that newsroom collaborate with graphic team who are familiar with data visualization in creating infographic that it focuses on mixing texts and illustrations.

Indah and Hasanah (2021) found that data-journalism-based media employ data as journalistic products using various data sources which can be seen in data visualization of infographics and this distinguishes the journalistic practice from mainstream media. Data visualizations are fundamentally integral to data narratives. Typically, data visualization has a crucial function in these narratives, although it's also feasible to construct data stories solely on text and numbers(Weber et al., 2018). This practice requires journalists to possess comprehension and ability to produce visual quantification as well as implementing qualitative enrichment (Hidayat & Hidayat, 2020). The practice of data journalism in Indonesian media companies is much more applicable and suitable for text-based media because this type of media can present more comprehensive data. Meanwhile, broadcasting media like television and radio present data for supplementary narratives. This means that different media platforms will offer different visual characteristics and narratives.

3. Establishment of Data Journalism Team

The role of news organizations is crucial in accommodating the implementation of data journalism. The development of a data journalism model in the newsroom is carried out by forming a special team consisting of data specialists, programmers, coders, or designers who can work together and support the activities of production and dissemination (Sanusi, 2018). Kusumawati (2023) and Muthmainnah et.al (2022) found that the adoption of data journalism can be initiated by someone possessing high position such as editor-in chief. Manager involvement in newsrooms should empower their team of data journalists and research divisions within media organizations (Hidayat & Hidayat, 2020). Furthermore, journalists not only gather information through interviews and from internet but also can actually contribute significantly to big data gathering for their organizations. For numerous media companies adopting data-driven newsroom changes leading to significant push to evolve and innovate. This transformation includes various initiatives, such as redesigning office design, enlisting multimedia and data journalists possessing various data literacy and skill as well as accommodating mindset and promoting partnership between editorial and advertising departments (Tsakarestou & Pogkas, 2017).

The way data journalists conduct their data-driven work is linked to two key areas: The professional area includes an organizational subgroup made up of specific individuals who develop practices and underlying knowledge influenced by the professional culture these journalists adhere to. The organizational area involves the structure of the organization, which can either integrate this subgroup by providing structural support or disconnect it by leaving it without structural ties, as well as the organizational culture, which can either reinforce a compatible professional subculture or reject it (Stalph, 2020).

4. Audience Engagement

In journalism, audience engagement should actively consider and communicate with the audience to better understand and fulfil their news media needs. This approach will result in more collaborative news that reflects a wider range of viewpoints, ultimately making the news appear more credible to the audience and deserving of their loyalty. (Nelson, 2019).

Audience engagement or user involvement has become part of news ecosystem that data journalism increase audience engagement through data visualization. Although data-journalism-based media provides infographics as data visualization, they strengthen the news by building narrative technique not only for newsworthiness aspect but also audience engagement(Indah & Hasanah, 2022). Furthermore, this technique supports interactivity between the media through their contents with audience(Hasanah & Indah, 2023).

Another key aspect of visual communication is becoming increasingly important in journalistic storytelling: design—the way data is presented. To capture readers' attention on websites or social media, data stories with strong visual design are more effective than those focused primarily on text. This approach demands a clear message conveyed through visualization, which incorporates narrative, explanatory, and argumentative elements. Additionally, data stories often allow users to explore the data themselves, enabling them to craft their own unique perspective on the story (Weber et al., 2018).

Conclusion

It can be concluded that data journalism practice in Indonesia has been developing in media ecosystem with some challenges such as (1) the availability of open access data from Indonesian government that has some data credibility issues such as less integrated data, lack of raw data and digital divide of internet availability and coverage in some Indonesian region; (2) journalists' competence of data skills from gathering to displaying (3) decision of building data journalism team is from top authority (4) data visualization supported by good narrative boost news values and create audience engagement, (5) data journalism interconnect with news ecosystem in terms of news production and dissemination collaboration.

Recommendation for data journalism practice in Indonesia may address on journalist competency by providing training to improve data journalism literacy and empower data journalism team at newsroom. Future research for data journalism practice may explore Indonesian media ecosystems highlighting audience engagement to provide insights in different media platform and focusing on ethical consideration in

implementing data journalism in terms of news production and dissemination establishing transparency and validity.

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