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DIGITAL LEADERSHIP IN MANAGEMENT: SOCIAL NETWORK ANALYSIS ON X DATA

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Abstract:

X, the second most popular social networking site in Malaysia, is a platform for sharing news, messages, photos, and short videos with a large audience. X generates vast amounts of data, which can be valuable for understanding online social communities and trending topics. However, there is a gap in understanding how leaders discuss and address these challenges in public discourse, particularly on digital platforms like X (formerly Twitter). Despite the growing importance of digital leadership, little is known about the key influencers driving discussions related to digital leadership in management. This research identifies key influencers in X discussions on digital leadership in management. This study conducted a social network analysis and content analysis of X data collected over a period (from January 1, 2023, to October 10, 2024). Influential users were examined via clusters in social network graphs. NodeXL Pro was used to extract data efficiently and public usernames were collected to map network edges. The findings found the ten most important X users and URLs within a network of 139 tweets. The main findings suggest that digital leadership is essential in the evolving work environment, especially for distributed and hybrid teams. Digital leaders must master digital tools, emotional intelligence, and collaboration skills to lead virtual teams. The research emphasizes that digital leadership goes beyond technical competence, requiring the ability to manage emotions, reduce stress, and foster innovation. To address these challenges, online leadership courses are becoming popular, offering practical, multimedia-rich content focused on modern team dynamics. Leaders must also embrace AI and continuously adapt to maintain operational efficiency and human connection, ensuring long-term success in a technology-

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driven world. In conclusion, continuous learning, adaptability, and a focus on human connection will define successful leadership in this rapidly evolving landscape, ensuring both team well-being and organizational success.

Keywords:

Digital Leadership, Social Network Analysis, Influencers, Management

Introduction

Digital leadership has become an increasingly important topic in recent years, as the use of digital technologies has become more widespread and essential to the functioning of modern organizations (Ming & Mansor, 2024). As such, there is a growing recognition of the need for effective digital leadership at all levels of an organization, from the top down. Several trends are shaping the landscape of digital leadership around the world. One trend is the increasing focus on data-driven decision-making (Ming & Mansor, 2024). As organizations collect and analyse more data, digital leaders are expected to be able to use this information to inform their decisions and drive innovation. Another trend is the growing importance of digital skills and competencies. As the digital landscape becomes more complex and fast-changing, digital leaders need a wide range of technical and non-technical skills to effectively navigate and lead their organizations in this environment (Kaiyai et al., 2024). There is also a trend towards more distributed and remote work, partly driven by the COVID-19 pandemic. This has led to a greater emphasis on digital tools and the ability to lead and manage teams effectively in a virtual setting. The world trend in digital leadership is towards a greater focus on the use of technology and data to drive innovation and performance, and the development of a wide range of digital skills and competencies to effectively lead in a complex and rapidly changing digital environment (Kaiyai et al., 2024).

X (previously Twitter) is a social networking website or online platform, that allows people to connect and share content, such as photos, videos, and messages (Burgess & Baym, 2020). Some of the most popular social networking sites include Facebook, Instagram, and LinkedIn can be used for personal communication and connection with friends and family, as well as for professional networking and career development (Haythornthwaite, 2024). X allows users to send and read short messages called "tweets." Tweets are limited to 280 characters and can include text, photos, videos, and links. X is often used for real-time news and information sharing, as well as for networking and communication with others. It is a popular platform for public figures, businesses, and organizations to share updates and engage with followers (Haythornthwaite, 2024).

The X data serve as a significant repository of information to facilitate the examination of various facets of online social networks and prevailing concerns. User-generated content can be utilised to comprehend consumer thoughts regarding products, assess sentiment on various issues, and establish social network models that depict collective knowledge. The utilisation of X and other social networking service data should be promoted in Malaysia and the community to enhance decision-making. Malaysia's transition to digital governance prioritises the utilisation of data and analytics to enhance decision-making and public service provision. The potential for social media to serve as a repository of collective knowledge underscores its importance in the digital governance framework that Malaysia is striving to implement (Meister & Okada, 2021).

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By integrating SNS data, the government can enhance transparency and citizen-centric services, fostering a more interactive communication channel with its citizens (Khalid & Yang, 2024). In line with that, digital leadership acts as a catalyst for adopting relevant technologies, enhancing digital skills, and fostering a culture of innovation and collaboration (Fitriani et al., 2023). Despite the importance of digital leadership, there are very few published results about using Social Network Analysis to identify influencers in X conversation on digital leadership in management. The study aims threefold: (1) to identify influencers in X conversation on digital leadership in management; (2) What online sources or URLs are frequently referenced in these discussions; and (3) What are the top keywords that emerge from the discussions? The study collects and analyses tweets using Social Network Analysis (SNA) techniques to achieve these objectives.

Literature Review

Evolution of Digital Leadership

We are immersed in a novel digital environment due to the rapid transformations occurring in society, where knowledge creates new avenues facilitated by advancements in knowledge and Communication Technologies (ICT). A "hyper-technologized" society (Tornero & Varis, 2010) is engulfed in numerous and ongoing transformations resulting from the integration of digital technology. Contemporary media that organise activities enhance the significance of defining the operations of labour and leisure in 21st-century society (Mills, 2010). In this setting, novel communication approaches arise, subsequently creating new trends and leadership frameworks aimed at increasingly rigorous and competitive social growth (Romero-Tena et al., 2020). The evolution of digital leadership has been shaped by the rapid development and adoption of digital technologies. In the early days of the internet, digital leadership may have simply involved the ability to use basic office software and email effectively. However, as technology has become more advanced and integrated into all aspects of business and society, the demands on digital leaders have increased significantly. One key development in the evolution of digital leadership has been the rise of social media and other digital platforms. These platforms have provided new opportunities for organizations to connect with and engage with their stakeholders and have led to a greater emphasis on the role of digital leaders in building and managing online communities and relationships (Pawar & Dhumal, 2024). Another key trend has been the growing importance of data and analytics in decision-making. As organizations collect and analyze more data, digital leaders are expected to be able to use this information to inform their decisions and drive innovation. This has led to a greater focus on the role of digital leaders in using data and analytics to drive performance and decision-making (Pawar & Dhumal, 2024).

Digital Leadership and Social Media

Social media, such as X, is an important part of this environment, as it allows organizations to connect with and engage with their stakeholders, share information and updates, and build their brand and reputation online (Kovalenko et al., 2020). Effective digital leaders can use social media platforms like X to their advantage, leveraging the reach and influence of these platforms to achieve their goals. This might involve using X to share updates and engage with customers and clients, to promote products and services, or to build a community of followers. Digital leaders may also use X to monitor and respond to customer feedback, gather insights and data about their audience, and stay up to date on industry trends and developments. For example, X can be used to gather customer feedback and sentiment about a company's products or services,

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which can help businesses understand what is working well and what areas need improvement. It can also be used to identify key trends and issues within the industry, helping businesses stay up-to-date and anticipate changes in the market. Furthermore, digital leaders utilize X to track competitors and see how they are positioning themselves in the market, which can inform strategic decision-making. It can also be used to identify potential partners and collaborators and to build relationships with key stakeholders. Apart from that, they may use X to network and build relationships with other leaders in their field, and to stay connected with their peers and colleagues. In that regard, X is an important tool for digital leaders to connect with their stakeholders and build their reputation online, and effective digital leaders can use it effectively to achieve their goals and drive innovation and performance. By monitoring and analyzing social media activity on X, they can stay connected with their customers, competitors, and industry trends, and use this information to make informed decisions that drive innovation and performance.

X Plaftorm

X (previously Twitter) is a rich source of data for this type of analysis and a popular platform for social network analysis. It allows researchers to easily access a large amount of data about users and their connections. Researchers can use tools such as X's API (Application Programming Interface) to collect data about users and their tweets, and then use this data to create visualizations of the network of connections between users. There are several ways in which social network analysis can be used to study X data. For example, researchers might use social network analysis to understand how information spreads on X and to identify key influencers who can reach many users through their tweets. They might also use social network analysis to study the formation and evolution of communities on X and to understand how users interact and communicate. The collected X data is an effective knowledge base that may be used to investigate many facets of online social communities and trendy subjects. User-generated information, for example, can be used to analyze sentiment toward an issue, create social network models to represent shared knowledge, and comprehend user attitudes about things. Studies have shown that a higher number of activities on social networks by leaders is positively associated with a higher number of platforms used by leaders. Korzynski (2013) highlights that the effectiveness of online social networks as tools for supporting leadership is contingent upon the number of activities, the diversity of platforms used, and the size of the organization Jeong (2024). This suggests that leaders who are more active and versatile in their social media engagement can leverage these platforms more effectively to enhance their leadership capabilities.

Moreover, recent research has demonstrated that online social networks are particularly beneficial for participative and consultative leadership styles compared to directive leadership styles. This finding aligns with the principles of Path-Goal Theory, which posits that different leadership styles yield varying levels of effectiveness depending on the context and the needs of followers (Rahman, 2022; Cheng & Osman, 2021). Participative leadership, characterized by collaboration and input from team members, tends to thrive in environments where social networks facilitate open communication and engagement (Rahman, 2022). In contrast, directive leadership, which often involves top-down communication and control, may not leverage the interactive potential of social networks as effectively (Cheng & Osman, 2021).

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The implications of these findings are profound for organizational leadership. Leaders who adopt a participative approach can utilize social networks to foster a sense of community and collaboration among team members, thereby enhancing engagement and performance (Cheng, 2023). This participative style is increasingly relevant in today's digital landscape, where social media platforms serve as vital channels for communication and feedback. Conversely, leaders who rely heavily on directive styles may find themselves at a disadvantage in environments where collaboration and shared decision-making are valued (Rahman, 2022; Cheng & Osman, 2021).

Influence on Social Networks Analysis

Social network analysis is a method of analysing and visualizing the relationships and connections between people or organizations in a social network. It can be used to understand the structure and dynamics of the network and to identify key players and influencers. Influence is an important concept in social network analysis, as it can help to identify individuals or organizations that can shape the thoughts, beliefs, and behaviours of others within the network. In social network analysis, influence is often measured using metrics such as centrality, which reflects the importance or influence of a particular node (individual or organization) within the network. For example, an individual with a high degree of centrality may be considered to have a greater level of influence within the network, as they are connected to other nodes and may be able to reach a wide audience. Other metrics that can be used to measure influence in social network analysis include betweenness, which reflects the ability of an individual or organization to act as a bridge between different parts of the network, and eigenvector centrality, which measures the influence of an individual or organization based on the influence of the nodes they are connected to. In general, social network analysis can be a powerful tool for understanding and measuring influence within a social network and can help organizations identify key players and influencers who may be able to shape the thoughts, beliefs, and behaviours of others within the network. The next section will discuss the concept of structuralist and its application into social network analysis.

Theoritical Framework

Structuralist theory is a perspective in social network analysis that focuses on how the structure of a social network – the patterns of relationships and connections between individuals or organizations – shapes the behaviour and outcomes within the network. According to structuralist theory, the structure of a social network is a key determinant of the patterns of communication, influence, and power within the network (Deni et al., 2022). For example, individuals or organizations that are highly connected or central within the network may have a greater ability to shape the thoughts, beliefs, and behaviours of others, and have more power and influence within the network. For the study, we focus on the patterns of relationships and connections between individuals or organizations within the network. Furthermore, the structuralist theory also emphasizes the role of social norms and expectations in shaping behaviour within a network. For example, individuals may conform to certain norms or behaviours to maintain their position within the network or seek to change the norms to achieve their goals. Therefore, we concentrate on the notion that interaction signifies activity within the social network, emphasising spatial and temporal dimensions, and how individuals inside the network exhibit this to generate or regenerate characteristics of an interactive system aimed at attaining desirable results.

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The theoretical foundation of digital leadership research is significantly informed by several key frameworks that elucidate leadership dynamics in technology-driven environments. One prominent framework is structuralist theory, which emphasizes the importance of social network structures in shaping communication patterns, influence, and power dynamics. Research indicates that individuals or organizations with higher centrality within networks possess greater influence, acting as bridges that connect diverse groups and facilitate knowledge dissemination. For example, Pearce and Conger (2002) argue that highly centralized networks often indicate a singular actor who plays a crucial role in fulfilling leadership responsibilities (Pasarakonda et al., 2020). This aligns with the findings of the present study, which utilized social network analysis (SNA) to identify influential users and their roles within discussions on digital leadership. Metrics such as betweenness and eigenvector centrality were instrumental in mapping these dynamics, as evidenced by studies that highlight the correlation between centrality scores and leadership effectiveness (Bienenstock & Bonacich, 2021).

Moreover, the integration of emotional intelligence (EI) theory into this framework underscores its critical role in mitigating technostress and fostering team collaboration in virtual environments. Anwar and Saraih (2024) emphasize the importance of EI in building trust and enhancing productivity within hybrid teams, suggesting that leaders with high emotional intelligence can better navigate the complexities of digital interactions (Sposato, 2024). This perspective is further supported by research indicating that emotional regulation is essential for effective leadership in increasingly digitalized workplaces, where interpersonal relationships are often mediated by technology (Bienenstock & Bonacich, 2021).

Additionally, the incorporation of artificial intelligence (AI) into leadership practices provides a contemporary lens through which leaders can leverage predictive analytics and automation to optimize decision-making and resource allocation. Sposato (2024) discusses how AI can transform leadership approaches, highlighting the interdependence between technology and leadership strategies (Sposato, 2024). This theoretical underpinning establishes a multidimensional framework where leadership transcends traditional technical competence, embracing systemic thinking, emotional regulation, and AI integration.

The present study’s theoretical framework integrates these elements, proposing a model that emphasizes network centrality, emotional intelligence, and AI-enabled decision-making as core competencies for digital leaders. This model underscores the necessity for leaders to balance technological proficiency with human-centric approaches, fostering innovation, collaboration, and well-being in increasingly digitalized workplaces. By bridging structuralist theory, EI, and AI integration, the study provides a comprehensive perspective that aligns with contemporary demands of leadership in a fast-evolving digital landscape.

Past Studies

In recent years, several studies have introduced new aspects of the digital leader role, and how it has been shaped up in the modern hybrid work environment with heavy dependency on artificial intelligence (AI), and emotional intelligence. Kusanke et al. (2023) highlighted that AI usage will change the fundamentals of leadership because such tools can help enhance decision-making with predictive analytics, optimize resource allocation, and customize the processes for offering support to team members. These findings highlighted the need for leaders' AI literacy in integrating these tools into the organization's workflows. Similarly,

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Cortellazzo et al. (2019) stated that the digitalization of leadership is not just about adopting technology, it is also about collaborating and innovating through AI-driven solutions.

Furthermore, there is also recent evidence to suggest the growing importance of emotional intelligence to help overcome the unique challenges presented by digital and hybrid teams. Anwar and Saraih (2024) found that emotional intelligence is a crucial skill that counteracts technostress, leading to better team productivity in a virtual setting. This supports the findings by Ertiö et al. (2024), that leaders who are high in emotional intelligence are more suited to building trust and commitment in dispersed teams, hence a positive impact may be seen in teams in terms of performance and well-being. Such findings highlighted both the emotional intelligence and the digital tools we deploy to solve both the ethical and logistical challenges posed by modern work environments.

The contribution of social media platforms like X (formerly Twitter) is important to leadership practices in the digital era. Burgess and Baym (2020) stated that social media can be used for real-time stakeholder engagement, reputation management, and community building. Korzynski (2023) recently discussed how leaders can take advantage of social networks to obtain feedback, observe industry trends, and build thought leadership in competitive markets. These studies highlight the strategic deployment of digital platforms to facilitate communication, collaboration, and influence across and outside organizational boundaries.

However, there is little evidence of such findings being widely applied across domains, including the ability to establish a comprehensive picture of who leads the discourse in leadership conversations on social media. This study fills these gaps by employing social network analysis to map the dynamic of influence on X and examining how AI and emotional intelligence work practically to create effective digital leadership. The integration of these sectors in the micro and macro contexts also facilitates a bottom-up insight into digital leadership from a theoretical perspective but also sets this study as one of the latest types of research within the context of digital leadership.

Methodology

Social network analysis (SNA), centred on relationships through structuralist theory and illustrated via network presentations, is employed for data analysis. To examine interaction patterns inside communication networks, network visualisation relationships can provide accurate information according to user preferences. This application can generate data that can be categorised and automatically construct network chains based on the names of X account holders (actors). Data from X is extracted using NodeXL Pro software and stored as Microsoft Excel files for this investigation. On October 10, 2024, a total of 139 tweets were downloaded from activities conducted between January 1, 2023, and October 10, 2024. A visualisation of the categorisation of the collected X messages was included. Conclusions were derived following a descriptive analysis and categorisation of the X data visualisation outcomes. The process flow for the study began with data extraction using NodeXL Pro, a versatile tool for social network analysis (SNA) that allows for the import of data from various social media platforms, particularly Twitter (Litterio et al., 2017). Following data extraction, the next stage involved data cleaning and categorization into relevant themes, which is crucial for ensuring the integrity and relevance of the data before analysis. This preprocessing step is essential for effective analysis, as it helps to eliminate noise and irrelevant information that could skew results (Barnett et al., 2011).

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Subsequent stages included social network visualization to map relationships and clusters within the data. Visualization is a critical component of SNA, as it allows researchers to visually interpret complex relationships and identify patterns that may not be immediately apparent through numerical data alone (Recuero et al., 2019). Keyword analysis was then conducted to identify central themes, which is a common practice in qualitative research to distill the most significant topics from a larger dataset. This analysis was complemented by betweenness centrality measurements, which highlighted influential users within the network. Betweenness centrality is a key metric in SNA that quantifies the extent to which a node (or user) acts as a bridge along the shortest paths between other nodes, thereby indicating its potential influence within the network (Qian, 2017).The final step comprised synthesizing these insights into actionable findings and recommendations. This synthesis is vital for translating data analysis into practical applications, ensuring that the insights gained can inform decision-making and strategy development (Silk et al., 2015).

The study faced challenges in data management, including limitations in sample size, biases in data distribution, and potential underrepresentation of certain perspectives. The dataset of 139 tweets was relatively small, raising concerns about the generalizability of findings. Moreover, the reliance on public tweets excluded private interactions, which could offer richer insights. Data collection was further complicated by the dynamic nature of social media, with fluctuating activity levels and the need for real-time monitoring. Analysis challenges included the complexity of identifying meaningful clusters within the social network graph and interpreting betweenness centrality scores in diverse contexts. Despite these challenges, the study provided valuable insights into digital leadership, highlighting both the opportunities and limitations of using social media data for leadership research.

Findings

Graph of X User Activity

A total of 139 tweets about digital leadership in management abroad were downloaded on October 10, 2024, during activities from January 1, 2023, to October 10. 2024 at 20:51 were subjected to social network analysis, as seen in Figure 1. On January 1, 2023, till October 10, 2024, there was a noticeable spike in posting activity.

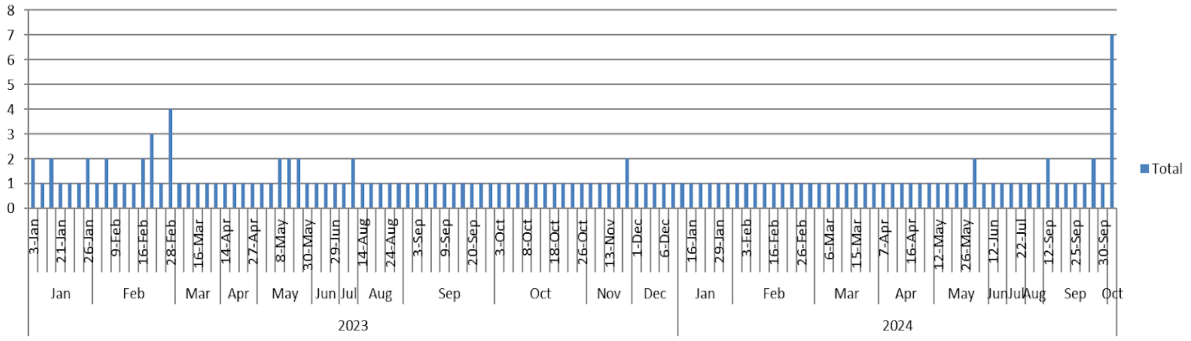

Figure 1: Graph Of X User Activity When Posting Topic About Digital Leadership In Management Abroad On January 1, 2023, Till October 10, 2024

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The time-series chart provided illustrates the frequency of tweets containing the terms "Digital Leadership" and "Management" from January 2023 to early October 2024. Analyzing this dataset reveals a steady pattern of mentions, with some notable peaks. The highest point in the dataset occurs in late February 2023, where there is a spike of three tweets in a single day, suggesting heightened discourse around this topic during that time. Following this peak, the data demonstrates relatively consistent tweet activity, with low, sustained mentions (mostly one or two tweets per day) occurring regularly across the months. There are a few dips in activity, particularly in July and early August 2023, where no tweets were recorded for several days, reflecting a lull in discussion during that period. Another peak emerges in late December 2023, which may be attributed to year-end discussions about digital leadership and management practices as organizations evaluate their strategies for the upcoming year. The overall trend points to a consistent interest in the topic of digital leadership and management, with fluctuations possibly driven by significant events, publications, or conferences related to digital transformation in leadership roles. The sustained activity from 2023 through 2024 indicates ongoing relevance and discourse in this space but without a dramatic increase in engagement over time.

Top Influencers and Their Groups

Figure 2 shows a complex web of relationships between various actors, categorized into distinct groups based on their connections and areas of focus. The prominent group (G1), which includes terms like “leadership,” “digital management,” and “digital transformation,” highlights the centrality of entities involved in leadership and management of digital innovation. This group connects extensively across the network, suggesting a pivotal role in knowledge dissemination and collaboration across multiple domains, such as technology and business transformation. Other groups (e.g., G2, G5, G6) focus on specialized areas like cybersecurity, digital business management, and performance management. The presence of dedicated clusters emphasizes the compartmentalization of expertise and resources, where interactions within groups are likely aimed at achieving focused goals. For example, G2's connections to "spycraft" may indicate the influence of security and surveillance technologies, while G5 and G6 reflect domains tied to operational and leadership functions in digital ecosystems. A key insight is the overlap of nodes across multiple clusters, which underscores the importance of interdisciplinary collaboration. G7, linked to "ventanaresearch," connects to multiple groups, indicating its role in research and strategic development, possibly acting as a bridge between operational groups and decision-makers.

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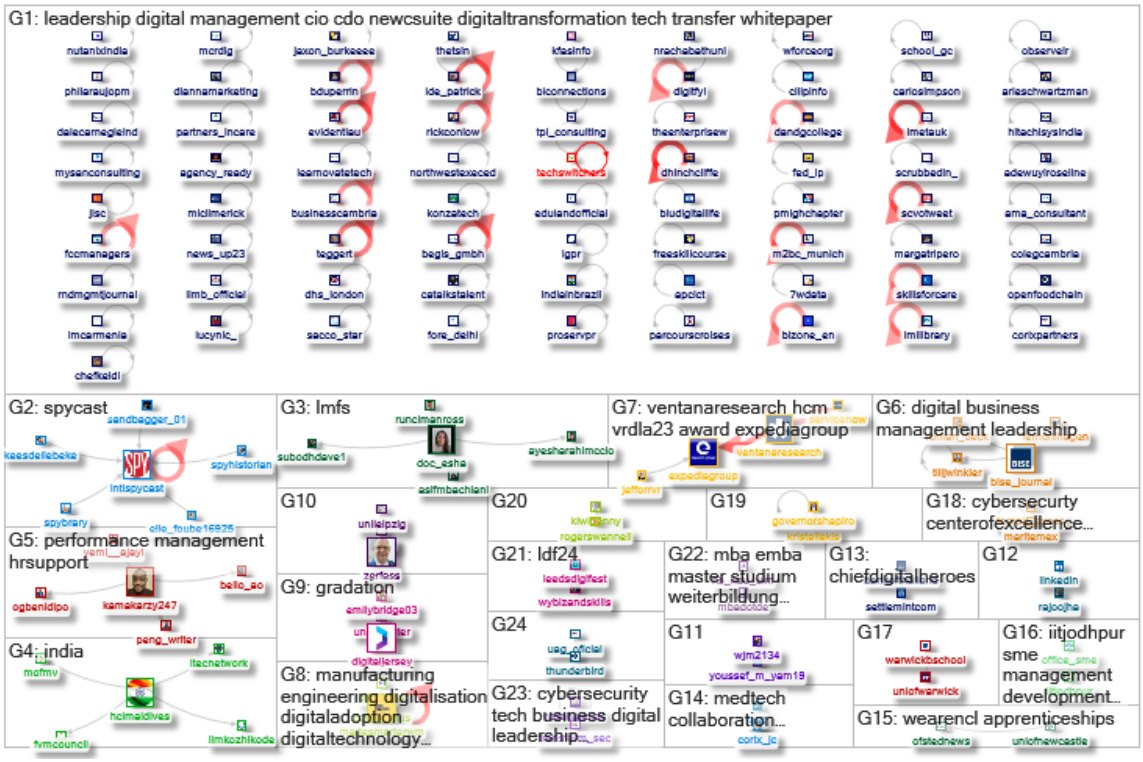

Figure 2: The Social Network Graph of "Digital Leadership in Management" on X

Table 1 reveals a diverse group of users who hold influential positions within distinct domains. The highest-ranking user, with a betweenness centrality of 20.000, is the host of a podcast specializing in espionage history, signalling a niche yet impactful position in network influence, particularly in Group 1. The following users ranked 2 to 4, each holding a betweenness centrality of 12.000, representing a strategist focused on the UN Sustainable Development Goals, India's diplomatic mission to the Maldives, and a healthcare expert in perinatal and liaison psychiatry. These users, located in separate groups (2, 4, and 3 respectively), highlight their central roles in their respective domains such as diplomacy, development, and healthcare. The remaining users (ranks 5-10) exhibit lower centrality scores, ranging from 6.000 to 2.000, indicating varying levels of influence across sectors like academia, digital industries, and market research. For example, User 5 represents a business journal in Group 6, while User 7 is associated with global travel brands in Group 7. Despite lower centrality, these users demonstrate specialized authority within their fields. The distribution across groups and centrality values suggests a well-connected but thematically diverse network, where influence is spread across different areas of expertise.

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Table 1: Top Influencers and Their Groups

Rank	User	Description	Betweenness Centrality	The group in Figure 2
1.	User 1	Host of a podcast focused on espionage history, interviewing spy chiefs, operators, and analysts.	20.000	1
2.	User 2	Strategist and advocate for community and career development, with a focus on the UN Sustainable Development Goals.	12.000	2
3.	User 3	Official Twitter account of India's diplomatic mission to the Maldives.	12.000	4
4.	User 4	Expert in perinatal and liaison psychiatry, with leadership in healthcare management and epidemiology.	12.000	3
5.	User 5	Official account for the Business & Information Systems Engineering Journal	6.000	6
6.	User 6	Provider of authoritative market research in business and IT	4.000	7
7.	User 7	Travel partner account, associated with major brands like Expedia and Hotels.com.	4.000	7
8.	User 8	Organisation representing and promoting digital industries in Jersey.	2.000	9
9.	User 9	Researcher and professor specializing in strategic communication.	2.000	10
10.	User 10	Boosting UK manufacturing growth across the West Midlands through access to digital adoption support & grant funding.	2.000	8

Top 10 URLS

Table 2 presents the URLs that were most often shared during this period. The analysis of the provided URLs in Table 2 reveals significant trends and focuses on leadership and management, particularly in virtual and digital environments. The top resource, Evidentia University's course on leadership and management of virtual teams, reflects the growing need for formal education in handling remote teams, emphasizing communication technologies and strategies.

Table 2: The Top 10 URLs

Rank	URL	Counts
1.	https://evidentiauniversity.com/ce/courses/leadership-and-management-of-virtual-teams/	3
2.	https://bit.ly/3pzZwqa	3
3.	https://bit.ly/3nVux3t	3
4.	https://bit.ly/3DtcM3U	2
5.	http://PA.gov	2
6.	https://www.duperrin.com/english/2022/10/04/management-in-the-future-of-work-digital-leadership-and-systemic-approach-to-	2

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	management/?utm_source=ReviveOldPost&utm_medium=social&utm_campaign=ReviveOldPost	
7.	https://bit.ly/456peRO	2
8.	https://buff.ly/3QOBJ0Q	2
9.	http://tbtech.co	2
10.	https://digitalpeoplemanagement.de/digital-leadership-in-zeiten-der-kuenstlichen-intelligenz-7-aufgaben-fuehrungskraefte/	2

Several other resources, including those from Bit.ly and Duperrin.com, point to a deeper exploration of digital leadership, with topics ranging from systemic approaches to management in the digital age to specific challenges posed by artificial intelligence. The inclusion of public administrative (PA.gov) and tech-focused platforms like tbtech.co further highlights the convergence of traditional leadership approaches with modern, tech-driven strategies in virtual settings. This range of resources underscores a critical emphasis on adaptability, technology integration, and systemic thinking as essential qualities for effective leadership in the evolving workplace landscape.

Brief Content Analysis

The Graph Metrics feature of NodeXL Pro software facilitates the identification of the most utilized words in tweets, as illustrated in Figure 3. These words offer insights into the dialogue. The most associated keywords were “digital”, “leadership”, “management”, “#leadership”, “#digital”, “#management”, “more” “business”, “tech”, and “skills”.

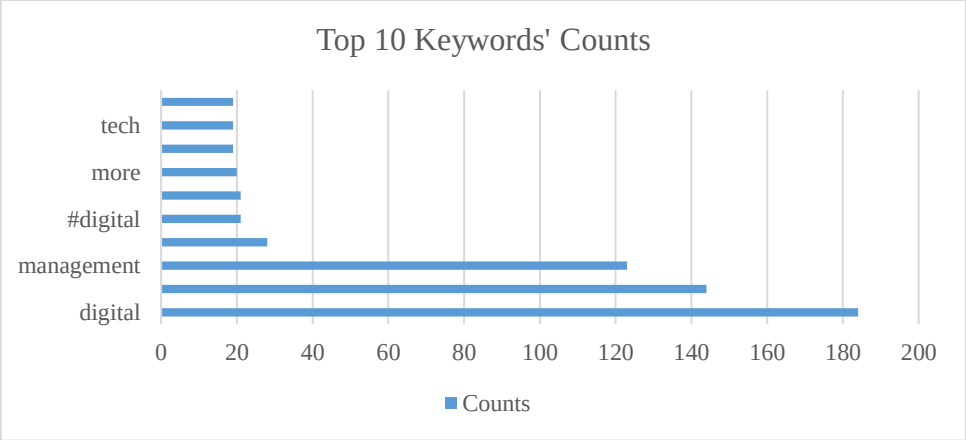

Figure 3: Top 10 Keywords

Discussions

Digital leadership is becoming increasingly crucial in the evolving landscape of work, particularly in distributed and hybrid environments (Ming & Mahaliza, 2024). As the pandemic revealed, many leaders struggled with adapting to the digital tools and communication methods necessary to lead effectively. Traditional management models, based on visual oversight and individual control, became obsolete in a world where teams were dispersed, and interactions moved online. Leaders who lacked digital leadership skills not only faced personal challenges but also hindered the potential of their teams (Kusanke et al., 2023).

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Digital leadership goes beyond merely using communication tools like email or chat; it requires understanding how to convey messages, emotions, and implicit cues effectively through digital channels. Leaders must learn to regulate and lead remote meetings, communicate with emotional intelligence, and foster collaboration without relying on physical presence. Emotional intelligence (EI) is crucial for digital leaders to mitigate technostress among employees. By understanding and managing emotions, digital leaders can foster a supportive environment that reduces stress and enhances productivity (Ertiö et al., 2024). In line with that, digital leaders enhance knowledge sharing and emotional intelligence among faculty, promoting innovation and improving organisational performance (Anwar & Saraih, 2024).

The challenge is not just about technology but about shifting the mindset toward systemic thinking—focusing on team collaboration rather than micromanaging individuals (Clutterbuck, 2021). In today's digitalized work environment, leaders must adapt their approach to improving collective performance by optimising team dynamics and fostering autonomy within a supportive system. Embracing digital leadership means embodying a modern managerial posture and leveraging digital tools to empower, rather than control, employees. Effective digital leaders understand that their role is to create a context where teams can thrive, improve their processes, and contribute to the overall success of the organisation (Cortellazzo et al., 2019).

To equip leaders with the skills and knowledge necessary to lead effectively in these contexts, online courses are gaining popularity. Online leadership courses, such as those focused on "*Leadership and Management of Virtual Teams*," emphasize several key characteristics to meet the evolving needs of leaders in digital contexts. First, they incorporate multimedia elements—like video snippets and podcasts—to cater to diverse learning styles, ensuring that leaders can engage with content in various formats. Second, these courses emphasize practical application through real-time discussions and interactive tasks, allowing participants to collaborate with peers and apply leadership concepts immediately, particularly in managing virtual teams. Additionally, such courses promote a comprehensive approach by blending leadership theories with modern team dynamics, prioritizing strategies that enhance team performance, and collaboration in virtual spaces. Final assessments are designed not merely as a test of knowledge but as reflective exercises that evaluate the leaders' ability to implement digital leadership skills effectively in their organizations.

Furthermore, digital leadership is critical in today’s rapidly evolving landscape dominated by Artificial Intelligence (AI). As organisations leverage AI to automate processes and personalize customer interactions, leaders must adapt to ensure these technologies create real value. This paradigm shift has sparked considerable discussion among professionals, reflected in high engagement metrics on social platforms like X, where insights on the integration of AI in management are frequently shared and discussed. However, digital leaders now face essential tasks: embracing AI's potential, adapting corporate strategies, eliminating mundane tasks, fostering team collaboration, managing risks, prioritizing team welfare, and investing in continuous learning. These responsibilities not only enhance operational efficiency but also cultivate a positive culture that values human connections alongside technological advancements (Tariq et al., 2021). The anticipated trends suggest that leaders will increasingly focus on developing a digital mindset, honing their skill sets, and utilizing advanced tools to navigate the complexities of this new age. Additionally, leaders should seek training that

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emphasises adaptability and collaboration with AI, ensuring they remain relevant in this dynamic environment.

Practical Recommendations

This study presents several practical implications for digital leaders who are looking to guide their organizations through the intricacies of contemporary business ecosystems. First, the emotional intelligence in working with distributed teams, mitigating technostress, and driving collaboration (Ertiö et al., 2024; Goleman, 2000). However, training programs should include modules on emotional regulation and communication strategies in the context of virtual settings. Second, networks such as X are effective tools for monitoring trends within industries, scouting opportunities, gathering stakeholder feedback, and improving the visibility of the organization (Burgess & Baym, 2020). Organizations can deploy structured strategies that engage leaders to engage in online conversations, share wisdom, and build digital networks (Anwar & Saraih, 2024). Third, the rising popularity of AI in making decisions, means that leaders need to keep upgrading AI tools and applications. It would be important to provide online courses on systemizing the use of AI in a managerial sense, focusing on human-centered leadership that leaders can still take online to help solve operational issues.

To achieve organizational resilience, organizations must be learning-led and adaptable. This also means developing frameworks to facilitate leadership development through interactive workshops, simulated cases, and mentorship programs based on digital applications (Anwar & Saraih, 2024). The use of collaboration tools like intranet social networks or digital forums can also optimize peer learning and knowledge sharing. Organizations should also prioritize the investment in digital tools that support data-driven decisions and streamline virtual interaction. Organizations should bridge the gap by incorporating technology-driven performance metrics that reflect digital leadership in performance reviews (Ming et al., 2024; Schrage et al., 2024). Therefore, the nurturing of digital leadership is a results-focused process, rooted in emotional intelligence, technologically literate, and strategically anticipatory, all underpinned by individuals who can endure in a fast-changing, technology-enabled environment.

Limitations

This study investigated digital leadership using social network analysis of X, a platform used by a diverse range of users and content. However, the small sample size and possible lack of representation of some perspectives and trends could restrict the generalizability of the results. Future researchers may implement data augmentation, along with longer Tweets over an extended time window, or source data from platforms such as LinkedIn or Facebook. Public tweets do not represent all forms of interaction and future research may benefit from mixed-method approaches involving social network analysis and qualitative methods such as interviews or surveys. Biases could be introduced based on the data collection and analysis uses of NodeXL Pro and the manifestation of digital leadership in management domains means that there are potential research strands in other sectors such as education, health, and public administration.

Conclusion

In conclusion, the rise of digital leadership marks a critical evolution in organizational management, as leaders must now transcend traditional models to navigate an increasingly complex and technologically driven world. The study on digital leadership in management had three primary objectives: (1) to identify key influencers within X discussions on digital

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leadership, (2) to analyze frequently referenced online resources and URLs, and (3) to extract and interpret top keywords driving these conversations. These objectives were successfully achieved through the application of social network analysis (SNA) and content analysis, enabling the identification of influential users, thematic clusters, and trending resources. The findings revealed critical insights, such as the importance of emotional intelligence and AI integration in leadership practices, and highlighted patterns of influence and discourse dynamics within the digital leadership domain.

The findings of this study reveal that the shift from hierarchical control to a more systemic, team-centric approach highlights the necessity for leaders to leverage digital tools not only for communication but also for fostering collaboration, emotional intelligence, and innovation. The pandemic accelerated the demand for these skills, revealing gaps in leadership adaptability, which are essential for guiding distributed teams effectively. Furthermore, the integration of Artificial Intelligence (AI) has introduced both opportunities and challenges, demanding that leaders embrace continuous learning to harness the full potential of AI while maintaining human-centered leadership practices. As organizations continue to digitalize, the ability of leaders to balance technological advancements with emotional intelligence will be vital for sustaining productivity, employee well-being, and organizational growth. Ultimately, digital leadership is not merely about technology adoption but about cultivating a resilient mindset that empowers teams, encourages innovation, and ensures that organizations remain agile in an ever-evolving global landscape.

The study makes significant contributions to the field of digital leadership by advancing theoretical and practical understanding of how leaders engage in and shape online conversations. The integration of structuralist theory, emotional intelligence frameworks, and AI-driven leadership strategies offers a multidimensional perspective that bridges existing knowledge gaps. Practically, the findings underscore the importance of leveraging social media platforms like X for stakeholder engagement, knowledge sharing, and innovation in digital leadership practices. This research also demonstrates the utility of SNA as a tool for identifying and analyzing key influencers and thematic trends in social network discourse.

Future studies could expand upon these findings by addressing limitations in the current research, such as the relatively small sample size and reliance on a single social media platform. Exploring other platforms like LinkedIn or incorporating mixed-method approaches, including qualitative interviews and surveys, could provide deeper insights into digital leadership dynamics. Additionally, future research could focus on longitudinal studies to track evolving trends and the impact of emerging technologies like AI and machine learning on digital leadership. By broadening the scope and methodologies, future studies can build on the foundation laid by this research, contributing to a more comprehensive understanding of leadership in a technology-driven world.

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