

Examining Digital Leadership, Digital Transformation, and Employee Engagement in Public Sector Discourse on X (Twitter): A Social Network Analysis and Sentiment Mining Approach

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ABSTRACT

Purpose – This study maps and analyzes public-sector discourse on digital leadership, digital transformation, and employee engagement on X (Twitter). It aims to identify the dominant framing of the conversation, its sentiment orientation, its thematic composition, and the actors who shape its diffusion.

Design/methods/approach – The study adopts a quantitative, exploratory computational social science design. A corpus of 288 English-language posts was retrieved from X (Twitter) 27 January until 28 July 2026 using Boolean keyword queries on the SocialX analytics platform. Three methods were combined: sentiment mining using a hybrid lexicon and machine-learning classifier, zero-shot thematic classification, and social network analysis (SNA) examining centrality and community structure.

Findings – "Government" is the dominant topic of discussion, with sentiment that is predominantly negative (73%), followed by neutral (23%) and positive (4%), indicating a critical and politically charged discourse. Zero-shot classification shows that most posts address government subjects (66%), followed by technology (28%) and human resources (6%). The interaction network is low-density and highly centralized with a hub-and-spoke structure, suggesting influence-driven rather than community-driven diffusion, while temporal analysis reveals an event-driven pattern with an early peak and subsequent decline.

Research implications/limitations – The study provides evidence-based recommendations for digital communication and reputation management in public-sector organizations through an integrated framework that connects sentiment polarity, theme orientation, and network position. Its limitations include a small sample size, a limited time frame, and the absence of independent domain-specific validation of the classifier. Future research could employ cross-platform designs, larger longitudinal corpora, and manually validated sentiment models.

Originality/value – The study integrates affective (sentiment), thematic (zero-shot), and relational (network) analyses into a single framework for examining public-sector digital discourse, linking what the public feels, which topics dominate, and who controls the flow of information.

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Introduction

One of the most significant forces behind institutional change in modern governance is digital transformation, which is changing how public enterprises allocate resources, create services, and make decisions. Government agencies are now operating in more connected, flexible, and data-informed ways as a result of the spread of technologies like artificial intelligence, cloud computing, and data analytics. (Vial, 2019). Yet the accumulating evidence indicates that technology adoption alone rarely delivers the anticipated gains in organizational effectiveness; leadership quality and the human dimension of change frequently determine whether digital initiatives succeed (Kane et al., 2019; Westerman et al., 2014). Within this landscape, digital leadership has emerged as a strategic capability that connects technological investment to organizational renewal in the public sector (Yusuf et al., 2023).

Empirical work has repeatedly linked digital leadership to improved employee outcomes. Studies report that leaders who articulate a digital vision, empower staff, and support innovation tend to raise both creativity and performance among their subordinates (Öngel et al., 2024; Qiao, 2024). This line of inquiry extends the earlier concept of e-leadership, which describes how leaders exercise influence through information technology and mediated communication rather than solely through face-to-face interaction (Avolio et al., 2000; Van Wart et al., 2019). Complementary research emphasizes that digital leadership operates through the cultivation of digital dynamic capabilities, enabling organizations to sense and respond to a volatile technological environment (Albannai et al., 2024). Nonetheless, the reported effects of digital leadership on performance remain inconsistent, suggesting the presence of intervening mechanisms rather than a purely direct relationship (Yusuf et al., 2023).

Employee engagement is widely regarded as one such mechanism. Engagement captures the physical, cognitive, and emotional investment that individuals bring to their work roles (Kahn, 1990), and it has been operationalized through the dimensions of vigor, dedication, and absorption (Schaufeli et al., 2006). The quality of the relationship between employees and their organization, including supportive leadership, is a recognized antecedent of engagement (Saks, 2006), while the job demands–resources perspective explains how leadership behaviours function as resources that sustain motivation and buffer strain (Bakker & Demerouti, 2017). In government contexts, engagement has been associated with higher satisfaction, retention, and public value creation (Abner et al., 2023), and transformational forms of leadership have been shown to strengthen performance through the engagement of employees (Wardana et al., 2024; Wardani et al., 2025). Growing attention to digital human resource practices further underscores that engagement and performance in the digital era are jointly shaped by leadership and by the technological reconfiguration of work (Abhari, 2025; Andestari et al., 2024).

Beyond the internal dynamics of organizations, the legitimacy of public sector digital transformation is increasingly negotiated in the public sphere. Trust in electronic government and the perceived quality of digital public services strongly condition citizen acceptance and, ultimately, the performance of digital initiatives (Abdulkareem & Ramli, 2022; Adade & de

Vries, 2024). Social media platforms have become central arenas in which these perceptions are formed, amplified, and contested. X (formerly Twitter) is particularly influential because its architecture of mentions, replies, and reposts enables opinions to propagate rapidly across large and loosely connected audiences (Balasubramanian et al., 2024; Ting, 2024). Analysing this discourse offers a window into how the public interprets government digitalization, how sentiment clusters around specific events, and which actors shape the flow of information (Gnanapriya & Anandan, 2025).

Two methodological traditions are especially relevant for studying such discourse. Sentiment analysis provides a scalable means of classifying the emotional orientation of large volumes of text and has been applied extensively to political and policy conversations on social media (Gnanapriya & Anandan, 2025; Kim et al., 2021; Liu, 2015). Social network analysis, in turn, characterizes the relational structure of interactions and identifies influential nodes through centrality measures (Freeman, 1979; Newman, 2010). A recurring insight from both traditions is that a small number of highly central actors often described as opinion leaders can disproportionately influence the diffusion of narratives online (Harff et al., 2025; E. Katz & Lazarsfeld, 1955; Rogers, 2003). Despite their complementarity, sentiment and network approaches are frequently applied in isolation, limiting understanding of how emotional orientation and structural position jointly govern the spread of public sector narratives.

Thus, there are still a number of gaps. First, survey-based designs carried out within individual businesses dominate the literature on digital leadership, engagement, and performance in the public sector, providing little insight into how these issues emerge in uninvited public discourse. Second, the discursive context surrounding these notions has received less attention, and the mediating function of employee involvement between digital leadership and performance has mostly been studied in private or bureaucratic settings. Third, there aren't many studies that combine relational, emotional, and thematic viewpoints into a cohesive analytical framework that can capture the discourse surrounding government digitization as well as its propagation. A computational approach that views public conversation as data is needed to close these gaps.

Therefore, using X as the empirical field, this study explores the online discourse surrounding digital leadership, digital transformation, employee engagement, employee performance, and human resources in the public sector. The study aims to identify the dominating framing of the conversation, its affective orientation, its topic composition, and the actors who shape its dispersion by combining sentiment mining, zero-shot thematic classification, and social network analysis. The following inquiries serve as a guide for the study:

1. How is public sector digital transformation discourse framed and thematically distributed on X?
2. What is the sentiment orientation of this discourse, and what does it imply for public perceptions of government digitalization?
3. Who are the central actors shaping the diffusion of the discourse, and what network structure do they form?

4. How can the integration of sentiment and network evidence inform digital communication and human resource strategies in the public sector?

Methods

In order to investigate public discourse on digital leadership and public sector transformation, this study used a quantitative, exploratory methodology based on computational social science and integrated social network analysis (SNA) with sentiment mining. Individual posts, the people who wrote them, and the connections between them make up the unit of study in this cross-sectional design. This dual-method approach enables the study to record the content of the conversation that is, how messages and actors are structurally connected within the network as well as how favorably or negatively it is represented.

SocialX, an analytics tool that offers integrated capabilities for social listening, sentiment classification, and network mapping, was used to gather data from X (Twitter). In order to capture contemporary discourse pertinent to the research issues, the retrieval window was extended from January 29, 2026, to March 16, 2026. The Boolean expression "Digital Leadership OR Digital Transformation OR Employ-ee Engagement OR Employee Performance OR Public Sector OR Government OR Human Resources" was used as part of an organized, theory-based keyword approach. These terms were chosen to reduce the sampling bias associated with single-keyword queries because they together represent the institutional, behavioral, and leadership characteristics that are essential to the study.

A 5,000 record maximum extraction ceiling was set. 288 valid records were kept for study after filtering and cleaning to remove duplicates, spam, non-English postings, bot-like accounts, and thematically inappropriate content. This sample is suitable for exploratory network and sentiment analysis, where the relevance and relational quality of the data matter more than sheer volume, even though it is small in comparison to major social media corpora. Text normalization (lowercasing, removal of URLs, menus, non-meaningful hashtags, emoticons, and non-alphanumeric characters), tokenization, stop-word removal using an English dictionary, and language filtering were the standard steps in the preprocessing process. In order to facilitate network creation, metadata like user identities, mentions, repost counts, and timestamps were kept.

Network construction treated users as nodes and their interactions mentions, replies, and reposts as edges. Several structural indicators were computed: degree centrality to detect the most connected accounts, betweenness centrality to identify bridging actors that mediate information flow, closeness centrality to gauge diffusion efficiency, network density to assess overall connectivity, and modularity to reveal community clusters (Freeman, 1979; Newman, 2010). These measures enabled the identification of key opinion leaders and the topological patterns that shape the discourse.

Sentiment analysis was performed with Social X using a hybrid approach that combines lexicon-based scoring with supervised machine-learning classification. The lexicon component assigned polarity scores to terms and phrases, while the machine-learning component

addressed context-sensitive phenomena such as negation, domain-specific vocabulary, and implicit sentiment that lexicons alone often miss (Liu, 2015). Each post was categorized as positive, negative, or neutral. To triangulate the affective reading, a zero-shot classifier was additionally used to infer the dominant thematic orientation of each post across government, technology, and human resources categories without task-specific training data. A sentiment index and temporal trend were computed to observe how the tone and volume of the conversation evolved over the observation window.

The combination of sentiment and network evidence is a key methodological aspect of this study. By mapping sentiment scores and thematic labels onto network positions, the analysis was able to establish a connection between affective orientation and structural effect. The use of automated tools increased processing consistency and decreased human coding bias, while a structured keyword frame and a well defined temporal scope improved content validity. In order to ensure that the study can be replicated using SocialX or similar platforms, reproducibility is addressed by recording the data source, time frame, key-word logic, sample size, and analytical processes. The study used posts that were accessible to the public, revealed no personally identifiable information, and presented findings in aggregate form. One acknowledged disadvantage is that the platform classifier was not independently verified against a manually labeled, domain-specific corpus. Fig. 1 summarizes the entire study process.

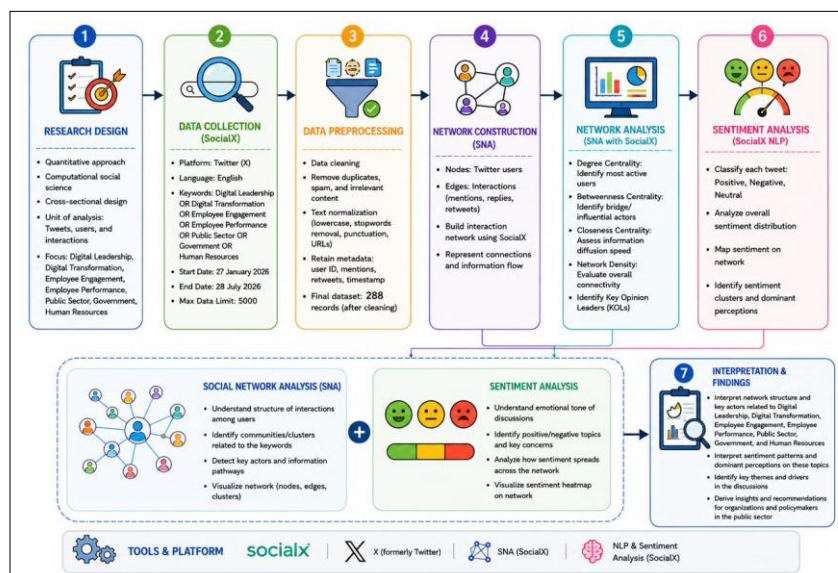


Fig. 1. Research methodology framework.

Results and Discussion

Wordcloud Analysis

The word "government" dominates the word cloud in Fig. 2, appearing significantly more frequently than any other token and serving as the conversation's focal point. Institutionally and politically charged terms like "federal," "state," "public," "party," "minister," "money," and "country" surround it, suggesting that the discourse framed by digital leadership and public sector keywords is, in reality, primarily directed through the lens of government and governance. The use of "digital" in conjunction with these phrases attests to the fact that

technology-related framing is ingrained in a larger discussion concerning the function, extent, and behavior of the state.

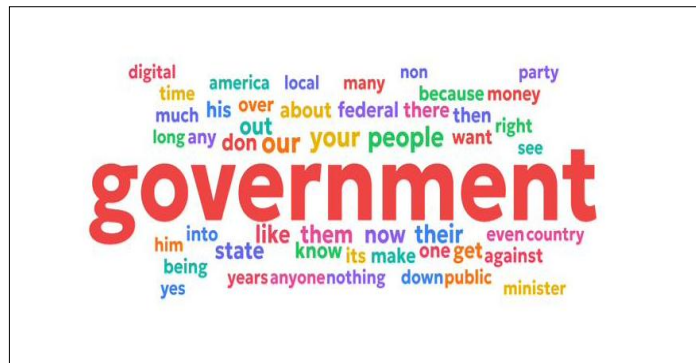


Fig. 2. Wordcloud visualization of public sector and digital government discourse on X (Twitter).

The evaluative and contestatory tone of the lexical field is noteworthy. Words like "want," "against," "nothing," "right," and "people" indicate that users are actively evaluating digital government, frequently critically, rather than just transmitting neutral information. This interpretation is in line with the finding that, in the digital age, citizens are becoming more critical of public institutions' accountability and transparency (Abdulkareem & Ramli, 2022; Adade & de Vries, 2024). The co-occurrence of "people," "public," and "government" further underlines the relational and political character of the conversation, in which the legitimacy of state digitalization is negotiated between institutions and their publics rather than passively accepted (Ting, 2024). In sum, the word cloud suggests that discussions ostensibly about digital leadership and transformation are inseparable from wider debates over governmental trust and performance.

Sentiment Analysis

The majority of the discourse is negative, as seen by the polarity distribution in Figure 3. Just 4% (11 posts) of the 288 classified posts were good, 23% (67 posts) were neutral, and 73% (210 posts) were negative. This profile indicates a critical and skeptical public attitude toward the government and its digital initiatives, which is very different from discussions where neutral, factual content predominates. The predominance of negative polarity suggests that the topic serves as a source of contestation and grievance rather than endorsement within this corpus.

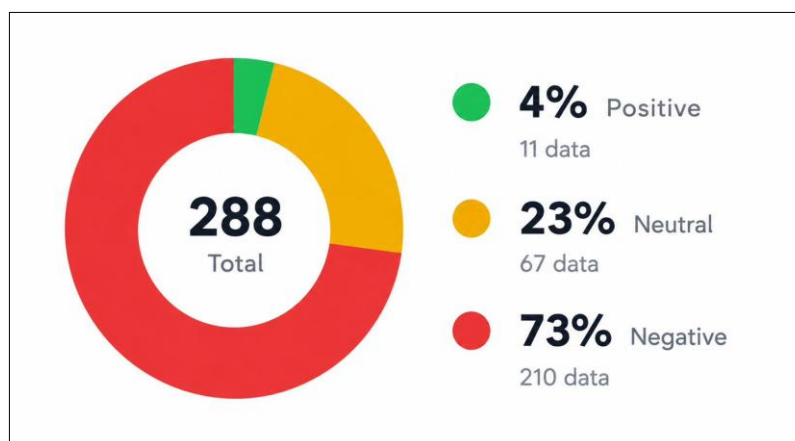
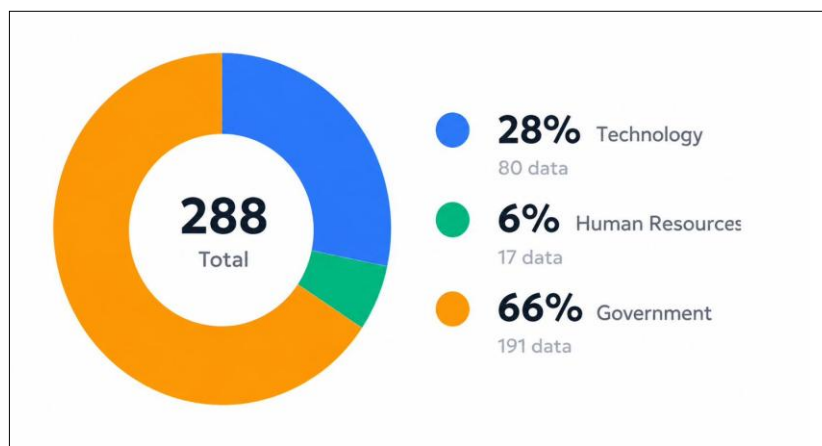


Fig. 3. Sentiment distribution of X (Twitter) discourse on public sector and government topics.

Several interpretations follow. Negative sentiment of this magnitude is frequently associated with distrust, perceived opacity, or dissatisfaction with institutional performance, all of which have been shown to undermine the effectiveness of digital government when left unaddressed (Abdulkareem & Ramli, 2022; Adade & de Vries, 2024). The comparatively large neutral share indicates a segment of users who report or forward information without explicit evaluation, a group that communication strategies could plausibly convert through credible, transparent messaging. The very small positive share suggests that, although digital transformation is a salient topic, it has not translated into visible advocacy within this public conversation. For public organizations, this pattern signals a reputational environment in which trust must be actively rebuilt; from a human resource standpoint, it also mirrors the internal reality that positive engagement outcomes depend on supportive leadership and credible communication rather than technology alone (Abhari, 2025; Abner et al., 2023; Bakker & Demerouti, 2017).

Zero-Shot Classification

Each post was placed into one of three thematic groups by a zero-shot classifier to supplement the polarity analysis. The government subject accounts for 66% of the discourse (191 posts), followed by technology at 28% (80 posts) and human resources at 6% (17 posts), as illustrated in Fig. 4. This distribution supports the word cloud: the discussion leans toward government as its organizing frame even when the seed keywords cover leadership, engagement, and human resources.

**Fig. 4.** Zero-shot thematic classification distribution across government, technology, and human resources.

The prominence of the technology theme (28%) indicates that a substantial minority of posts engage directly with the digital and technological dimensions of public administration, consistent with the framing of digital transformation as a technological as well as an institutional project (Albannai et al., 2024; Vial, 2019). The modest human resources share (6%) is instructive: although engagement and performance are pivotal to the success of digital transformation in scholarly accounts (Kahn, 1990; Saks, 2006; Schaufeli et al., 2006), the human and workforce dimension is comparatively under-represented in public conversation. This asymmetry suggests a communication gap in which the workforce implications of digitalization capability building, engagement, and change readiness receive limited public visibility relative to the more politically charged government frame. Bridging this gap

represents an opportunity for public organizations to broaden the narrative beyond institutional critique toward the people who deliver digital public value.

Social Network Analysis

The interaction network in Fig. 5 exhibits a highly centralized, hub-and-spoke structure. A small number of high-degree accounts most prominently @elonmusk, together with prominent hubs such as @TheSurvivalMom, @sFaulkFoto, and @RoseColoredGI17 occupy central positions and function as focal points through which information flows to peripheral users. Their centrality signals substantial control over the visibility and circulation of narratives, consistent with the theoretical expectation that a limited set of influential nodes governs the majority of diffusion in digital ecosystems (Freeman, 1979; Newman, 2010).

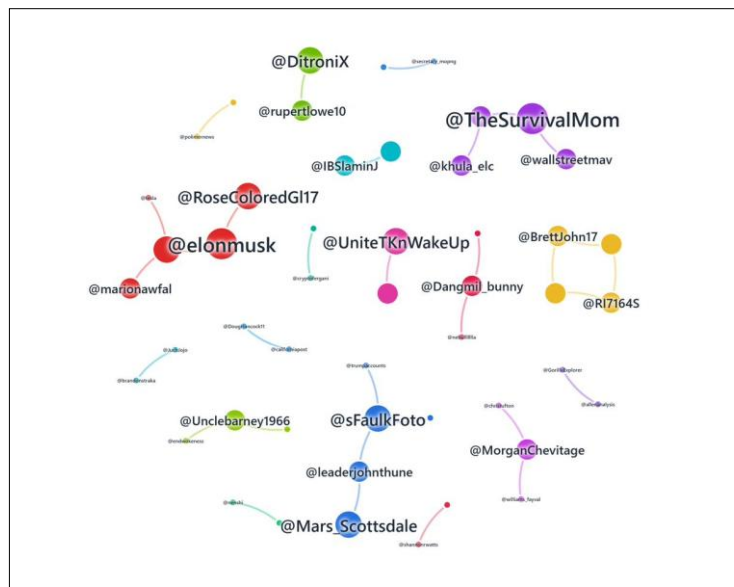


Fig. 5. Social network graph of key actors in public sector and government discourse on X (Twitter).

Around these hubs, the visualization reveals several smaller clusters organized by secondary actors such as @MorganChevitage, @DitroniX, @UniteTKnWakeUp, and the @BrettJohn17 @RI71645 community. These clusters represent localized, topic-specific conversations that connect to the core through intermediary accounts, reflecting a two-step flow in which central figures relay information to broader audiences via bridging nodes (Harff et al., 2025; E. Katz & Lazarsfeld, 1955). The overall structure is characterized by low density: many peripheral users attach to central hubs but interact little with one another. This indicates that diffusion is efficient through influential accounts yet limited in peer-to-peer exchange, so the conversation is influence-driven rather than community-driven (Rogers, 2003). From a public sector communication perspective, the pattern highlights both a risk and an opportunity: because a few high-visibility actors can rapidly amplify critical narratives, engaging credibly with high-centrality accounts is strategically important for shaping how digital government is perceived.

Trend Analysis

The temporal pattern in Fig. 6 shows a short but dynamic attention cycle. Posting volume rose to an early peak in the first week of February (approximately 60 posts), remained

comparatively stable at around 40 posts per interval through late February, and then declined markedly toward mid-March (falling to 9 posts). This trajectory is typical of event-driven discourse, in which a topic gains momentum around specific triggers such as viral content, participation by influential accounts, or salient policy events before attention decays (Balasubramanian et al., 2024; Gnanapriya & Anandan, 2025).

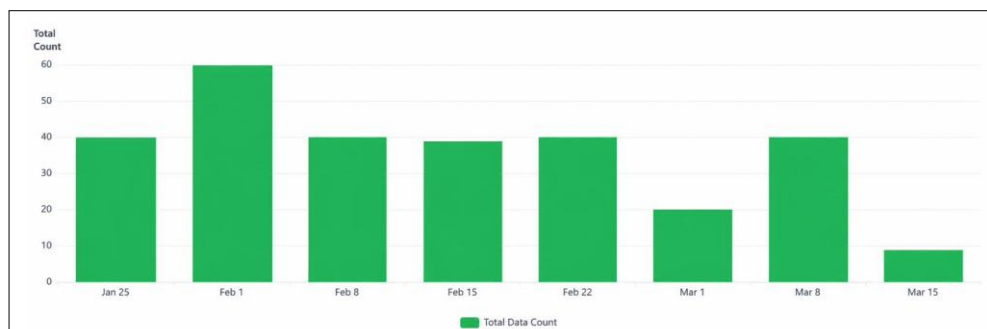


Fig. 6. Trend analysis of X (Twitter) activity on public sector and digital government discourse.

The view that public opinion about government digitalization is temporally concentrated and reactive rather than sustained is supported by the oscillations. While troughs show the fleeting nature of social media interest as users switch to other information, peaks probably correspond with times of increased controversy or news importance. This suggests to practitioners that the influence of communication is very time-dependent: in order to affect perception prior to the consolidation of critical narratives, it is crucial to watch the conversation in real time and intervene during peak periods. The cycle's ephemeral nature also warns against extrapolating long-term public sentiment from a single peak, highlighting the importance of ongoing rather than sporadic monitoring.

Discussion

When combined, the findings provide a comprehensive, multifaceted picture of how public sector digital transformation is debated on X. The affective data displays a predominantly negative tone; the relational evidence suggests a centralized, influence-driven network; and the theme evidence depicts a debate centered on government with technology as a secondary framing and human resources negligible. When taken as a whole, these results show that a limited number of high-centrality actors within a temporally concentrated attention cycle amplify critical narratives regarding government digitalization. The study's main analytical contribution is this combination of the-matic, affective, and structural viewpoints, which builds on earlier research that addressed sentiment and network analysis independently (Freeman, 1979; Gnanapriya & Anandan, 2025; Liu, 2015).

Theoretically, the network pattern aligns with the logic of social influence and the two-step flow of communication, in which opinion leaders mediate the diffusion of information to wider publics (S. D. Katz, 1991; Rogers, 2003). The dominance of negative sentiment resonates with public value and e-government trust perspectives, which hold that the legitimacy and perceived performance of digital government are contingent on transparency and accountability rather than on technology deployment alone (Abdulkareem & Ramli, 2022; Adade & de Vries, 2024). The findings also echo the broader digital transformation literature's

core claim that the human and leadership dimensions, not technology per se, determine outcomes (Kane et al., 2019; Vial, 2019; Westerman et al., 2014). The under-representation of the human resources theme in public discourse is especially notable given the centrality of employee engagement and performance to transformation success in organizational research (Kahn, 1990; Saks, 2006; Schaufeli et al., 2006; Schaufeli & Bakker, 2010).

Practically speaking, the findings have significant ramifications for human resource strategy and public sector communication. First, organizations should prioritize authentic, transparent engagement with high-centrality actors and communities above broadcasting homogenous messages since the reputational environment is crucial and influence-driven. Second, there is a chance to reframe the story around the individuals who provide digital public value, emphasizing capability development, engagement, and service improvement, given the prominence of the government frame and the dearth of workforce-oriented content (Abhari, 2025; Abner et al., 2023; Andestari et al., 2024). Third, the event-driven trend calls for real-time sentiment monitoring and rapid, evidence-based response during peak periods. Collectively, these measures can help translate neutral and sceptical audiences into more supportive perceptions and better align external communication with the internal drivers of engagement and performance.

There are various limitations to this study. Despite being enough for exploratory research, the corpus of 288 postings is small and limited to a particular window, which limits generalizability. The transferability of results to other linguistic or platform contexts may be limited by English-language filtering and platform-specific dynamics. Most significantly, classification reliability should be regarded cautiously because the sentiment classifier was not independently validated against a manually annotated, domain-specific corpus. To improve robustness and external validity, future research is urged to use bigger, longitudinal datasets, manually labeled corpora with cross-validation, and multi-platform comparisons.

Conclusion

This study combined sentiment mining, zero-shot theme classification, and social network analysis of 288 posts on X to map public discourse on digital leadership, digital transformation, employee engagement, and human resources in the public sector. The data demonstrates that the discussion is framed primarily through the government, is primarily negative, focuses on the government rather than the workforce thematically, and is diffused through a highly centralized, influence-driven network with a brief, event-driven attention cycle.

These results highlight the benefits of integrating affective, thematic, and relational analyses into a single framework: sentiment shows the public's emotions, zero-shot classification indicates the topic of the discourse, and network analysis reveals how it spreads and who controls its flow. The findings highlight the fact that effective digital transformation for public organizations requires not only technology but also open communication, trust, and the obvious involvement of those implementing the change. Converting critical and neutral audiences to more supporting perspectives can be achieved through strategically involving

high-centrality actors, raising the workforce aspect of digitization, and monitoring sentiment in real time.

The study offers a repeatable, integrative method for analyzing public sector digital discourse despite its drawbacks, which include a small sample size, a limited time frame, and the lack of independent domain-specific validation of the classifier. This framework can be expanded upon in future research using cross-platform designs, larger longitudinal corpora, and manually validated sentiment models to produce more reliable and broadly applicable insights on how governments can effectively lead and communicate in the digital world.

Declarations

Author contribution statement

The corresponding author led the study's conceptualization and design, data collection, analysis, interpretation of results, and the initial drafting of the manuscript. All authors contributed to the critical revision of the content for intellectual rigor and approved the final version for publication. All authors are responsible for every aspect of the work.

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Data availability statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. As the study relies on publicly accessible social media posts, the data were analyzed in aggregate form and contain no personally identifiable information.

Declaration of Interests Statement

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