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Data Visualization and Sports Journalism: The Case of Greek Sports Websites

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Abstract

The development of big data has brought changes to the forms and narratives of sports journalism, while data journalism has introduced visualizations into article production. The data become part of the journalistic product, leading to «data storytelling». Thanks to visualization techniques, data and text are transformed into a visual presentation, making articles more accessible and readable. Today, major sports media outlets worldwide combine the value of intensifying sports data, narrative ability and visualization technologies, creating a new model of sports journalism. The aim of this study was to examine whether five Greek sports websites (Sport24.gr, SDNA.gr, Sport-Fm.gr, Gazzetta.gr, Sportal.gr) adopt data visualization in the production of their articles. Using content analysis, the study explored in which cases and through which visualization practices these websites applied such techniques in articles published during the period of November–December 2024, specifically regarding Super League teams. The results showed that they did not use either big data or data visualization techniques in article production. Although big data were identified in sections related to betting content, they weren't present in the main editorial content of the websites. The only exception was Sportal.gr, where a dedicated "Statistics" section was found within its main article content.

Keywords: Visualization, big data, sports journalism, narration.

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Introduction

The digital transformation of journalism has introduced new formats, tools, and epistemologies to the profession. At the core of this transformation lies the increasing use of data—not only as a resource for investigative reporting, but as a building block of storytelling itself. In this context, data journalism has emerged as a powerful model for producing news stories that are both grounded in evidence and shaped by visual communication.

As audiences demand greater transparency, clarity, and context, journalists have begun to integrate data visualizations into their workflows. These visual elements help make sense of complex information, highlight trends, and support compelling narratives. The evolution of data journalism is particularly significant in fields such as sports reporting, where statistical analysis and storytelling coexist.

This paper offers a theoretical overview of data journalism and its reliance on big data, analysis, and visualization. It outlines the role of visual storytelling in contemporary journalism, with emphasis on how visualizations contribute not only to the form but also to the function of news content. Drawing on key academic sources, the discussion frames data visualization as a tool for both investigation and engagement.

The age of Big Data and journalism

Big data refers to the processing of vast amounts of information across diverse fields, such as scientific research, public policy, and business (Parasie, 2015). The use of data is considered the most important trend in today's journalistic practice (Treadwell, Ross, Lee & Lowenstein, 2016). The ability to retrieve and use information from big data expands the limits of traditional journalism, introducing new practices that align with rapid technological advancements (Veglis, Saridou, Panagiotidis, Karypidou & Kotenidis, 2022).

A helpful framework to understand big data is the "5Vs" model, which highlights its five defining characteristics (Robinson & Gillis, 2023):

Volume: The massive quantity of data generated and collected from diverse sources, which demands advanced technologies for efficient management and analysis.

Velocity: The speed at which data is created, collected, and processed, often in real time.

Variety: The diversity of data formats -structured, unstructured, and semi-structured- adds complexity to analysis and integration.

Veracity: The accuracy, quality, and trustworthiness of the data to avoid misleading conclusions.

Value: The potential benefits and insights that can be extracted from large datasets for informed decision-making and knowledge creation.

With the digitization of journalistic work and the rise of the internet, media organizations now operate across multiple publishing platforms (Veglis, 2012). Each platform generates data, collectively contributing to massive datasets. These data can become qualitative sources, shifting journalistic epistemology towards evidence-based narratives rather than intuition or subjective interpretation (Parasie, 2015).

Data Journalism: Concept, processes and new practices

The availability of digital data and online tools for analysis and visualization has strengthened the application of data journalism (Veglis & Bratsas, 2017). As a socio-cultural phenomenon, big data distinguishes data journalism from investigative or computational journalism (Sandoval-Martin & La-Rosa, 2018), introducing new methods of producing and understanding journalistic truth (Kalatzi, Bratsas & Veglis, 2018; Karypidou, Veglis & Bratsas, 2019).

Data journalism incorporates data analysis and visualization methods (Arias, Sánchez-García & Redondo, 2018) and aligns with the principles of open journalism (Rogers, 2014). It fosters collaboration between journalists, programmers, and designers, transforming newsroom routines and enabling new forms of storytelling based on data (Reese & Shoemaker, 2016).

The process generally involves three stages: accessing publicly relevant data, analyzing it through specialized software, and constructing narratives based on findings (Arias et al., 2018). Although journalists have long used statistics, the proliferation of datasets and advanced tools has enhanced reporting capacity in both depth and interactivity.

The use of Big Data in sports

Thanks to the rapid development of information and communication technologies, the sports industry is now closely connected to big data. Globally, the analysis of such data mainly focuses on three key areas: The improvement of athletic performance, the prevention athletes' injuries and digital entertainment. Moreover, the rise of data journalism has led to significant changes in sports journalism - both in terms of news sources and the methods used in news writing (Gao, Tang & Lu, 2022).

The element that makes big data significant in sports journalism is prediction. This is because journalists, by relying on big data, can make predictions - for example, regarding a team's performance, the outcome of a match, or even the likelihood of an athlete's injury. These predictions are based on data related to an athlete's history, their movements, abilities and skills, the current condition of a team etc. (Gao, Tang & Lu, 2022).

The role of visualizations in data journalism

Visualizations are not just decorative; they serve analytical and communicative functions. They visually represent non-visual data in clear and recognizable formats, supporting the audience's understanding.

Narrative visualizations help communicate complex and sometimes controversial issues (Hullman & Diakopoulos, 2011), enabling readers to interact with data stories. In data journalism, traditional reporting is enriched through graphics, interface design, and computational tools, offering access to untold stories and enhancing user engagement (Kennedy, Allen, Engebretsen, Hill, Kirk & Weber, 2021).

Effective visualizations can present new insights, spark curiosity, reinforce or challenge existing knowledge, and support critical engagement. They may also influence decision-making processes or political attitudes (Amit-Danhi, Pentzold & Krämer, 2024).

Types of visualizations and their narrative value

There are two main ways a data-driven story can begin: with a dataset that complements an existing news lead, or as a story built entirely from data exploration (Sirkkunen & Lehtonen, 2011). Data visualizations differ from static graphics in their flexibility: they can dynamically adapt as data or user inputs change. Visualizations can be static, dynamic, or interactive. All share the goal of revealing patterns and relationships that deepen understanding. While static visuals may require repeated viewing to interpret, dynamic and interactive ones allow tailored exploration of datasets (Veglis, 2009; Caple, Anthony & Bednarek, 2019).

The novelty lies in the computer-assisted ability to represent complex relationships between variables, fostering personalized interaction. Through these interfaces, data journalism moves from static web content to an interactive information platform (Royal & Blasingame, 2015; Sirkkunen & Lehtonen, 2011).

The visualization of sports data and its significance

The way people consume news has changed thanks to technology, which has made reading faster and more efficient (Pinto, 2017). How did this happen? Through the

transformation of the appearance of mass media, which in turn have incorporated graphics into their daily practice in order to present news in a visualized form, although they still use narrative text (Holton, Lewis & Coddington, 2016; Weber & Rall, 2016; Ghode, 2012; Schlichting, 2016).

Visualization serves specific functions, such as the communication of complex data (Wojtkowski & Wojtkowski, 2002, as cited in Segel & Heer, 2010), as well as the illustration and clarification of complicated information (Holsanova, Holmberg & Holmqvist, 2008). There are times when a news story may appear somehow “rigid” in the eyes of readers and thus visualization becomes necessary in order to add a more emotional touch (Hanser, Kevitt, Lunney & Condell, 2010).

Other important functions served by visualization include the shaping of meaning (Weber & Rall, 2016), the depiction of the news story, its support, the overview function and the decorative function (Volsdal, 2011). Therefore, the significance of visual elements in storytelling, explanation and persuasiveness is considerable (Normah & Faridah, 2018).

Researches have shown that understanding a news story becomes easier when it is visualized through infographics. This is because people can comprehend and imagine the story more easily. This, however, requires that the visualization be prepared with great attention to its content (Holsanova, Holmberg & Holmqvist, 2008). Another function it serves is emphasizing key points or values within a story, as the infographic visually communicates data to the public and more easily triggers emotions (Lestari Sjafiie, Hastjarjo & Muktiyo, 2018).

As mentioned above, it is important to pay close attention to the content of the graphic, as it must accurately represent the news story. This means that the focus should be more on the content than on aesthetics. For this reason, its creation requires the involvement of an investigative journalist. To achieve the best possible result, the production of a graphic demands close collaboration between a graphic designer, an illustrator and journalists (Weber & Rall, 2016). It is worth noting the following: Visualization is not merely an accompanying element, but a rather integral part of the idea, the concept and the words in the text. Therefore, visualization constitutes an essential component in the construction of meaning within the news article (Hanitzsch, 2007).

In the field of sports, big data visualization technology transforms symbolic descriptions into geometric ones. Compared to the traditional way of presenting data in tables or documents, visualized data is presented in a more intuitive manner, making it more objective and convincing for the audience. Furthermore, thanks to visualization

techniques, the invisible becomes visible, facilitating the understanding of the unknown. At the same time, the importance of visualization is highlighted, as it contributes to the formation of arguments or subjective opinions, the summarization or accumulation of data, the understanding and pursuit of truth, and the spreading of knowledge. The aim of data visualization is to move from merely observing objects to acquiring knowledge (Gao, Tang & Lu, 2022).

In conclusion, data journalism and visualization are two rapidly developing areas within sports journalism, as their combination offers an exceptional reading experience and high-value news content to readers (Gao, Tang & Lu, 2022), ultimately leading to its complete transformation (Horky & Pleka, 2016).

Purpose

The purpose of this study is to investigate whether and how major Greek sports news websites incorporate big data and data visualization techniques into their journalistic content. Specifically, the research aimed to assess the extent to which these tools are used in sports reporting, identify the types of visualizations applied (if any), and explore the potential for enhancing storytelling through data-driven practices. By focusing on five prominent Greek websites and analyzing football-related articles published during November–December 2024, the study sought to highlight current practices, reveal possible gaps, and propose pathways for innovation in Greek sports journalism.

Methodology

Grounded in the theoretical perspectives that highlight the transformative impact of big data and data visualization on journalistic practices (Gao, Tang & Lu, 2022; Hanitzsch, 2007; Weber & Rall, 2016), this study aimed to assess the current use of big data and data visualization techniques in Greek sports journalism. Specifically, it examined whether leading Greek sports websites incorporate data as a narrative and visual element in their published content.

As it mentioned above, recent scholarship suggests that data visualization serves not merely as an aesthetic enhancement, but as a critical tool for narrative construction, comprehension of complex information and audience engagement (Holsanova, Holmberg & Holmqvist, 2008; Perin et al., 2018). In parallel, the increasing availability of sports-related big data presents opportunities for predictive analytics, performance assessment,

and enriched storytelling, ultimately reshaping the editorial process (Gao et al., 2022; Liu & Wang, 2022).

The research sought to answer the following questions:

RQ1: Do these websites use big data in the production of journalistic content?

RQ2: Do they apply data visualization techniques?

RQ3: In which cases and formats are data and visualizations employed?

These questions aim to bridge the gap between theoretical insights and practical applications, offering a contextualized understanding of how data journalism is - or is not - being operationalized in the Greek sports media environment.

To address the research questions and ensure a comprehensive examination of current practices regarding the use of big data and data visualization in sports journalism, the study focused on a corpus of online articles related to football, published on five widely recognized Greek sports news websites: Sport24.gr, SDNA.gr, Sport-FM.gr, Gazzetta.gr and Sportal.gr. These websites were selected on the basis of their popularity, audience reach, and consistent production of sports-related content, particularly in football, which is the most prominently covered sport in the Greek media landscape.

The data collection covered a specific two-month period, from November 1st to December 31st, 2024, chosen due to its relevance to the mid-season coverage of the Greek Super League, during which media output and public interest are typically high. This temporal focus also enabled a targeted and manageable sample size for systematic analysis.

In total, the sample consists of 8,923 articles, distributed relatively evenly across the two months. Specifically, 4,368 articles were published during November 2024, while 4,555 articles were published in December 2024. The content was retrieved directly from the archives and live feeds of each website, ensuring consistency in source validity and relevance (Table 1).

Table 1. The number of articles that were published from November 1st to December 31st, 2024 and the number of articles that included visualizations

Website's name	Number of articles (November 2024)	Number of articles (December 2024)	Articles and visualizations
Sport24.gr	549	561	1
SDNA.gr	1144	1188	1
Sportfm.gr	983	993	0

Gazzetta.gr	992	1133	0
Sportal.gr	700	680	1
Total	**4.368**	**4.555**	**3**

For the purposes of this study, quantitative content analysis was selected as the primary methodological approach. This technique is widely used in media and communication research and is particularly suitable for studies seeking to systematically identify, classify, and measure patterns in large volumes of textual or visual content. As defined by Berelson (1952), content analysis constitutes a scientific research method that aims to provide an objective, systematic, and quantitative description of the manifest content of communication. It enables researchers to observe recurring structures, themes, and communicative features through a replicable process of coding and classification.

Similarly Bryman (2017) notes that content analysis is particularly concerned with the explicit, directly observable elements of communication units, distinguishing it from interpretive methods that focus on latent or symbolic content. The key advantage of this method lies in its ability to translate qualitative textual material into quantifiable data, making it possible to analyze trends, frequencies, and correlations with statistic analysis.

The decision to employ the quantitative content analysis in the present study was based on several key strengths of the method. Firstly, it is considered to be highly transparent and objective, as it allows for consistent criteria of analysis that can be replicated by other researchers. Secondly, it is a flexible methodology method, as it can be applied across a variety of media types and research questions. Thirdly, it offers the potential for intertemporal or comparative analysis, which is particularly useful when analyzing changes over time in media practices or content structures (Bryman, 2017).

While numerous studies using content analysis rely on predefined coding schemes drawn from existing research (White & Marsh, 2006), the present study developed and implemented original coding categories. This decision was necessary due to the absence of prior studies that specifically examine the use of big data and data visualization in Greek digital sports journalism and thus no directly comparable coding frameworks were available. The creation of custom coding instruments ensured that the analytical framework was tailored to the unique characteristics of the dataset, while still maintaining methodological dligence.

Results

The findings show that the examined sports websites do not consistently use big data in content creation. Key observations include:

Sport24.gr featured a custom infographic summarizing player statistics and team records (Figure 1).

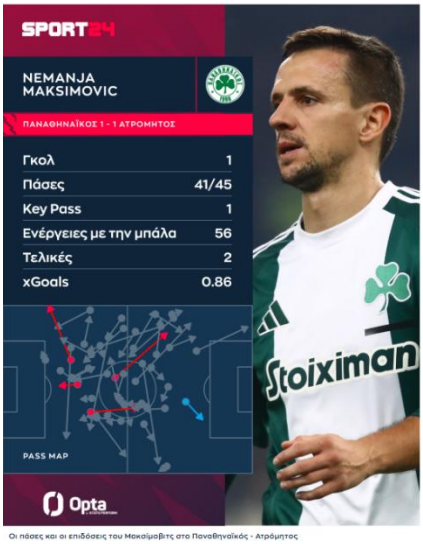

Figure 1. Example of a static infographic published on Sport24.gr, summarizing player scoring efficiency and team performance milestones. The visualization is original but lacks interactivity[1].

Sportal.gr maintained a dedicated “Statistics” tab, although visual elements were often republished from external sources.

SDNA.gr included match statistics presented as static images, typically screenshots from official scoreboard graphics (Figure 2).

[1] Source: https://www.sport24.gr/football/panathinaikos-to-94-tou-skorer-maximovits-kai-to-rekor-tou-tete-den-eftasan-sto-trifilli/.

Figure 2. Match statistics presented as a static screenshot on SDNA.gr, extracted directly from the stadium scoreboard and embedded without further analytical context or interactivity[2].

Most of the visualizations identified across the examined websites were static, lacking interactivity, customizability, or deeper layers of analytical insight. These graphics were typically limited to simple infographics or image-based statistics with no user engagement mechanisms. Moreover, data-driven content was predominantly located in sections related to betting and odds, rather than in core editorial articles or in-depth sports reporting.

These findings indicate that, although some basic attempts at data presentation are present, the systematic integration of big data techniques and visualization practices into everyday journalistic production remains minimal. The potential of data visualization to enrich narrative quality and support evidence-based storytelling is currently underutilized in Greek sports journalism.

So, the analysis revealed that articles featuring data visualizations were virtually absent from the examined Greek sports websites. Most platforms relied primarily on textual reporting or embedded images without analytical depth or interactive elements. This finding highlights a significant gap between the potential of data-driven storytelling and current practice in the Greek sports media landscape.

Given this limited use of data visualizations, the research team developed proposals to demonstrate how visual elements could be created based on existing content:

[2] Source: https://www.sdna.gr/podosfairo/1257792_i-statistiki-toy-ntermpi-emoiaze-isorropimeno-itan-peripatos-pic.

One of the proposed examples includes a basic visualization created using Microsoft Excel, based on an existing article that featured textual reporting, a data table, and a simple graphical element (Figure 3). The visualization represents match-specific data such as:

- Goals
- Shots on target
- Possession percentage
- Pass accuracy
- Fouls committed
- Yellow and red cards

This example demonstrates how widely accessible spreadsheet tools can be used to transform raw data into a clear and engaging visual format. The result is a layout that enhances both the readability and the informative value of the article, making key match insights more accessible to the audience.

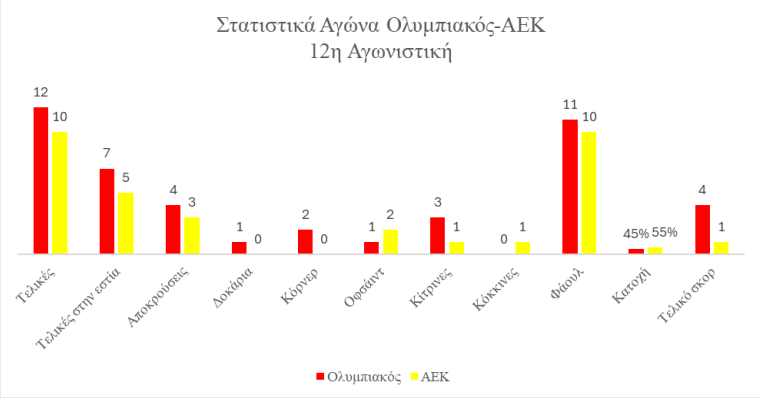

Figure 3: Match Statistics Visualization: Olympiacos vs AEK. A basic chart created using Microsoft Excel, representing key match data including goals, shots on target, possession percentage, pass accuracy, fouls committed, and yellow/red cards.

Another proposal involves the development of an interactive bubble chart using Tableau, designed to visualize team performance data in a clear and engaging way (Figure 4 and 5). It is recommended that journalistic articles integrate such interactive visualizations, which can also be interconnected, allowing readers to navigate across related datasets and gain a more comprehensive understanding of the content.

In this specific chart, each bubble represents a football team. The color of the bubble corresponds to the team's identity, enabling immediate visual differentiation. The size of each bubble reflects the team's overall performance, specifically the combined total

of wins and losses. The horizontal (x) and vertical (y) axes represent key performance metrics—such as the number of wins on one axis and the number of losses on the other—offering a comparative view across all teams.

What makes this visualization particularly effective is its interactivity: users can click on a bubble to isolate data for a single team, highlight patterns, and explore specific details. Furthermore, by linking visualizations together, journalists can create a dynamic narrative space, where readers transition seamlessly from one dataset to another, reinforcing the story's analytical depth and enhancing user engagement.

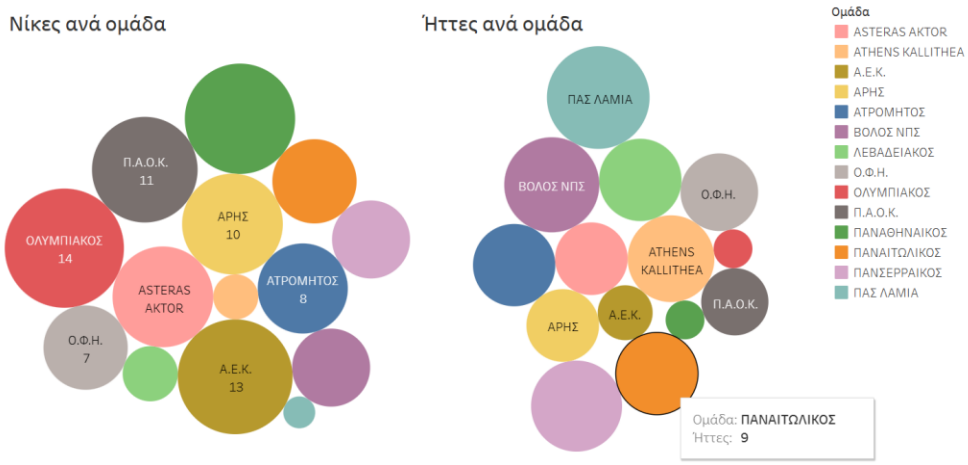

Figure 4. Interactive Bubble Chart of Team Performance created with Tableau. Each bubble represents a football team; color denotes team identity, size reflects total wins and losses, while axes display performance metrics. Users can click on a bubble to isolate data for a specific team.

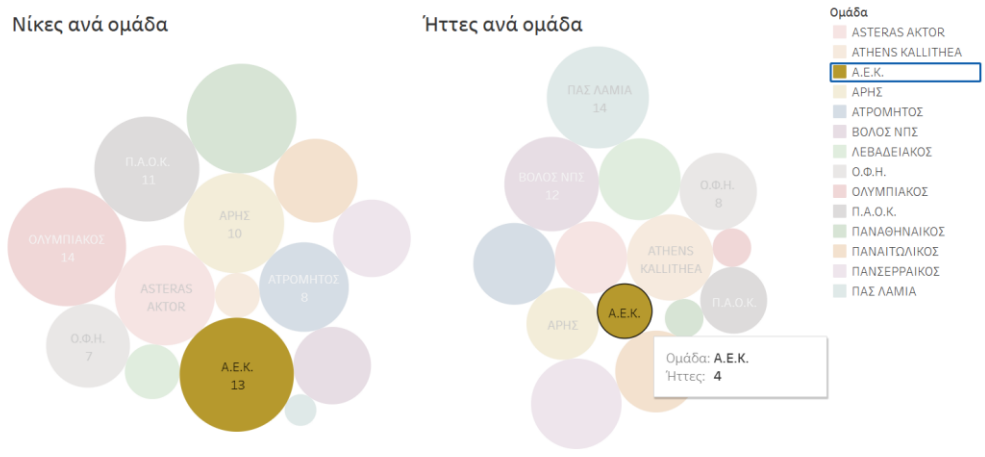

Figure 5: Extended Team Statistics Dashboard created with Tableau. This interactive visualization aggregates multiple key performance indicators and allows filtering and comparison between teams, enhancing user engagement and exploratory analysis.

Another Tableau dashboard was developed to present broader team-level statistics (Figure 6). This visualization aggregates key performance indicators and enables dynamic filtering and comparison between teams.

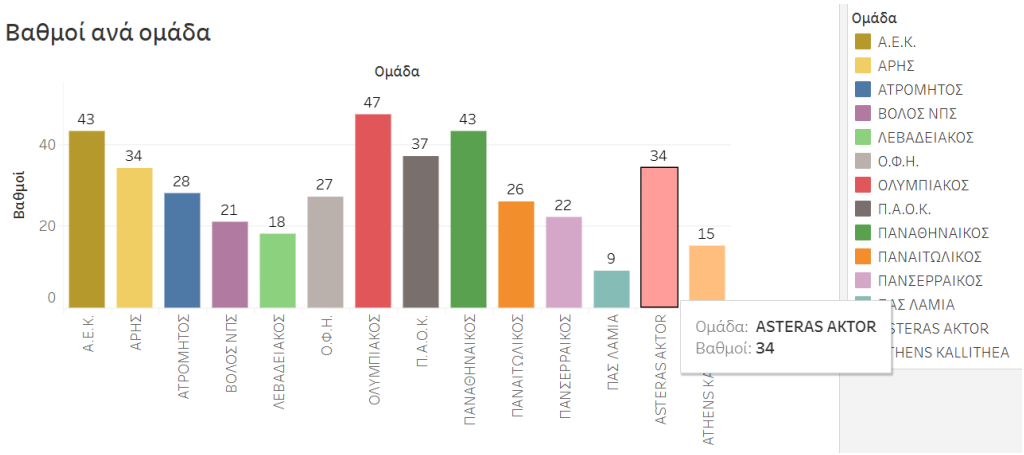

Figure 6. Extended Team Statistics Visualization. A Tableau-based interactive chart presenting detailed performance data across teams, allowing users to filter results and compare metrics such as wins, losses, and other key indicators.

These examples show that simple, accessible tools like Excel, as well as more advanced platforms like Tableau, can be used to create meaningful data visualizations that enrich sports articles. Such implementations can help Greek sports journalism transition toward more data-informed, engaging, and interactive content.

Discussion

Despite the growing global momentum of data journalism - particularly within sports media - Greek sports websites continue to lag in adopting data-driven storytelling practices. The integration of big data into journalistic practices remains minimal, and when data visualizations are present, they tend to be static, surface-level, and lacking interactivity. These limitations suggest that the potential of data journalism to transform how sports stories are told remains largely untapped in the Greek context.

This study set out to investigate the extent to which Greek sports websites incorporate big data and data visualization into their journalistic practices during the period of November–December 2024. To guide the analysis, three key research questions were posed:

RQ1: Do these websites use big data in the production of journalistic content?

RQ2: Do they apply data visualization techniques?

RQ3: In which cases and formats are data and visualizations employed?

With regard to **RQ1**, the findings demonstrate that the use of big data in content production is minimal and unsystematic. Data is rarely integrated into the editorial workflow, and when present, it appears more often in the context of betting or odds-related content than in core sports reporting.

Concerning **RQ2**, although some examples of data visualizations were found, these were mostly static and lacked interactivity or analytical depth. Visual content was limited to basic infographics or screenshots of match statistics, with no dynamic or exploratory features.

As for **RQ3**, the study identified very few formats or cases where data and visualizations were used effectively. The most notable examples included a custom infographic on Sport24.gr and a scoreboard image on SDNA.gr. To address this shortfall, the research team developed proposals demonstrating how data from existing articles could be enhanced through visual techniques, using both basic tools (e.g., Excel) and advanced platforms (e.g., Tableau).

These results suggest that, despite the growing global relevance of data journalism, Greek sports journalism is still in the early stages of adopting data-driven storytelling practices. The gap between the tools available and their application in newsrooms highlights an urgent need for change and this study underscores the need for further research and practical initiatives aimed at enhancing the digital competence of journalists, improving the quality of content produced and aligning media practices with the contemporary demands of the digital environment.

Suggestions for Future Research

In alignment with the theoretical framework that highlights the narrative and communicative potential of data visualization in journalism (Hanitzsch, 2007; Weber & Rall, 2016; Holsanova et al., 2008), future research could meaningfully focus on the organizational and editorial dimensions of its implementation. Especially:

- Investing in interactive data visualization tools (such as Tableau, Flourish, or Datawrapper) would allow for more sophisticated representations of sports data that go beyond traditional charts and static infographics. These tools enable dynamic, user-driven exploration and can greatly enhance audience engagement.
- Training journalists in data literacy and visual storytelling is crucial. Reporters must become comfortable working with datasets, interpreting patterns, and understanding

which visual formats best communicate their findings. Integrating these skills into editorial workflows would empower journalists to uncover richer narratives.

- Fostering interdisciplinary collaboration between journalists, developers, and designers could lead to the production of more technically and aesthetically refined visualizations. Collaborative teams can ensure that data is not only accurate but also meaningful, accessible, and engaging for readers.
- Evaluating audience engagement with data-based content—through analytics, feedback mechanisms, or usability studies—can help editors understand how visualizations affect reader comprehension and interest. This knowledge can inform future editorial decisions and format choices.

Looking ahead, future research could further explore the internal dynamics of Greek sports newsrooms, particularly through qualitative interviews with editors and journalists. These conversations could uncover the practical, technical, and cultural barriers to adopting data journalism tools and help identify targeted solutions.

Additionally, there is significant value in categorizing sports data into structured typologies, such as box-score data (i.e., game-based statistics like goals, assists, fouls, etc.), and designing reusable visualization templates for reporting on match events. Such models would streamline the production of consistent, high-quality visual content and potentially establish new storytelling standards within the field.

In conclusion, while Greek sports journalism currently underutilizes the possibilities of big data and visualization, the tools, practices, and knowledge required to bridge this gap are both available and increasingly accessible. What remains is a strategic commitment to innovation—one that aligns journalistic storytelling with the demands and expectations of the digital age.

Practical Contribution of the Research

This study identifies a significant gap in the integration of big data and data visualization within Greek sports journalism. It highlights the need for strategic investment in interactive tools (like Tableau or Datawrapper) and journalist training in data literacy and visual storytelling. The findings suggest practical steps, such as fostering interdisciplinary collaboration among journalists, designers, and developers, and implementing reusable visualization templates. The research also proposes evaluating audience engagement through analytics and feedback, offering actionable insights for newsroom practices. These contributions can serve as a roadmap to modernize content production and align Greek sports journalism with international digital standards.

Conclusion

This study set out to explore the extent to which major Greek sports websites integrate big data and data visualization techniques into their journalistic practices. The analysis, which covered nearly 9,000 articles across five leading platforms, revealed that the use of such tools remains minimal and unsystematic. Data visualizations were rare, and when present, they were typically static and lacked interactivity or analytical depth. In most cases, data-driven content was confined to betting sections rather than core editorial storytelling.

The findings highlight a significant underutilization of the potential offered by data journalism in Greece's sports media landscape. While global sports journalism increasingly leverages big data and visual storytelling to enhance narrative richness and reader engagement, Greek outlets have yet to adopt these practices at scale. This gap not only limits the quality and innovation of sports coverage but also undermines the audience's ability to engage with and understand complex sports data.

To address these challenges, the research proposes actionable steps, including the adoption of interactive data visualization tools, training journalists in data literacy, and promoting collaboration between journalists, developers, and designers. Additionally, establishing templates and structured models for visual reporting could help streamline workflows and set new editorial standards. Evaluating audience responses to visual content can further inform best practices and strategic editorial decisions.

Ultimately, the study emphasizes that the tools and knowledge necessary to bridge this digital divide already exist and are increasingly accessible. What is needed now is a strategic and cultural shift within Greek newsrooms - one that embraces innovation, values data as a narrative asset, and redefines the standards of sports reporting in line with the demands of today's digital media environment.

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