Identifying the Level of Data Journalism Literacy and Skills of Local Media Journalists in Indonesia

Ansar Suherman[1], Harry Fajar Maulana[2], Herman Lawelai[3]

[1]ORCID iD: 0000-0002-2539-0426, Universitas Muhammadiyah Buton, Jl. Betoambari No. 36, Baubau, Southeast Sulawesi 93724, Indonesia
[2]ORCID iD: 0000-0001-5024-5784, Universitas Muhammadiyah Buton, Jl. Betoambari No. 36, Baubau, Southeast Sulawesi 93724, Indonesia
[3]ORCID iD: 0000-0002-7266-4557, Universitas Muhammadiyah Buton, Jl. Betoambari No. 36, Baubau, Southeast Sulawesi 93724, Indonesia
*Corresponding author, e-mail: ansar.suherman@umbuton.ac.id

Abstract
Introduction: Datafication still plagues Indonesian journalists, especially local ones, skewing news validity and neutrality. Indonesian journalists from 13 local media were surveyed and interviewed for this study. This study relied on several studies that suggest journalists may deliver more accurate, objective, and unbiased news by expanding their datafication capacity. As digital technology advances and social media spreads misinformation, it becomes critical.
Methods: Mixed-methods experimentation and triangulation. Indonesia has 13 native media representing its diversity. Using regional media, this study can illustrate data journalism literacy levels in different locations, including those with differing technology and education. We chose material based on data journalism approaches including data visualization, infographics, and data-driven reporting. This ensures study-relevant respondents.
Findings: Indonesian media's poor data literacy has a big impact. Data-driven journalism in local media is poor due to data analysis incompetence. Access and chances for journalists to develop data skills are major issues. Clearly, formal training is needed. Another factor is local media's focus on reporting speed over data analysis. Lack of technology and institutional support hinders local journalist data literacy projects.
Originality: Previous studies on Indonesian journalists' datafication knowledge and abilities are scarce and fragmented. Despite data journalism's growing popularity in newsrooms and academic status, comprehensive study is needed to define it.
Keywords: Local Journalists, Local Media, Datafication, Indonesia.

Introduction

Data journalism is an emerging narrative genre that combines traditional journalistic approaches with statistical analysis, programming, and visualization techniques (Appelgren & Lindén, 2020a; Araya & Gómez, 2019a; Arias-Robles & López López, 2021). Local media is one of the main instruments that provides communicative space for community engagement at the local level. It plays a role in building local networks (Ferrucci & Perreault, 2024), monitoring democratization (Gulyas & Baines, 2020), regional development (Arias-Robles & López López, 2021), a sense of belonging to a community (Gulyas et al., 2019), and entrepreneurial journalism (Harte & Matthews, 2022; Wahl-Jorgensen, 2023).

The preliminary findings of this study underscore an urgent need for numerous local media outlets to effectively leverage data in their news reporting. The current situation often leads to coverage that lacks depth and evidence-based analysis, highlighting the critical need for data literacy among local journalists. This is particularly important in the fight against misinformation and disinformation, as individuals with limited data literacy

often struggle to authenticate information based on data. Another key finding was the existence of a competency gap between local and national media. National media often demonstrate a strong proficiency in data-driven journalism, mainly due to their superior resources and access to advanced technology. This investigation is crucial to tackle the evolving environment of media and technology. Journalists must evolve their practices as big data and contemporary visualization tools become more prevalent. However, the absence of a well-defined framework for skill levels presents a pressing challenge, making the need for effective adaptation strategies for local journalists even more urgent. Journalists skilled in data journalism can enhance public trust in local media through their objective and evidence-based methods. However, the failure to identify the data literacy level of local journalists represents a significant missed opportunity, underscoring the need for immediate action.

This initial section describes the main problem among local journalists in Indonesia, namely the understanding and skills of data utilization (Datafication) (Flensburg & Lomborg, 2023). This is related to the responsibility of journalists to present news content that is factual, objective, and verified sources. This research is still related to our previous research on data visualization of national mass media based on data journalism and mass media practices in reporting based on precision journalism, which also relies on datafication (Allan & Peters, 2020).

Since 2013, there has been research on the practice of data journalism (local journalist) in various specific regions. Based on the search, we found links to similar research results from various countries, which were then used to make comparisons. For example: Sweden (Appelgren & Nygren, 2014; Møller Hartley & Askanius, 2021; Stenbom et al., 2023), Norway (Nyre & Maiden, 2022; Olsen & Furseth, 2023), Belgium (Mathisen, 2023; Pignard-Cheynel & Amigo, 2023; Van Leuven et al., 2021), Canada (Boulanger & Gagnon, 2021; Meese, 2021; Pereira, 2023; Wenzel & Crittenden, 2021a), Russia (Dovbysh, 2021; Shilina & Shilina, 2019; Zagidullina et al., 2023), United Kingdom (Arias-Robles & López López, 2021; Harte & Matthews, 2022; Strukov, 2021), United States (Anderson, 2020; Fink & Anderson, 2015; Juarez Miro & Anderson, 2024; Planer & Godulla, 2021; Turkel et al., 2021; Wenzel & Crittenden, 2021a), Germany (Haim, 2024; Neuberger, 2024; Weinacht & Spiller, 2014), Italy (Biernacka-Ligieza, 2021; Delmastro & Splendore, 2021; Morini, 2023), Australia (Fisher et al., 2022; Magasic et al., 2023; Ross et al., 2021; Valencia-Forrester, 2023), Latin America (Borges-Rey, 2024; de-Lima-Santos, 2024; de-Lima-Santos et al., 2023; García-Perdomo, 2023; Magaña & García-Perdomo, 2024; Mesquita & Fernandes, 2021; Moreira De Oliveira et al., 2021; Nerents, 2020; K. Wright et al., 2019), China (Fang & Repnikova, 2022; Meng & Zhang, 2022; Wang & Li, 2019; S. Wright & Nolan, 2023; Wu, 2023; S. Zhang & Feng, 2019; X. Zhang & Chen, 2022), Arab Region (Abdulmajeed & Fahmy, 2022; Alhuntushi & Lugo-Ocando, 2022; Allam & El Ghetany, 2020; Appelgren et al., 2019; Belaid, 2020; Fahmy & Attia, 2021; Jebril & Altef, 2024; Lewis & Nashmi, 2019; Mutsvairo, 2019; Mutsvairo et al., 2020; K. Wright et al., 2019), Pakistan (Alhuntushi & Lugo-Ocando, 2022; Ittefaq et al., 2021; Jamil, 2021a, 2021b, 2023), and Hong Kong (Du, 2024; Wu, 2023; X. Zhang & Chen, 2022; Zhu & Du, 2018).

There are several previous studies that confirm the use of data by journalists, such as studies in America and Europe, are described as content analysis on news programs using statistics and need to provide more context. The conclusions of these previous studies suggest that the use of data is often limited to the fundamental level (Juarez Miro, 2022; Kyriakidou et al., 2023; Wilczek & Thurman, 2022).
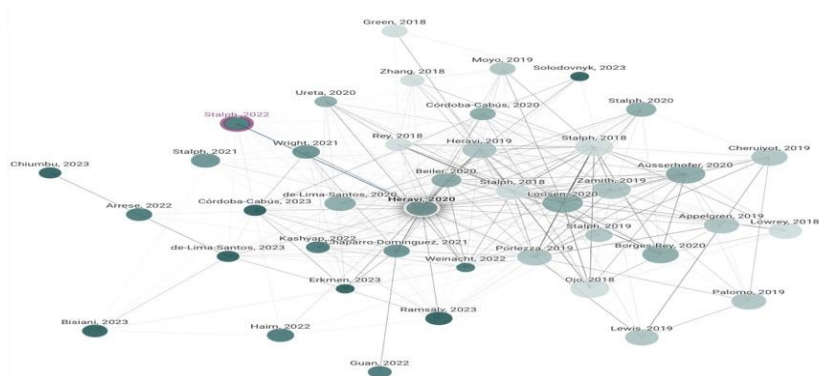
Figure 1. Related Research Results (source: Data from Connected Paper, 2024)

Other research conducted by Borges-Rey (2019a, 2020), Ekström et al. (2021), Heravi & Lorenz (2020), Porlezza & Splendore (2019), Solodovnyk et al. (2023), and Stalph (2019) on the use of academic knowledge in journalism reached broader conclusions. They found that among journalists working in several media companies, about 52% reported that they often used research studies in the reporting process and that it helped deepen context and strengthen news accuracy. Studies conducted in the Nordic countries reveal that journalists continue their work practices while working with data as usual (Himma-Kadakas & Ojamets, 2022; Wenzel & Crittenden, 2021b). These studies concluded that access to data is considered good, but when data is analyzed and trends are found, they find that its presentation presents its challenges.

Journalists usually deal with ready-made data from government agencies. The finished data is usually not analyzed again to find the best interpretation of the patterns shown by the data. However, in our opinion, it is essential whether journalists entirely depend on the information they get from ready-made data that tends to have been framed by the data owner without further analysis. This one has not been answered in previous studies. At the same time, the framing impacts the audience as consumers, where the audience has no power to sort out data and facts. Entman's warning is that the audience and journalists cannot encode the intent behind the use of specific frames (Veglis et al., 2022). We are concerned that journalists often replicate the information provided by data owners without critically analyzing the interests behind the data.

Some studies indicate that journalists use data that domestic government agencies have pre-processed as the primary source of data reporting (Iacob, 2022; Karlsson & Clerwall, 2018; Morini et al., 2023). We believe local journalists' critical attitude towards data is low or non- existent. Previous research on data verification by journalists shows minimal references. This is due to the attitude of journalists who are too trusting of figures produced by government agencies, which come from an official collection process. Godler et al. (2020) emphasize the need for more 'practical hecitation' in the routine activities of journalists.

However, apart from the critical attitude of local journalists towards data, we objectively see that other factors intervene in journalists context and routines activities. In different situations, the current phenomenon can be attributed to the roots of the history of journalism. Journalism initially emerged as storytelling, which is included in the humanistic field (Godler et al., 2020). It must be recognized that journalism education still focuses on the knowledge aspect: how to express yourself, news genres, production techniques, handling sources, and journalistic ethics. Meanwhile, data analysis or retrieval using social science methods, one of which is the concept of Precision Journalism (Suherman et al., 2023), has yet to find a place in the education curriculum of

communication science students. A few decades ago, McCombs underlined that the use of social science perspectives and methods by journalists is not new (Eaman, 2021).

Local journalists should indeed not be distinguished from national media journalists. Although in some previous studies, defining the word 'local' in journalism has presented different interpretations in the study of journalism itself. Nelson (2021) and (Reyes-de-Cózar et al., (2022) said that studying local journalism with the word 'local' has presented an ambiguous meaning due to various interpretations. However, from the various definitions, the word is generally conceptualized in definitions based on its place in the pre-digital era (Banshal et al., 2022; Gulyas & Baines, 2020; McCallum et al., 2023). We underline that local journalists should be operationalized as an essential part of a business unit operating in a geosocial space to emphasize that while geography is important, news media companies and their journalists work in a broader social cycle and digital space, and move at the centre of power (Ferrucci & Perreault, 2024; Magasic et al., 2023).

Previous studies on the understanding and skills of local journalists in Indonesia on datafication are lacking--if any--are fragmented on the reporting side and have not identified the level of literacy and datafication skills of local journalists. Despite the growing interest in data journalism in newsrooms and its emergence as an academic discipline, there is still a need for systematic research that identifies the level of literacy and datafication practices of journalists. This study will provide a descriptive overview of the research results and discuss findings on aspects of literacy and datafication skills. Thus, we believe that this is the novelty position of our research.

Identifying the level of data literacy and data journalism skills of local journalists in Indonesia has not been widely studied. Based on our understanding of the existing literature, the main force driving the growth of data journalism in Indonesia in general is the need to gain a deeper understanding and effectively interpret the vast amount of data collected for investigative stories. The purpose of this study is to analyze and capture the full landscape of the current state of data journalism specifically in local media in Indonesia and the viewpoints of journalists employed by local media companies in Indonesia. This study provides a comprehensive summary of the data literacy and skills of local journalists in relation to the development of data journalism in Indonesia. The study poses several research questions to show the full landscape: 1) How do local media view data journalism? 2) How has data journalism influenced the practice of journalism among local journalists in Indonesia? and 3) What challenges do local journalists face in improving their data journalism literacy and skills?

Methods

The study uses an action approach that belongs to the qualitative research paradigm to solve problems related to the topic of this study, namely the identification of data literacy and data journalism skills of local journalists in Indonesia. This research approach is appropriate for studies whose development and change processes occur quickly and are difficult to predict. Through this approach, researchers can provide extensive opportunities for many parties to be involved in providing information to generate ideas and reflections on this study. In general, this study aims to create awareness and knowledge among local journalists about the importance of data journalism and the significance of media companies' active involvement in setting up instruments that can improve the data journalism knowledge and skills of their journalists, including encouraging their journalists to have a desire to work with data.

This study will ask for the participation of informants (local journalists) to share their work activities as journalists, how they experience working with data, and whether it has an impact. The researcher's position in the study is as a facilitator, so our presence is to help informants understand, formulate, and determine alternative solutions to the problems they face. Two data collection methods were used in this study: surveys and in-depth interviews. Surveys were conducted online and administered to reporters and editors, and interviews were conducted with media companies at the managerial level.

Results

Tabel 1. Online Survey Respondents

Level of education			Respondents who answered completely	Respondents who did not answer completely
Senior High School	Diploma/ Bachelor	Magister/ Doctor		
5 (4.2%)	106 (89.8%)	7 (5.9%)	115 (97.5%)	3 (2.5%)

Note: The number of respondents was 118, consisting of 98 male and 25 female.

The online questionnaire was distributed in June and August 2024. Of the 118 respondents, 115 completed all questions in the questionnaire (97.5%), while 3 respondents did not answer completely (2.5%). Questions that were not answered consisted of questions about education and length of employment. As for gender, all respondents mentioned their gender, with a percentage of 98 male (79%) and 25 female (21%), with the general education level being high school at 5 (4.2%), diploma/bachelor's degree at 106 (81.3%), and master/doctor's degree at 7 (5.9)%. Respondents ranged in age from 20 to 60 years old, with an average age between 25-47 years old.

The online questionnaire included 25 questions addressed to reporters and editors from 13 local media outlets in Indonesia. The sampling technique used was a non-probability sample, where the selected respondents were reporters and editors in the media who were the subject of this study. Interviews were conducted with local media representatives from the management level of media companies. In this study, those assigned to serve our interviews were generally from the editorial department. Interviews were conducted in June and August 2024, with 14 informants interviewed across the subjects of this study. Before the interviews were conducted, we explained the purpose and objectives and then asked for the informants' consent to record during the interview process. The interview results in the form of recordings will then be transcribed to facilitate the analysis of the interview results.

Table 2. Media Companies that are the subject of research

No.	Media Name	Number of Informants (Interviewer)	Number of Respondents (Survey)
1	Sentralnusantara.com	1	5
2	Kabaresijurnalis.com	1	5
3	suaramerdeka.com	1	4
4	Metrosemarang.com	1	4
5	Upeks.co.id		3
6	Papua Pos	1	3
7	Rubriksultra.com	1	4
8	Tribun-Maluku.Com	1	5
9	Harmoni News		3

10	Spesnews		4
11	Harian Rakyat Maluku		4
12	Pijarnews.com	1	5
13	Jejak Fakta		5
14	Penasultra.id	1	5
15	HaloSultra.com		5
16	SKH Baubau Post	1	3
17	Surumba.com		5
18	Penatajamnews.com	1	5
19	Berita Kota Kendari		3
20	Kasamea.com		3
21	Sulawesion.com	1	3
22	Mediakendari.com		5
23	Edarinfo		5
24	Mediakaltim.com	1	3
25	Surabaya Post	1	5
26	Lombokinsider.com		5
27	Suara.com		5
	Total	14	118

Note: The number of respondents was 118, consisting of 98 male and 25 female.

Table 3 shows the experiences or skills of journalists when working with data and their relationship with gender.

Table 3. Data Skill Level

Type of Gender	Skill Level				Total
	Highly	Skilled	Less Skilled	Not Skilled	
Male	1	4	10	103	98
Female	0	2	2	16	25
Total Response	1	4	10	103	118

Note: The table displays data skill levels by gender.

Table 3 shows that women have fewer data skills compared to male respondents. Based on Pearson's r formula, the correlation value between gender and skills is 0.210 or $p<0.01$, which means that both have a correlation.

Table 4. Data Access Activity

Who accesses the data	Frequently	Rarely	Never
Reporter	2	21	28
Editor Team	2	8	6
Data Analyst	6	0	0
Editor-in Chief	9	13	17
Others	0	4	2
Total	19	46	53

Note: While there are Journalists who double as Editors or data analysts, we assign them based on their primary duties.

The method local journalists use in accessing data is general data or free data provided by the government or private institutions, which is less than half the number of respondents. These data are then added in the preparation of their journalistic stories. Based on the results of the interviews, all local media that are the subjects of this study do not have a particular unit or section in charge of research or data processing, almost

all media leaders admit that the resources they have do not have qualified data analysis skills, they rely entirely on data that is already available in the cloud.

Table 5. Data journalism experience

Respondent	Frequently	Rarely	Never
Reporter	0	1	49
Editor Team	1	4	11
Data Analyst	6	0	0
Editor-in chief	7	15	18
Others	0	0	6
	14	20	84

Note: Data journalism experience that uses crowdsourcing methods.

Table 5 asks how the experience of local media journalists working with data journalism with crowdsourcing techniques reveals that the cause of low knowledge of crowdsourcing techniques that are an integral part of the data journalism method is highly correlated with their ability to utilize these techniques. This can be seen from the calculated Pearson's r correlation with a correlation value=0.426 where $p<0.01$.

In the questionnaire presented in Table 5, we asked questions assessing respondents' attitudes towards data journalism. Pearson's r value was calculated to get an answer to the question of whether attitudes have a relationship with the respondents' level of experience. The results show a positive relationship between the respondents' attitudes and their experience with data journalism in their daily activities as journalists or editors-in-chief. Another important finding is that the respondents realized that experience working with data journalism is closely related to the motivation to implement data journalism. In addition, they recognize that the lack of experience correlates with or results in difficulties experienced by journalists in working with data journalism. So, most journalists agree that experience is essential for journalists to have, and they agree that data journalism knowledge and skills for local journalists are urgent, but they do not have it yet.

The positive value of journalists' attitudes towards data journalism also correlates with enjoying working with quantitative data and the realization that their current level of competence is not enough--if not very little--to be skilled in quantitative data collection and processing. As a closing question in the survey, we asked about the meaning of 'data journalism.' Data journalism by local journalists is not a new phrase for them. However, can they distinguish each genre of journalism, especially those most similar in method to data journalism? For example, precision journalism, investigative journalism, or science journalism? What distinguishes each genre of journalism?

Although the respondents had provided answers to each question in the survey questionnaire, most respondents needed help understanding the differences in the open-ended question. They are not so confident that what they have written in their journalistic work so far, which includes numbers and statistical data, can they claim to be part of data journalism work. A summary of the various answers to the open-ended question concludes that local journalists (who do not have knowledge and experience of data journalism) are still 'unfamiliar' with the proper implementation of 'data journalism'. This contrasts journalists answers with more or less basic knowledge and even some data journalism experience.

The final part of the survey's open-ended questions explored their interests, challenges, and views on data journalism in the future. In terms of interest, all respondents to this survey showed a high interest in data journalism and a strong desire to learn about it. The main challenge local journalists face to be literal with data is the readiness of

facilities and infrastructure that should be provided by the media companies where they work but are unavailable. Most respondents suggested the importance of media companies and the government in preparing various infrastructures and superstructures that will support their interest in learning data journalism, such as training, curriculum in universities, etcetera. Regarding their views on the future of data journalism, they expressed high optimism that it has become a mandatory instrument in newsrooms. Journalists are required to have this competency, which should be a basic competency that must be mastered.

In-Depth Interview

As listed in Table 2, the 14 informants who participated in the interviews in this study were the chief editors of several local media in Indonesia. All informants were asked to comment on their perspectives on data journalism. Other interview questions were about how they implement data collection, data processing and visualization techniques in their newsrooms. The four editors have the same view of data journalism. Data journalism is closely related to expertise in the process of data collection, verification of data sources, data validation, data processing and how data is visualized so that journalistic works, one of which is in the form of news, can be easily understood by readers, and guarantee the objectivity of the news. In addition, most editors stated that the integration of statistical figures or qualitative data is not only for economic news content but applies to all fields of news (social, political, cultural, sports, etcetera). All informants stated that data journalism, like precision journalism and investigative journalism, requires data processing and interpretation competence.

Seven editors had a different opinion. They said that data journalism is quite troublesome, and they are not so burdened by the demands of the importance of data literacy for their journalists. For them, data journalism is not something new at all; they are used to working with data, although the data they use in their reporting is data that generally comes from the government, and there is already an explanation of the data, so they do not need to bother analyzing and describing the data. We then reiterated the question, what is data journalism? According to them, data journalism is a way of processing data quickly. Another editor-in-chief shared this perception and interpreted data journalism as a way to obtain and process large amounts of complex data.

Three other editors believe that data journalism is closely related to big data, how to filter data, and effective steps in data visualization. The question of crowdsourcing received more or less the same reaction from all informants. They generally only participate a little in crowdsourcing activities. For the same reason, they do not have the knowledge and resources to crowdsource with parties outside their media company. Crowdsourcing is a method of data collection and analysis, data sharing, and audience engagement activities. Instead of engaging in crowdsourcing, they have been acting more as users or utilizing mature government data or news content from other media (especially national media). However, they believe that audience involvement is integral to being an accountable and independent media for their readers. According to them, participation from readers can provide more varied ideas and views in efforts to develop and improve news content and company development.

Eleven Editors-in-Chief stated that although they will set up a feature on their media website that accommodates crowdsourcing for all parties outside the company, they will also be preparing the resources needed to manage the various inputs. Twelve Editors-in-Chief recognized that crowdsourcing could help them and that it is a method of gathering ideas from the audience on a particular topic in the hope that the media will get a more

comprehensive view of specific topics quickly. However, two chiefeditors had a different opinion. According to them, crowdsourcing is not very usefulbecause only some or most readers care about it, and even if they do, the comments fromreaders sometimes do not have substance to the topic presented. In addition, they areconcerned about the high-security vulnerability of the website if they provide the feature. Since all the media subjects in this study did not apply the crowdsourcing method, we cannot describe their visualization method. Visualization methods are an important part of data journalism.

Discussion

In Indonesia, data journalism has been positioned (especially by the national media) as a widely operated journalism trend nationally in the last decade. This is also the case with data journalism trends that occur globally (Aigner et al., 2016; Andersen et al., 2023; Appelgren & Lindén, 2020b; Araya & Gómez, 2019b; Skovsgaard & Andersen, 2020; Wu, 2022). In the case of local media in Indonesia, data journalism is a term that has been discussed previously by editors-in-chief and local journalists. This includes an awareness of the importance of knowledge and skills in data journalism. However, unequal access to data sources and the availability of supporting infrastructure (due to geographical conditions and the responsibility of media companies) have led to uneven dissemination of data literacy to local journalists working in local media in Indonesia. The same problem is faced by several countries in the world, especially regions from developing countries (Araya & Gómez, 2019b; Barredo-Ibáñez & Díaz-Cerveró, 2017; Borges-Rey, 2019b; Knutsen et al., 2017; Moyo & Munoriyarwa, 2019; Muneri, 2019).

The first component of the necessary infrastructure for fostering and strengthening data journalism literacy among local media journalists in Indonesia is providing training and education in data journalism. This may allow local journalists to participate in technical training associated with data literacy and reportage. Collaborating with universities, journalism organizations, and non-governmental organizations (NGOs) is required to provide data-based training (Reggi & Dawes, 2022). This training will include the development of a curriculum that covers the fundamentals of data analysis, data processing, and visualization, as well as using e-learning to reach journalists in remote areas. Access to contemporary tools and technology for the processing and analysis of data, such as software for data processing and tools for data visualization, is the second factor. Third, communities should be established that facilitate the exchange of information and promote collaboration (McLoughlin et al., 2018). In the fourth place, there is support for policies and regulations that encourage data utilization in news coverage. This has the potential to inspire local governments to open access to data lawfully and transparently (Ohemeng & Ofosu-Adarkwa, 2015; Okamoto, 2017), to develop policies that safeguard journalists who report on sensitive data-based issues, and to ensure that works of data journalism are protected by copyright. Equally important is the fourth requirement, which is to educate the general public on the significance of data. The general public needs to have an appreciation for journalism that is driven by data in order to raise the demand for information of a high quality and to ensure public support for data-driven journalism.

All Editors-in-Chief of local media in this study expressed their commitment to increasing resources to strengthen and improve data journalism knowledge and skills within their media organizations. Based on the comprehensive interviews, we can succinctly summarize the commitments of the Editors-in-Chief. Their unwavering dedication to integrating data journalism into the organization's overarching strategy is

a testament to their vision. This includes the strategic use of data in the coverage of significant news developments. Their commitment to ensuring a dedicated budget for the advancement of data journalism, encompassing technological tools, training, and other resources, is a clear indication of their resolve. Furthermore, the Editors-in-Chief place a high priority on enhancing the capabilities of journalists through comprehensive training. They demonstrate this commitment by engaging professionals in the field of data journalism to conduct internal training. This includes the organization of regular workshops that cover both fundamental and advanced aspects of data journalism, instilling confidence in the staff's abilities.

Another significant commitment of the Editors-in-Chief is the establishment of a data culture within the organization. They plan to achieve this by promoting a data-driven approach among all editorial staff members in their daily work. This involves the creation of editorial guidelines that underscore the importance of data in news coverage, the recognition of journalists who produce high-quality data-driven reports, and the promotion of cross-departmental collaboration to maximize data efficiency.

In addition, they have pledged to ensure that there is greater availability of data and information sources by establishing partnerships with government agencies, universities, and NGOs in order to acquire data that can be utilized for reporting purposes. Furthermore, they will encourage the development of internal data repositories to store datasets pertinent to the organization. It is recommended that they establish a specialized job or group solely responsible for the processing and analysis of data. The development and appointment of one or more staff members as data analysts who support the news reporting process by providing data-driven insights, identifying trends, and validating the accuracy of data used in reports is one way this might be accomplished.

It is essential for media organizations to establish an evaluation system that will monitor and evaluate the development and achievement of data journalism performance indicators that are applied inside the company. This will ensure that all of these commitments can be carried out in the most effective manner possible. In order to identify both the problems and opportunities associated with the growth of data journalism inside their particular media organizations, media organizations need to demonstrate a commitment to performing regular reviews and demonstrate consistency in doing so.

Furthermore, the results of this commitment are inevitably part of the investment to create a credible and accountable media that can ultimately lead to strengthening the capacity of Indonesian local journalists as an integral part and one of the pillars of democracy in Indonesia and the fulfilment of public media rights and quoting the statement of Hermida & Young (2021) that the current media industry needs to determine the steps of a comprehensive and innovative approach by prioritizing various genres of journalism, connecting with audiences, and building a creative media industry, as well as infrastructure that supports 21st-century journalism. Newsrooms need to actively participate by preparing human resources and equipment to strengthen the capacity of journalists.

All informants who participated in the interviews gave different definitions or meanings of data journalism. However, the common point of the different interpretations of the editors is the standard view that data journalism is an effort to integrate research methods in the news workflow through data collection, data processing, and data visualization. Although some interview informants said that data journalism is familiar to them, the constraints of data literacy and the low ability to use data processing software

are the main factors that cause local journalists not to take advantage of the available data. The survey in this study focuses on measuring data literacy and data journalism among local journalists in Indonesia. The survey showed low knowledge of datajournalism, indicating that data journalism for local journalists in Indonesia is stillnascent. This indication can be seen from the strong commitment and desire of journalists,editors, and the Editor-in-Chief to integrate data journalism methods and technology into data processing, in line with the findings of several previous studies that underline that journalists' knowledge of data must be supported by their ability to operate computers (Schapals & Porlezza, 2020), where computer-assisted reporting (C.A.R.) will make it easier for journalists to compile data-based news (Caswell, 2021; Caswell & Dörr, 2019; Jones et al., 2022) and present interesting visualizations (Esteves & Neves, 2022; Lopezosa et al., 2022; Túñez-López et al., 2020) for readers.

The survey results show that the respondents' experiences strongly correlate with their attitudes towards data journalism. Some editors and data analysts with knowledge and skills in data processing stated that the need to provide objective reporting demands an essential role for local journalists to work with data. However, they also pointed out that acquiring the skills to work with data in a short time is impossible. According to them, local journalists must learn diligently and be open to technological developments targeting the mass media. The positive attitude of local journalists towards data journalism is also related to their desire to have data processing skills and their positive belief in the future of data journalism, which will continue to grow in the world of journalism in Indonesia. Crowdsourcing has yet to be used in the local media environment in Indonesia dueto the assumption that crowdsourcing is not a necessity for local media, and they are worried about the security impact that this feature can have.

The local media ecosystem in Indonesia has yet to fully adopt the practice of crowdsourcing in news content production. This is because local media leaders have formedthe assumption that crowdsourcing is not a necessity for them, and they are worried aboutthe impact that this crowdsourcing feature might have on security. Here's why this is the case.The Alliance of Independent Journalists (AJI) and several other NGO's that advocate for data transparency have created training programsfor data journalism. A range of organizations has undertaken these programs. Thedevelopment of data journalism in the regions has been significantly aided by the programsmentioned below. The objective of these programs is to equip local journalists with the coreskills of data analysis and visualization to strengthen their capacity to transmit news relevant to the working environment in which they are responsible.

In addition, several local journalists have begun to make use of data in order to cover themes that are pertinent to the communities in which they operate. These topics include health, education, and the environment, among others. By utilizing this fact, which is sometimes overlooked in the coverage of national media platforms, they can find trends andeffects of local laws more precisely. This allows them to uncover these things in a more personalized approach. Even though it is still in its early phases of development, data journalism offers tremendous potential at the local level. This is especially true regarding promoting public literacy and improving accountability in local government structures.

Data journalism significantly influences the evolution of journalistic techniques among local journalists in Indonesia. By employing data as the foundation for reporting, journalists communicate factual information and possess a more robust statistical and analytical basis, thus enhancing the quality of their reports. This transition enables local

journalists to report on intricate issues, such as corruption, public health, or climate change, with quantifiable data. Data journalism enables journalists to scrutinize claims and statements made by the Government or other entities, enhancing public trust in local media. Data analytics enables the discovery of concealed patterns that frequently elude ordinary inspection. Moreover, the training and enhancement of skills necessary for data processing and visualization pose a barrier, as few journalists have mastered these approaches.

Nonetheless, substantial obstacles exist, including restricted access to credible and dependable public data, particularly in remote regions. Although data journalism facilitates broader engagement with academic institutes and NGO's, challenges persist regarding infrastructure and the accessibility of accessible and reliable data. The adoption of data journalism in Indonesia needs to be improved by technical and budgetary constraints in certain local media, resulting in a slower adaption compared to national or international outlets.

Conclusion

The results of the online survey and in-depth interviews in this study show various obstacles local journalists face in understanding data processing and data journalism. Some of these obstacles include local journalists who have never attended data processing training that should be facilitated by the media companies where they work, the assumption that working with data is a waste of time, and the unavailability of infrastructure supporting data journalism work. So, the local media industry needs to take a role and bridge the gap by increasing data literacy, providing supporting infrastructure, and encouraging the use of data in reporting. Local journalists in Indonesia are beginning to adopt the data journalism methodology even though they continue to face more significant challenges than journalists working for large national media sources. The most significant obstacles that need to be conquered include restricted access to public data, resources, and knowledge. The method is still experimental because many local journalists need access to technological support and specialized training in data management and analysis. It needs to be implemented appropriately into their day-to-day professional practices. This is because those journalists do not have access to these resources. The limitation of this study lies in the time duration. This study was conducted over a short period of time, making it difficult to see the development of journalists' data literacy skills in the long term. Longitudinal approaches that can track the development of data literacy over time, as well as its impact on the quality of local journalism, are still rare due to funding and time constraints. For future research, we suggest that this study be continued at the regional and international levels to compare the perspectives of each of these levels on the topic of local journalists' data journalism and compare them with the perspectives of national media.

Conflict of Interest

We certify that there is no conflict of interest with any financial, personal, or other relationships with other people or organization related to the material discussed in the manuscript.

Acknowledgements

References

Abdulmajeed, M., & Fahmy, N. (2022). Meta-analysis of AI Research in Journalism: Challenges, Opportunities and Future Research Agenda for Arab Journalism. *European, Asian, Middle Eastern, North African Conference on Management & Information Systems*, 213–225.

Aigner, W., Niederer, C., Sedlmair, M., Rind, A., Gutounig, R., & Ausserhofer, J. (2016). *Visual exploration of media transparency for data journalists: Problem characterization and abstraction.*

Alhuntushi, A., & Lugo-Ocando, J. (2022). Articulating statistics in science news in Arab newspapers: The cases of Egypt, Kuwait and Saudi Arabia. *Journalism Practice*, *16*(4), 702–718.

Allam, R., & El Ghetany, S. (2020). Journalism and media education in times of conflict: Three cases from the Arab region. *Arab Media & Society*, *29*, 43–59.

Allan, S., & Peters, C. (2020). The visual citizen in a digital news landscape. *Communication Theory*, *30*(2), 149–168. https://doi.org/10.1093/CT/QTZ028

Andersen, K., Shehata, A., & Andersson, D. (2023). Alternative news orientation and trust in mainstream media: A longitudinal audience perspective. *Digital Journalism*, *11*(5), 833–852.

Anderson, C. W. (2020). 'A journalism of fear.' *Journalism.* https://doi.org/10.1177/1464884920913383

Appelgren, E., & Lindén, C.-G. (2020a). Data journalism as a service: Digital native data journalism expertise and product development. *Media and Communication*, *8*(2), 62–72. https://doi.org/10.17645/mac.v8i2.2757

Appelgren, E., & Lindén, C.-G. (2020b). Data journalism as a service: Digital native data journalism expertise and product development. *Media and Communication*, *8*(2), 62–72.

Appelgren, E., Lindén, C.-G., & van Dalen, A. (2019). Data journalism research: Studying a maturing field across journalistic cultures, media markets and political environments. In *Digital Journalism* (Vol. 7, Issue 9, pp. 1191–1199). Taylor & Francis.

Appelgren, E., & Nygren, G. (2014). Data Journalism in Sweden: Introducing new methods and genres of journalism into 'old' organizations. *Digital Journalism*, *2*(3), 394–405.

Araya, R., & Gómez, C. E. (2019a). Data journalism in Chile: Towards a critical appropriation. *Data Journalism in the Global South*, 301–315.

Araya, R., & Gómez, C. E. (2019b). Data journalism in Chile: Towards a critical appropriation. *Data Journalism in the Global South*, 301–315.

Arias-Robles, F., & López López, P. J. (2021). Driving the closest information. Local data journalism in the UK. *Journalism Practice*, *15*(5), 638–650.

Banshal, S. K., Verma, M. K., & Yuvaraj, M. (2022). Quantifying global digital journalism research: a bibliometric landscape. *Library Hi Tech*, *40*(5), 1337–1358.

Barredo-Ibáñez, D., & Díaz-Cerveró, E. (2017). Interactivity in Latin American digital journalism. An analysis of the main digital media of Colombia, Mexico and Ecuador (2016). *Revista Latina de Comunicación Social*, *72*, 273.

Belaid, N. (2020). The State of Teaching Data Journalism in Some Schools of Journalism in the Arab World. *World Journalism Education Congress 2019, Paris, 2020.*, 918.

Biernacka-Ligieza, I. (2021). The significance of digital media in local public space crisis management: The case of Poland, the United Kingdom and Italy. *Journal of Arab & Muslim Media Research*, *14*(1), 47–70.

Borges-Rey, E. (2019a). Data journalism in Latin America: Community, development and contestation. *Data Journalism in the Global South*, 257–283.

Borges-Rey, E. (2019b). Data journalism in Latin America: Community, development and contestation. *Data Journalism in the Global South*, 257–283.

Borges-Rey, E. (2020). Towards an epistemology of data journalism in the devolved nations of the United Kingdom: Changes and continuities in materiality, performativity and reflexivity. *Journalism*, *21*(7), 915–932.

Borges-Rey, E. (2024). Data Journalism in Latin America: The Duality and Tensions of Normative and Indigenous Values. In *The Palgrave Handbook of Global Digital Journalism* (pp. 323–345). Springer.

Boulanger, P.-P., & Gagnon, C. (2021). The translation of 'transparency'in the Canadian press: an inquiry into symbolic power. In *Journalistic Translation Research Goes Global* (pp. 15–32). Routledge.

Caswell, D. (2021). Structured journalism and the semantic units of news. In *Algorithms, Automation, and News* (pp. 155–177). Routledge.

Caswell, D., & Dörr, K. (2019). Automating complex news stories by capturing news events as data. *Journalism Practice*, *13*(8), 951–955.

de-Lima-Santos, M.-F. (2024). The Entanglements between Data Journalism, Collaboration and Business Models: A Systematic Literature Review. *Digital Journalism*, *12*(2), 256–281.

de-Lima-Santos, M.-F., Mesquita, L., Sanseverino, G. G., Carpes, G., Federal, K. F., & Salaverría, R. (2023). Harnessing data and digital journalism in Latin America. In *Different Global Journalisms: Cultures and Contexts* (pp. 9–33). Springer.

Delmastro, M., & Splendore, S. (2021). Google, Facebook and what else? Measuring the hybridity of Italian journalists by their use of sources. *European Journal of Communication*, *36*(1), 4–20.

Dovbysh, O. (2021). Do digital technologies matter? How hyperlocal media is re-configuring the media landscape of a Russian province. *Journalism*, *22*(12), 2955–2970.

Du, R. (2024). Storytelling in the Age of Data: Data Journalism in Hong Kong. *The Routledge Companion to Journalism in the Global South*, 357–367.

Eaman, R. (2021). *Historical dictionary of journalism*. Rowman & Littlefield Publishers.

Ekström, M., Ramsälv, A., & Westlund, O. (2021). The Epistemologies of Breaking News. *Journalism Studies*, *22*(2), 174–192. https://doi.org/10.1080/1461670X.2020.1831398

Esteves, S., & Neves, M. (2022). "I learned it on the job" Becoming a Data Visualization professional in news media. *Information Design Journal*, *27*(3), 309–319.

Fahmy, N., & Attia, M. A. M. (2021). A field study of Arab data journalism practices in the digital era. *Journalism Practice*, *15*(2), 170–191.

Fang, K., & Repnikova, M. (2022). The state-preneurship model of digital journalism innovation: Cases from China. *The International Journal of Press/Politics*, *27*(2), 497–517.

Ferrucci, P., & Perreault, G. (2024). Local is now national: The Athletic as a model for online local news. *New Media & Society*, *26*(7), 4219–4235.

Fink, K., & Anderson, C. W. (2015). Data Journalism in the United States: Beyond the 'usual suspects.' *Journalism Studies*, *16*(4), 467–481.

Fisher, C., Nolan, D., McGuinness, K., & Park, S. (2022). Australian regional journalists' role perceptions at a time of upheaval. *Media International Australia*, *184*(1), 92–105.

Flensburg, S., & Lomborg, S. (2023). Datafication research: Mapping the field for a future agenda. *New Media & Society*, *25*(6), 1451–1469.

García-Perdomo, V. (2023). Re-digitizing television news: The relationship between TV, online media and audiences. In *Digital Journalism in Latin America* (pp. 7–25). Routledge.

Godler, Y., Reich, Z., & Miller, B. (2020). Social epistemology as a new paradigm for journalism and media studies. *New Media and Society*, *22*(2), 213–229. https://doi.org/10.1177/1461444819856922

Gulyas, A., & Baines, D. (2020). Introduction: Demarcating the field of local media and journalism. In *The Routledge companion to local media and journalism* (pp. 1–21). Routledge.

Gulyas, A., O'Hara, S., & Eilenberg, J. (2019). Experiencing Local News Online: Audience Practices and Perceptions. *Journalism Studies*, *20*(13), 1846–1863. https://doi.org/10.1080/1461670X.2018.1539345

Haim, M. (2024). The german data journalist in 2021. *Journalism Practice*, *18*(6), 1378–1397.

Harte, D., & Matthews, R. (2022). *Reappraising local and community news in the UK*. Routledge.

Heravi, B. R., & Lorenz, M. (2020). Data journalism practices globally: Skills, education, opportunities, and values. *Journalism and Media*, *1*(1), 26–40.

Hermida, A., & Young, and M. L. (2021). Journalism innovation in a time of survival. *News Media Innovation Reconsidered: Ethics and Values in a Creative Reconstruction of Journalism*, 40–52.

Himma-Kadakas, M., & Ojamets, I. (2022). Debunking false information: investigating journalists' fact-checking skills. *Digital Journalism*, *10*(5), 866–887.

Iacob, R. (2022). Blind Spots in the Spotlight. *Financial and Monetary Policy Studies*.

Ittefaq, M., Ejaz, W., Fahmy, S. S., & Sheikh, A. M. (2021). Converged journalism: practices and influences in Pakistan. *Media International Australia*, *181*(1), 167–182.

Jamil, S. (2021a). Artificial intelligence and journalistic practice: The crossroads of obstacles and opportunities for the Pakistani journalists. *Journalism Practice*, *15*(10), 1400–1422.

Jamil, S. (2021b). Increasing accountability using data journalism: Challenges for the Pakistani journalists. *Journalism Practice*, *15*(1), 19–40.

Jamil, S. (2023). Syncing with science: The challenge of knowledge-based journalism to report on science in Pakistan. *Journalism Practice*, 1–23.

Jebril, N., & Altef, S. (2024). Perceptions of data journalism and its impact on democratising Arab news media. *Journalism*, *25*(7), 1500–1518.

Jones, B., Jones, R., & Luger, E. (2022). AI 'Everywhere and Nowhere': addressing the AI intelligibility problem in public service journalism. *Digital Journalism*, *10*(10), 1731–1755.

Juarez Miro, C. (2022). The comment gap: Affective publics and gatekeeping in The New York Times' comment sections. *Journalism*, *23*(4), 858–874.

Juarez Miro, C., & Anderson, J. (2024). Correcting False Information: Journalistic Coverage During the 2016 and 2020 US Elections. *Journalism Studies*, *25*(2), 218–236.

Karlsson, M., & Clerwall, C. (2018). Transparency to the Rescue?: Evaluating citizens' views on transparency tools in journalism. *Journalism Studies*, *19*(13), 1923–1933. https://doi.org/10.1080/1461670X.2018.1492882

Knutsen, C. H., Kotsadam, A., Olsen, E. H., & Wig, T. (2017). Mining and local corruption in Africa. *American Journal of Political Science*, *61*(2), 320–334.

Kyriakidou, M., Cushion, S., Hughes, C., & Morani, M. (2023). Questioning fact-checking in the fight against disinformation: An audience perspective. *Journalism Practice*, *17*(10), 2123–2139.

Lewis, N. P., & Nashmi, E. Al. (2019). Data journalism in the Arab region: Role conflict exposed. *Digital Journalism*, *7*(9), 1200–1214.

Lopezosa, C., Pérez-Montoro, M., & Guallar, J. (2022). Data Visualization in the News Media: Trends and Challenges. *Technology, Business, Innovation, and Entrepreneurship in Industry 4.0*, 315–334.

Magaña, M. I., & García-Perdomo, V. (2024). Cracking the data journalism code in Latin America: Activism, transparency and democracy fuel the adoption of technology. *Journal of Applied Journalism & Media Studies*.

Magasic, M., Hess, K., & Freeman, J. (2023). Examining the social, civic, and political impact of local newspaper closure in Outback Australia. *Media and Communication*, *11*(3), 404–413.

Mathisen, B. R. (2023). *Journalism between disruption and resilience: Reflections on the Norwegian experience*. Routledge.

McCallum, K., Waller, L., & Myers, A. (2023). Revelation, reckoning and recovery: Bearing witness proximally in local journalism. *Journalism Studies*, *24*(9), 1175–1193.

McLoughlin, C., Patel, K. D., O'Callaghan, T., & Reeves, S. (2018). The use of virtual communities of practice to improve interprofessional collaboration and education: findings from an integrated review. *Journal of Interprofessional Care*, *32*(2), 136–142.

Meese, J. (2021). Journalism Policy across the Commonwealth: Partial Answers to Public Problems. *Digital Journalism*, *9*(3), 255–275. https://doi.org/10.1080/21670811.2020.1835514

Meng, J., & Zhang, S. (2022). *Digital Journalism in China*. London and New York: Taylor & Francis.

Mesquita, L., & Fernandes, K. (2021). The new praxeology of digital journalism in Latin America: Media organizations learn how to walk by running. In *Journalism, data and technology in Latin America* (pp. 23–53). Springer.

Møller Hartley, J., & Askanius, T. (2021). Activist-journalism and the Norm of Objectivity: Role Performance in the Reporting of the# MeToo Movement in Denmark and Sweden. *Journalism Practice*, *15*(6), 860–877.

Moreira De Oliveira, T., Barata, G., & Uribe-Tirado, A. (2021). Ten years of altmetrics: A review of Latin America contributions. *Journal of Scientometric Research*, *10*(1), 102–114.

Morini, F. (2023). Data journalism as "terra incognita": newcomers' tensions in shifting towards data journalism epistemology. *Journalism Practice*, 1–17.

Morini, F., Dörk, M., & Appelgren, E. (2023). Sensing what's new: considering ethics when using sensor data in journalistic practices. *Digital Journalism*, *11*(3), 465–483.

Moyo, D., & Munoriyarwa, A. (2019). Data journalism in the age of big data: An exploration into the uptake of data journalism in leading south African Newspapers. *Data Journalism in the Global South*, 85–105.

Muneri, C. T. (2019). Prospects for data journalism in Zimbabwe: Challenges of engendering a democratic society and an informed citizenry in the digital age. *Data Journalism in the Global South*, 39–52.

Mutsvairo, B. (2019). Challenges facing development of data journalism in non-western societies. *Digital Journalism*, *7*(9), 1289–1294.

Mutsvairo, B., Bebawi, S., & Borges-Rey, E. (2020). *Data journalism in the Global South*. Springer Nature.

Nelson, J. L. (2021). The next media regime: The pursuit of 'audience engagement'in journalism. *Journalism*, *22*(9), 2350–2367.

Nerents, D. V. (2020). The development of the data journalism in Latin America. *ВЕСТНИК РГГУ*, 80.

Neuberger, C. (2024). How journalism adapted the Internet in Germany: Results of six newsroom surveys (1997–2014). *Journalism*, *25*(5), 1070–1091.

Nyre, L., & Maiden, N. (2022). Can action research improve local journalism? *Nordicom Review*, *43*(2), 171–189.

Ohemeng, F. L. K., & Ofosu-Adarkwa, K. (2015). One way traffic: The open data initiative project and the need for an effective demand side initiative in Ghana. *Government Information Quarterly*, *32*(4), 419–428.

Okamoto, K. (2017). Introducing open government data. *The Reference Librarian*, *58*(2), 111–123.

Olsen, R. K., & Furseth, P. I. (2023). Service innovation and value creation in local journalism during times of crisis. *Journalism Studies*, *24*(4), 496–514.

Pereira, F. H. (2023). Media crisis and its effects on digital journalism careers in Canada. *Journalism*, *24*(11), 2533–2550.

Pignard-Cheynel, N., & Amigo, L. (2023). (Re) connecting with audiences. An overview of audience-inclusion initiatives in European French-speaking local news media. *Journalism*, *24*(12), 2612–2631.

Planer, R., & Godulla, A. (2021). Longform journalism in the USA and Germany: Patterns in award-winning digital storytelling productions. *Journalism Practice*, *15*(4), 566–582.

Porlezza, C., & Splendore, S. (2019). From open journalism to closed data: Data journalism in Italy. *Digital Journalism*, *7*(9), 1230–1252.

Reggi, L., & Dawes, S. S. (2022). Creating Open Government Data ecosystems: Network relations among governments, user communities, NGOs and the media. *Government Information Quarterly*, *39*(2), 101675.

Reyes-de-Cózar, S., Pérez-Escolar, M., & Navazo-Ostúa, P. (2022). Digital competencies for new journalistic work in media outlets: A systematic review. *Media and Communication*, *10*(1), 27–42.

Ross, A., Lester, L., & Konkes, C. (2021). Audience perspectives on paying for local news: A regional qualitative case study. *Journalism Studies*, *22*(8), 1066–1082.

Schapals, A. K., & Porlezza, C. (2020). Assistance or resistance? Evaluating the intersection of automated journalism and journalistic role conceptions. *Media and Communication*, *8*(3), 16–26.

Shilina, A., & Shilina, M. (2019). Towards data journalism in Russia? *Data Journalism in the Global South*, 163–190.

Skovsgaard, M., & Andersen, K. (2020). Conceptualizing news avoidance: Towards a shared understanding of different causes and potential solutions. *Journalism Studies*, *21*(4), 459–476.

Solodovnyk, D., Havryliuk, I., Sypchenko, I., Ishchenko, O., & Kyrylenko, O. (2023). Data journalism visualization in Ukraine and in Europe: a comparative analysis. *Amazonia Investiga*, *12*(64), 102–116.

Stalph, F. (2019). Hybrids, materiality, and black boxes: Concepts of actor-network theory in data journalism research. *Sociology Compass*, *13*(11). https://doi.org/10.1111/soc4.12738

Stenbom, A., Wiggberg, M., & Norlund, T. (2023). Exploring communicative AI: Reflections from a Swedish newsroom. *Digital Journalism*, *11*(9), 1622–1640.

Strukov, V. (2021). Digital journalism: toward a theory of journalistic practice in the twenty-first century. *The Palgrave Handbook of Digital Russia Studies*, 155–170.

Suherman, A., Cangara, H., & Karnay, S. (2023). Precision Journalism: Digitalization and Research Approaches in Journalism Practices in Indonesian Online Media. *4th Borobudur International Symposium on Humanities and Social Science 2022 (BIS-HSS 2022)*, 594–599.

Túñez-López, J. M., Toural-Bran, C., & Frazao-Nogueira, A. G. (2020). From data journalism to robotic journalism: The automation of news processing. *Journalistic Metamorphosis: Media Transformation in the Digital Age*, 17–28.

Turkel, E., Saha, A., Owen, R. C., Martin, G. J., & Vasserman, S. (2021). A method for measuring investigative journalism in local newspapers. *Proceedings of the National Academy of Sciences*, *118*(30), e2105155118.

Valencia-Forrester, F. (2023). 'It's time to start listening': Reporting on disability in practice-based journalism education. *Australian Journalism Review*, *45*(2), 217–232.

Van Leuven, S., Vanhaelewyn, B., & Raeymaeckers, K. (2021). From one division of labor to the other: The relation between beat reporting, freelancing, and journalistic autonomy. *Journalism Practice*, *15*(9), 1203–1221.

Veglis, A., Saridou, T., Panagiotidis, K., Karypidou, C., & Kotenidis, E. (2022). Applications of big data in media organizations. *Social Sciences*, *11*(9), 414.

Wahl-Jorgensen, K. (2023). Origin stories of local journalism entrepreneurs. *Journalism*, *24*(10), 2118–2135.

Wang, X., & Li, X. (2019). The Use of Data Journalism in China. *3rd International Conference on Culture, Education and Economic Development of Modern Society (ICCESE 2019)*, 558–560.

Weinacht, S., & Spiller, R. (2014). Data Journalism in Germany: An exploratory study on role models of data journalists. *Publizistik*, *59*, 411–433.

Wenzel, A. D., & Crittenden, L. (2021a). Reimagining local journalism: A community-centered intervention. *Journalism Studies*, *22*(15), 2023–2041.

Wenzel, A. D., & Crittenden, L. (2021b). Reimagining local journalism: A community-centered intervention. *Journalism Studies*, *22*(15), 2023–2041.

Wilczek, B., & Thurman, N. (2022). Contagious accuracy norm violation in political journalism: A cross-national investigation of how news media publish inaccurate political information. *Journalism*, *23*(11), 2271–2288.

Wright, K., Zamith, R., & Bebawi, S. (2019). Data journalism beyond majority world countries: Challenges and opportunities. *Digital Journalism*, *7*(9), 1295–1302.

Wright, S., & Nolan, D. (2023). The development of data journalism in China: influences, motivations and practice. *Digital Journalism*, *11*(9), 1664–1681.

Wu, S. (2022). Asian Newsrooms in Transition: A Study of Data Journalism Forms and Functions in Singapore's State-Mediated Press System. *Journalism Studies*, *23*(4), 469–486.

Wu, S. (2023). Evaluating 'exemplary data journalism' from Asia: An exploration into South China Morning Post's data stories on China and the world. *Journalism*, *24*(9), 2042–2058.

Zagidullina, M., Fedotova, N., Antropova, V., Fedorov, V., Lebedzeva, M., Panova, E., & Patrebin, A. (2023). How is journalism defined in university handbooks? A conceptual analysis of students' literature, examples of Russia and Belarus. *Journalism*, *24*(1), 211–232.

Zhang, S., & Feng, J. (2019). A step forward? Exploring the diffusion of data journalism as journalistic innovations in China. *Journalism Studies*, *20*(9), 1281–1300.

Zhang, X., & Chen, M. (2022). Journalists' adoption and media's coverage of data-driven journalism: a case of Hong Kong. *Journalism Practice*, *16*(5), 901–919.

Zhu, L., & Du, Y. R. (2018). Interdisciplinary learning in journalism: A Hong Kong study of data journalism education. *Asia Pacific Media Educator*, *28*(1), 16–37