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Editors


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From Likes to Comments: Tracking Interaction Trends on Social Networks to Promote Cultural Events

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Abstract. Tourism drives the economy through job creation and infrastructure development, while the cultural component, such as gastronomy and historical heritage, enriches the visitor experience and reduces regional disparities. Municipalities use channels like Instagram to promote cultural events and strengthen local identity, reaching a diverse audience and encouraging community and visitor engagement. This study explores interaction trends in event posts on Bragança, Portuguese City Municipality's Instagram from 2020 to 2023. The aim is to analyse the evolution of metrics such as likes, comments and views over the last four years. Using a quantitative approach, data was collected from Instagram posts using the APIFY platform, followed by an analysis using Python for statistical evaluation to identify correlations and patterns. The main results reveal significant variations in user engagement with different types of events and changes in follower behaviour over time. These findings offer valuable information for social media management and municipal event planning, emphasising the importance of adaptive strategies on digital platforms.

Keywords: Smart Destinations · Digital Transformation · Social Media Interaction

1 Introduction

Tourism is a crucial factor in the economy as it generates direct and indirect jobs, driven by the growth of tourism activities and the need for infrastructure [1, 2]. The cultural component of tourism, which includes gastronomy, historical heritage, crafts, and local traditions, enriches the visitor experience and helps reduce disparities in the influx of visitors between regions [3]. Public and private agents promote cultural encouragement through tangible products, such as handicrafts, and non-tangible products, such as cultural events and festivals, promoted by municipalities through digital and physical channels [4].

Municipalities play an essential role in their communities but have yet to recognise the importance of an effective digital marketing presence and communication to promote their activities [5]. The need for an integrated and consistent communication strategy, crucial for reaching a diverse audience through multiple channels, is increasingly realised [6, 7]. Instagram has become a powerful communication tool for municipalities, effectively disseminating cultural events and promoting local identity and cultural heritage [8, 9]. With a global audience, Instagram makes it possible to reach diverse audiences, including potential international visitors, strengthening tourism promotion in an accessible and interactive way while increasing the visibility of municipal activities and strengthening community engagement [10–12]. Based on this, by connecting to the study of scientific literature conducted through the search equation “social media” OR “media” AND “Instagram” OR “insta” AND “Tourism” OR “municipality” AND “events” OR “culture” on the SCOPUS and WoS platforms, it was possible to discern the relevance of analysing interaction trends in event publications on social networks, with a specific focus on the Instagram platform. This study investigated the interaction trends in event posts on Bragança City Municipality’s Instagram account between 2020 and 2023. The main objective was to study the evolution of engagement metrics, such as likes, comments, and views, over the last four years. Data was collected from Instagram posts via the Apify platform, followed by statistical analysis using Python to identify correlations and patterns. Data collection is fundamental in any scientific research as it determines the quality and reliability of the conclusions drawn. In this study, comprehensive data collection from the Bragança Municipal Municipality’s Instagram (@municipiobraganca), conducted through the Apify platform between 2020 and 2023, played a crucial role in analysing trends in interaction and engagement with events promoted by the institution. Following the initial data collection phase, Python programming was employed to conduct tests and statistical analyses.

2 Framework

Tourism has taken on an increasing dimension in Portugal’s national accounts, contributing to the country’s economic growth and that of its various regions. This growth encompasses a solid cultural and social dimension, as tourism and culture commonly go side by side with most tourism destinations also featuring a cultural component. This cultural aspect has helped reduce asymmetries in visitor influx, particularly in areas traditionally characterised by high tourist activity [1, 13–15].

At a macroeconomic level in Portugal, tourism is considered a significant source of revenue, generated through various activities such as accommodation, catering, transportation, cultural activities, and the purchase of various goods and services directly or indirectly related to tourism [2, 16]. Tourism also plays a crucial role in job creation, both directly and indirectly [3, 17, 18], as the growth of tourism activity is linked to developing public and private infrastructures. Public infrastructures include roads, bus terminals, trains, and airports [19], while private structures encompass resorts, hotels, guesthouses, local accommodations, and restaurants.

Regarding the cultural dimension and its relationship with tourism, it is increasingly common for this dimension to be integrated into a region’s tourism offerings,

whether through gastronomy, the promotion of historical and architectural heritage, craftsmanship, or the sharing of traditions. Over the past decade, there has been a growing awareness of popular traditions (an integral part of the culture) from a dual perspective: increasing respect for their maintenance and a greater consciousness of the need for their dissemination, seen to perpetuate them [20, 21]. Furthermore, beyond enabling the alignment of the municipality's institutional image (creating a distinctive identity), an appropriate digital marketing strategy will also facilitate the promotion of cultural activities held within the city, thereby contributing to the overall promotion of tourism activity, given the diversity of activities associated directly and indirectly with tourism, synergies, and positive externalities among various economic agents in the region who are benefiting from the influx of visitors into the city [3, 17].

Municipalities play a fundamental role in the communities they represent. Yet, there has only sometimes been awareness of the need for a robust digital presence and communication, particularly in promoting various activities [5]. Consequently, the realisation of the necessity to implement an integrated communication and marketing strategy, conducted professionally, assertively with continuity, exploring multiple channels to reach an increasingly diverse audience, is becoming recognised as crucial for municipalities [6, 7, 21]. Municipalities are increasingly aware of the importance of digital marketing in promoting local events. Studies in various countries have demonstrated how municipalities effectively use digital marketing to promote local events. For example, analyses of TripAdvisor reviews can influence the image of tourism destinations and how visitor profiles can be delineated from these reviews, underscoring the importance of digital platforms in the management and promotion of cultural tourism [22, 23]. Another study in Barcelona highlighted how the municipality uses platforms like Instagram to promote cultural festivals and community events, reaching residents and international visitors [8]. Similarly, studies in cities such as London and Amsterdam have shown that an active presence on social media increases public participation in local events, strengthens cultural identity, and attracts visitors [9]. These examples illustrate how digital marketing strategies are critical for increasing the visibility of municipal events, fostering local pride, and driving the economy through tourism and community engagement.

With the advent of social media, especially platforms like Instagram, municipalities have found an effective way to promote cultural events, traditional festivities, and other locally relevant activities to a vast and diverse audience [24, 25]. The strategic use of these tools enhances the visibility of municipal initiatives and strengthens local identity and pride, promoting community engagement and boosting tourism. The ability to reach not only residents but also potential national and international visitors through visually appealing content and direct interactions makes digital marketing a cornerstone in the agenda of modern municipalities to maximise the engagement of their events and strengthen the social and economic fabric of the region [26–28].

3 Methodology

3.1 Sample

Studies investigating organisations utilising Instagram and other platforms to promote events often hinge on selecting an appropriate sample to achieve valid and generalisable results. For instance, when analysing how different types of Instagram posts affect participation and engagement in events, selecting a representative sample of posts capturing the diversity of content promoted by organisations is crucial [29].

The sample's representativeness is crucial for extrapolating conclusions about how specific strategies of Instagram posts influence the target audience's behaviour towards promoted events. Furthermore, statistical accuracy is enhanced when the sample is sufficiently large and diverse to capture a significant range of event promotion practices on digital platforms. Therefore, the careful selection of the sample not only strengthens the internal validity of the findings but also facilitates the generalisation of the results to similar contexts of event promotion through social media [30]. Thus, this study focuses on the city of Bragança, located in northeast Portugal, as the chosen sample to investigate the strategic use of Instagram in promoting local events. Bragança, renowned for its rich cultural heritage and diverse events throughout the year, provides an ideal setting to explore how digital platforms like Instagram are utilised by local entities, including the Bragança City Municipality and other cultural organisations, to engage the community and attract event participants.

Bragança was selected as the sample because it is a dynamic regional cultural hub that hosts events ranging from music festivals and art exhibitions to traditional fairs and sports events. The city represents a significant example of how semi-rural areas can leverage digital marketing strategies to amplify the reach of their events, enhance cultural visibility, and strengthen connections with residents and visitors. By examining how different types of Instagram content, such as photos, videos, and stories, engagement participation and engagement in Bragança's events over time (specifically between 2020 and 2023), this study aims to contribute to a deeper understanding of cultural promotion dynamics through social media in specific regional contexts like that of Bragança, Portugal.

3.2 Data Collection Process

Data collection is a fundamental stage in any scientific research as it determines the quality and reliability of the conclusions drawn [31]. In the specific case of this study, the comprehensive data collection from Instagram page of Bragança City Municipality (@municipiobraganca), conducted through the Apify platform between 2020 and 2023, plays a crucial role in analysing trends in interaction and engagement with events promoted by the institution. Apify was chosen as the tool to extract data from Municipality Bragança's Instagram due to its ability to automate the collection process, ensuring a systematic and efficient approach to compiling a complete set of information over the study period. This approach ensured the integrity of the collected data. It facilitated the analysis of a substantial volume of data, providing a comprehensive insight into the municipality's event promotion practices on the social platform. Following the initial

data collection phase, the process involved using Python programming to conduct tests and statistical analyses. This step was essential in extracting significant insights and substantiating the study's conclusions. Tests conducted in Python enabled the exploration of correlations between different types of posts (such as photos, videos, and stories) and engagement metrics, including likes, comments, and views.

Moreover, ChatGPT played a complementary role in the analysis process by assisting in interpreting the results. Leveraging advanced natural language processing capabilities, ChatGPT was employed to analyse descriptive texts, identify patterns in user interactions, and aid in contextualising the collected data. This approach enhanced the understanding of the results and facilitated the generation of additional qualitative insights [33–35].

The importance of the data collection process extends beyond the quantity of information gathered to include the quality of result interpretation. Rigorous methodology from extraction to statistical analysis contributes to the study's internal validity, ensuring that conclusions are based on solid and replicable evidence [31, 32]. In summary, the meticulousness in collecting all data from Instagram page of Bragança City Municipality via Apify and statistical analysis using Python to interpret the results were crucial in deepening the understanding of digital interaction dynamics and event promotion in municipal administration. This process underscored the effectiveness of the municipal municipality's digital marketing strategies and demonstrated the potential of advanced technological tools in applied scientific research on social media and consumer behaviour.

3.3 Methods

The methodological process of this study follows a detailed quantitative approach to investigate interaction trends in event posts on the Instagram account of Bragança City Municipality, spanning from 2020 to 2023. Data from Instagram posts were collected using the APIFY platform. APIFY enables automated web data extraction, suitable for obtaining structured information from social media platforms like Instagram [36]. Following data collection, analysis was conducted using the Python programming language. Python is widely employed for data analysis due to its flexibility and the availability of powerful libraries such as Pandas, NumPy, and Matplotlib [37].

Statistical techniques were applied to identify correlations between variables such as likes, comments, and views over the four-year study period. This encompassed calculating means, standard deviations, analysis of variance (ANOVA), Pearson correlations, and other relevant statistical measures. Means were computed to understand the typical values of each interaction metric, while standard deviations were used to assess data dispersion around these means. ANOVA was employed. Additionally, Pearson correlations were computed to examine relations between interaction metrics.

The primary objective was to identify patterns in follower behaviour over time and significant variations in user engagement with different event types. Data visualisation techniques (graphs, diagrams) were utilised to communicate the analysis findings effectively.

4 Results

4.1 Destination Promoted by Instagram @Municipiobraganca

The Instagram page of Bragança City Municipality aims to inform and engage the local community and visitors about the municipality's activities, services, events, and updates. It is a platform to promote governmental transparency and citizen and visitor participation. Initial manual analysis of Bragança City Municipality's Instagram account revealed several direct insights into its social media presence. The page employs high-quality images and videos, with regular and visually coherent posts. Its diverse content keeps the audience engaged, covering a wide range of topics relevant to residents and visitors of Bragança. The account proactively responds to followers' comments and questions and utilises interactive stories with polls, questions, and quizzes to enhance community engagement.

The page boasts many followers (18,000), reflecting public interest in municipal activities. The follower base's growth over time is a positive indicator of engagement. Posts reach a broad audience, with substantial impressions and unique reach, suggesting that the content resonates well with the audience. Specifically, as of the study's date (until the end of 2023), the social media account has 18,000 followers, follows 175 accounts, and has made 500 posts, including 70 reel videos, 217 sidocar posts (a specific type of carousel post allowing multiple images or videos in one post), and 213 single-image posts, along with over 24 story archives. Bragança City Municipality's Instagram page is an effective communication and community engagement tool, promoting transparency and citizen participation through quality content and consistent interaction with followers (CM Bragança) (ePortugal). Like any local authority, Bragança City Municipality regularly organises various events yearly. Specific listings of events promoted via social media are detailed in Table 1. These include Cultural Festivals and Events, Sporting Events, Social and Community Events, Local Celebrations and Festivities, and Tourism Promotion Programs. Cultural events feature music festivals, traditional fairs, art exhibitions, and local cultural showcases. Table 1 details the most significant cultural events and their annual schedule.

As previously mentioned, cultural events have been increasingly pivotal in stimulating tourism across various regions, and the Municipality of Bragança is no exception. Therefore, the importance of the municipality's role in promoting these events through official channels is underscored. These include the municipality's website at <https://www.cm-braganca.pt/pages/87>, the Facebook page at <https://www.facebook.com/municipio-braganca>, and the Instagram page at <https://www.instagram.com/municipiobraganca/>. Additionally, the municipality operates a Tourist Office with a physical location and a digital presence integrated into the municipality's website. Information is available in nine languages beyond Portuguese, including German, Simplified Mandarin, Spanish, French, Dutch, English, Italian, Japanese, and Russian.

The physical presence of the Tourist Office is considered significant as it meets the substantial demand for tourist information from visitors who directly contact the office. The office provides various printed materials that remain highly requested. Nevertheless, there is an undeniable trend towards increasing access and consultation of

Table 1. Cultural events promoted by the Municipality of Bragança.

Events	Description	Schedule
<i>Festa das Cantarinhas</i>	Held annually in May, it celebrates the tradition of “cantarinhas,” small clay jugs used for carrying water, with events and activities related to local culture	May
<i>Festas de São João</i>	Celebrated at the end of June, they include bonfires, music, dance, and typical food, following the Portuguese tradition of celebrating São João	June
<i>Festas do Povo</i>	The biennial transforms the streets of Bragança into open-air art galleries with decorative installations created by the local community, highlighting popular art and culture	Biennial
<i>Feira de São Bartolomeu</i>	The Feast of São Bartolomeu is one of the oldest in Portugal, dating back to the 15th century	August
<i>Festiva do Butelo e das Casulas & Carnaval dos Caretos</i>	Held in February, it is a fair dedicated to the traditional smoked products of the region, such as sausages, hams, and cured meats, promoting local gastronomy	February
<i>Mascararte Bienal da Máscara</i>	This biennial event celebrates the art of masks, exploring their various forms and meanings through exhibitions, performances, workshops, and other related activities	Biennial
<i>Bragança, Terra Natal e de Sonhos</i>	It consists of a seasonal event that takes place during the Christmas season in the city of Bragança, Portugal. This event is organized by the Bragança City Municipality and typically includes various attractions and themed activities to celebrate the Christmas spirit	December
<i>Encontro de Culturas</i>	Held in September, it promotes the exchange of experiences between different cultures through diverse cultural events and activities	September

the municipality’s digital channels. This highlights the importance of institutional (particularly digital) marketing in maintaining updated information and promoting cultural events in Bragança. This growing concern underscores the municipality’s commitment to communicating a coherent and consistent image through an increasingly integrated and professional process.

4.2 Evolution of Instagram's Engagement

To thoroughly analyse interactions on Instagram posts by the Municipality of Bragança from 2020 to 2023, the Apify tool was utilised to extract data and compile a structured dataset in Excel format. Below, the key columns of this dataset and their meanings are explained. The dataset comprises various columns, but the primary focus is on user interactions, particularly the number of comments, likes, and video views. Table 2 codifies the information collected, making it easier to read and analyse the results.

Table 2. Description of database coding.

Code	Description	Type
<i>timestamp</i>	Date and time of the post	Numeric
<i>caption</i>	Post caption	Text
<i>commentsCount</i>	Number of comments	Numeric
<i>likescount</i>	Number of likes	Numeric
<i>videoViewCount</i>	Number of video views (for video posts)	Numeric
<i>type</i>	Type of post (photo, video, sidecar)	Text

The dataset comprises various columns, but the principal information revolves around user interactions with posts, particularly concerning the number of comments, likes, and video views. These data points are organised by the date and time of posts, captions, number of comments and likes, video views, and post type (whether it is a photo, video, or sidecar). In the initial phase of the analysis, the timestamp column was converted into an appropriate date format. Subsequently, graphs (Fig. 1) were generated illustrating the temporal evolution of key engagement metrics: comments, likes, and video views.

The graph depicted shows the trends in comments, likes, and video views on Instagram posts over the years from 2020 to 2023, where each line represents one of these metrics over time: in the blue line, comments show significant variation with frequent spikes, remarkably increasing in magnitude from 2021 onwards. This suggests that more recent posts have generated more discussions among users; the green line indicates the number of likes, which also exhibits variation with notable peaks, reflecting a general increase in the popularity of posts over time; the red line represents video views, displaying a pronounced upward trend, especially from 2022 onwards. A significant spike was observed in July 2020, associated with a promotional video about the region (https://instagram.com/p/CC8_rydIwSJ/), which garnered over 40,000 views and 500 likes.

The descriptive analysis of engagement metrics on Instagram posts, including comment count, likes, and video views, provides significant insights into content behaviour and user interaction. The data indicate that the average number of comments per post is 9.6 (± 10.42), with substantial variability across posts. The minimum number of comments observed is 0, while the maximum reaches 77. These values suggest that while some posts generate little or no discussion, others achieve a significantly high level of engagement. The distribution is skewed, with the first quartile at four comments, the

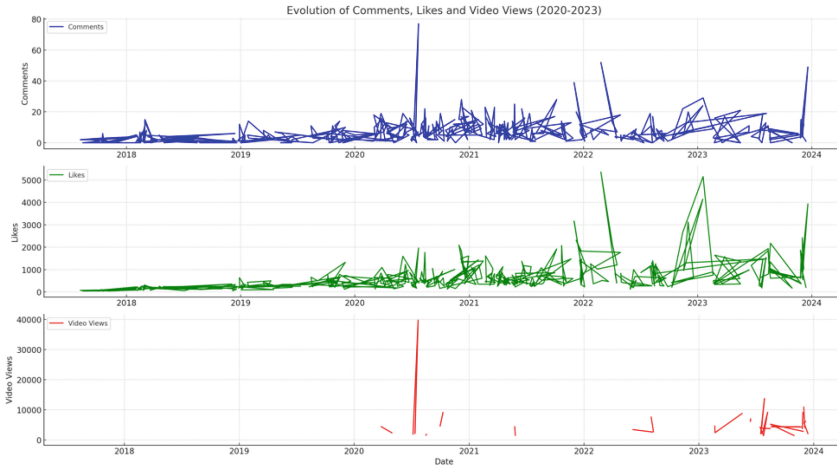


Fig. 1. The evolution of comments, likes and video views (2020–2023) was created by Matplotlib Chart.

median at 7.5, and the third quartile at 12.75, indicating that most posts receive between 4 and 13 comments. However, some outliers receive a much higher number of comments. Regarding likes, posts average 640.17 (± 436.25), demonstrating considerable variation in the popularity of posts. The minimum number of likes is 47, while the maximum is 1967. This significant range indicates that some posts attract more attention and engagement than others. The first quartile is at 320.25 likes, the median at 490, and the third quartile at 932.75, meaning that 75% of the posts receive fewer than 933 likes, though some posts exceed this value significantly. Video views present an average of 4761.19 (± 5052.03), revealing an extensive variation in video views. The minimum count is 221, while the maximum is 39,780 views. This vast difference suggests that some videos reach a much larger audience than others. The quartiles indicate that 25% of the videos have fewer than 2358 views, 50% have fewer than 3816, and 75% have fewer than 5610.5 views, highlighting that only a minority of videos achieve very high view counts. These findings offer valuable insights into user engagement dynamics with Instagram content over time. They highlight the importance of ongoing, strategic content planning and suggest investing in diverse and targeted content types, particularly videos, which can significantly enhance user interaction. Understanding and leveraging these engagement trends is crucial for the Municipality of Bragança to continue effectively connecting with and growing its audience on social media.

4.3 Metrics Correlation

To evaluate the differences in engagement metrics (comments, likes, and video views) across Instagram posts from the Municipality of Bragança, an ANOVA was conducted. This statistical method compares the means of different independent groups and determines if they have differences. In this context, the ANOVA helps to understand whether the average engagement levels in comments, likes, and video views are distinct [38–40].

The ANOVA yielded an F-statistic of 54.39. This high value indicates a substantial difference between the groups being compared. In the context of ANOVA, a higher F-statistic typically suggests that the group means are not all equal and that at least one group mean is significantly different. The corresponding p-value is extremely low, at 1.04×10^{-19} (p-value < 0.001). A p-value < 0.05 is commonly used as a threshold for statistical significance. Here, the p-value is far below this threshold, reinforcing the conclusion that a statistically significant differences exist between the means of comments, likes, and video views. The significant differences in means across comments likes, and video views suggest that these forms of engagement do not behave uniformly across posts. Each metric captures different aspects of user interaction and reflects varying levels of engagement depending on the content type and user interest. For instance, while comments indicate active discussion and interaction, likes to represent passive approval, and video views show content consumption without direct feedback. The distinctiveness in engagement metrics highlights the importance of a diversified content strategy. Different posts may appeal to different audience segments or elicit various forms of engagement. For example, video content may drive more views and likes but not necessarily more comments. Understanding these nuances allows for more tailored and effective content planning.

To complement the analysis, the relationships between different engagement metrics in the Instagram posts of the Municipality of Bragança were explored, and a Pearson correlation analysis was carried out. This statistical method measures the linear relationship between pairs of variables, producing a Pearson correlation coefficient (r) that ranges from -1 to 1. A value closer to 1 indicates a strong positive correlation, while a closer to -1 indicates a strong negative correlation. A value around 0 suggests no linear relationship [40–42]. The analysis focused on the correlation between three key engagement metrics: comments, likes, and video views. Table 3 shows the Pearson correlation matrix between the *commentsCount*, *likesCount* and *videoViewCount* variables.

Table 3. Pearson's correlation matrix.

	<i>commentsCount</i>	<i>likesCount</i>	<i>videoViewCount</i>
<i>commentsCount</i>	1.000000	0.644710	0.877141
<i>likesCount</i>		1.000000	0.743384
<i>videoViewCount</i>			1.000000

Note: All values are statistically significant at a 5% significance level

These significant correlation coefficients provide valuable insights into how different types of engagement are interrelated on Instagram. Concretely, the Pearson correlation coefficient between the number of comments and likes is 0.645. This indicates a moderate positive correlation, suggesting that posts with more comments receive more likes. This relationship implies that user interactions involving discussions are often accompanied by expressions of approval in the form of likes. At the same time, the correlation coefficient between comments and video views is 0.877. This strong positive correlation highlights that posts with higher engagement in comments also tend to have higher

video views. This suggests that videos that provoke discussions are generally viewed more frequently, indicating a robust interaction between viewership and active engagement. Regarding the correlation between likes and video, views are 0.743, reflecting a moderate to strong positive relationship. This suggests that videos viewed more often also tend to receive more likes, implying that viewership is closely tied to user approval as indicated by likes. The moderate to strong positive correlations between comment likes and video views indicate that these metrics are interrelated. Higher engagement in one metric often corresponds to higher engagement in another. For instance, videos that generate a lot of comments are likely to be viewed more and liked more, pointing to a holistic interaction where engagement is not isolated but cumulative across metrics. Since videos with more comments tend to have higher views and likes, creating content that encourages discussion and interaction can enhance engagement. This implies that creating engaging, discussion-worthy content can lead to broader engagement. By leveraging the strong correlation between comments and video views, content creators can optimise their strategies to maximise both metrics simultaneously. Encouraging user interaction through questions, prompts, or provocative content can drive up the viewership and the number of likes, leading to a more engaged audience.

5 Main Findings

The Instagram account of Bragança City Municipality serves as a vital communication channel aimed at informing and engaging both the local community and visitors about the municipality's activities, services, and events. This platform promotes governmental transparency and fosters citizen and visitor participation. An initial manual review of the Bragança City Municipality's Instagram presence reveals several key insights into its social media strategy. The account is characterised by high-quality images and videos, regular postings, and a visually coherent aesthetic. This diverse content approach effectively maintains audience engagement by covering a broad spectrum of topics relevant to the residents and visitors of Bragança. Interactive elements, such as prompt responses to follower comments and the use of stories featuring polls, questions, and quizzes, significantly enhance community engagement. The account boasts a substantial follower base of 18,000, indicating strong public interest in municipal activities. The growth in followers over time highlights increasing engagement and interest. The posts reach a broad audience, with significant impressions and unique reach, suggesting that the content resonates well with its viewers. As of the end of 2023, the account had posted 500 times, including 70 reel videos, 217 sidecar posts (carousel posts with multiple images or videos), and 213 single-image posts, alongside more than 24 story archives. This demonstrates the account's effectiveness as a communication and community engagement tool, promoting transparency and participation through quality content and regular interaction with followers.

The results underscore the importance of ongoing, strategic content planning. Investing in diverse and targeted content types, particularly videos, can significantly enhance user interaction. Understanding and leveraging these engagement trends is crucial for the Municipality of Bragança to connect with and grow its audience on social media effectively. The ANOVA shows that the distinctiveness in engagement metrics highlights the

need for a diversified content strategy. Different types of posts appeal to different audience segments and elicit various engagement forms. Understanding these nuances allows for more effective content planning. Complementing the ANOVA, a Pearson correlation analysis was performed to explore the relationships between engagement metrics. These correlations reveal that higher engagement in one metric often corresponds to higher engagement in another. Videos generating many comments will likely be viewed more and receive more likes, pointing to a holistic interaction where engagement is cumulative across metrics. Drawing on the strong correlation between comments and video views, content creators can optimise strategies to maximise both metrics. Encouraging user interaction through questions, suggestions, or provocative content can increase views and likes, leading to a more engaged audience.

6 Conclusions

To summarise, the study combined automated data collection methods with advanced statistical analysis to explore and understand the dynamics of user interaction on Instagram over four years. The findings highlight the dynamics of how different types of content engage audiences and the effectiveness of various strategies in promoting interaction. The analysis reveals a clear trend of increasing engagement over time regarding comments, likes, and video views. This suggests that the efforts of the Municipality of Bragança in content creation and community interaction have been progressively successful. The growing number of followers and rising levels of interaction indicate that the municipality's social media strategy effectively captures and maintains public interest. Videos have proven particularly influential, showing significant growth in views and strong correlations with other engagement metrics, such as comments and likes. This highlights the importance of investing in high-quality, captivating video content as an essential component of the municipality's digital strategy.

The analysis of engagement spikes aligns with the timing of specific events and promotional campaigns, indicating their success in driving higher user interaction. This finding underscores the value of leveraging special events and targeted campaigns to boost engagement. The municipality should continue to strategically promote these through its social media channels. The significant differences in engagement metrics revealed by the ANOVA suggest that comments, likes, and video views reflect unique aspects of user interaction. Understanding these differences can foster crafting more tailored and effective content strategies that cater to the specific ways users engage with posts. The strong positive correlations between comment likes and video views suggest these metrics are interrelated. Higher engagement in one metric often corresponds to higher engagement in another, pointing to a holistic interaction where engagement is cumulative across metrics. This insight is crucial for developing strategies that enhance overall engagement by focusing on content encouraging comprehensive user interaction. While the study provides valuable insights, it is essential to acknowledge certain limitations. The dataset used for the analysis is limited to 2020 and 2023, with two years elapsed in the COVID-19 pandemic period. Additionally, the study primarily focused on quantitative engagement metrics without a detailed qualitative analysis of the content context. Future research should extend the analysis over a longer period, which could

provide insights into how engagement patterns evolve and help identify more long-term trends.

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