



Article

Digital Leadership as a Networked Social Process: Evidence from Twitter (X) Leadership Communities

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Abstract

This study investigates digital leadership as a networked social process by analyzing how influential actors operating across professional and institutional domains construct leadership discourse and draw on transformational leadership (TFL) principles within Twitter (X) networks, with particular attention to the skill-transfer gaps that persist between formal academic preparation and workforce demands. Social Network Analysis (SNA) using the NodeXL program was used to examine the relational structure of that discourse across a dataset of 1186 Twitter accounts and 1362 relational ties. The analysis identified 27 prominent actors operating within a distinct community cluster whose discourse spanned politics, health, technology, media, and education, with thematically diverse but uneven engagement with leadership topics. Combining semantic cluster analyses, inductive thematic mapping, and a supplementary exploratory factor analysis (EFA), the study finds that the four TFL principles (individualized consideration, intellectual stimulation, inspirational motivation, and idealized influence) are unevenly represented in this discourse. The EFA condensed the co-occurrence structure into three platform-shaped factors, with the strongest support for individualized consideration and no coherent factor for idealized influence, indicating partial rather than comprehensive alignment with the four-dimensional TFL model. The findings position digital leadership as a relational and iterative social process, sustained through repeated interactions, endorsements, and positional recognition within platform-based publics that extend across academic, industry, and socio-political boundaries. The study highlights social media as a networked yet uneven environment for leadership development and the broader social negotiation of skill-transfer challenges across digital professional contexts.

Keywords: community clusters; digital leadership; social process; social network analysis; transformational leadership; Twitter (X)

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1. Introduction

Leadership development and mentorship have become central mechanisms through which organizations transmit knowledge, build capacity, and reproduce leadership across professional communities (Sons 2016; Moldoveanu and Narayandas 2019). Despite the widespread implementation of such initiatives across academic, industry, and professional sectors, persistent skill-transfer gaps remain, particularly for individuals entering complex, fast-evolving work environments such as retail. These gaps are frequently

attributed to the underdevelopment of soft skills, including communication, emotional intelligence, problem-solving, and teamwork, which are critical for effective collaboration and leadership in dynamic organizational contexts (Deming 2017; Succi and Canovi 2020).

In addition, competencies related to digital literacy, technological proficiency, and data analytics have become increasingly important (Nietzel 2025), yet they remain unevenly integrated into formal training and academic programs. Prior research suggests that institutional curricula often emphasize theoretical or technical instruction over the cultivation of adaptive, interpersonal, and leadership-oriented skills, leaving graduates underprepared for cross-functional collaboration and real-time decision-making (Jackson 2010). This challenge is further intensified by the pace of technological change, as institutional training structures often lag behind shifting industry and societal demands (van Laar et al. 2017; Willems et al. 2017). Such misalignment is especially visible in sectors with rapidly evolving consumer behavior, digital platforms, and interconnected supply chains (Skelly and Handrinos 2023). Without addressing emerging challenges such as an omni-channel environment or AI-driven innovation, many professionals enter the workforce with outdated knowledge and limited leadership readiness (Ehlers 2020; Hall et al. 2024).

Skill-transfer gaps refer to the discrepancies between the competencies fostered through leadership development initiatives and those required in contemporary professional contexts. Addressing this gap requires leadership approaches that extend beyond technical skill acquisition to encompass motivation, values, and relational capacity. Transformational leadership (TFL), extended by Bass and Avolio (1990), distinguishes leaders who motivate and inspire others toward shared goals from those who rely primarily on transactional exchanges. TFL emphasizes leadership as a moral, value-driven, and relational process that supports egalitarian influence, collective purpose, and shared transformation (Korejan and Shahbazi 2016). By cultivating commitment, creativity, and intrinsic motivation, transformational leaders promote innovation and professional growth across teams and organizations (Bass and Riggio 2006).

While TFL has traditionally been examined within formal organizational or institutional contexts, its core principles are increasingly observable within social media environments. On platforms such as Twitter (X), leadership unfolds through public-facing discourse, where influence, mentorship, and community learning emerge through ongoing interaction rather than hierarchical authority. These platform-based dynamics shift leadership from a top-down communication model to a networked and reciprocal process shaped by recognition, engagement, and relational positioning among educators, professionals, and learners.

Accordingly, this study examines digital leadership not as a mechanism of information diffusion, but as a networked social process through which influence, legitimacy, and authority are collectively constructed within platform-based communities. Employing social network analysis (SNA) (Wasserman and Faust 2009) using the NodeXL Pro tool, the study addresses the following research questions:

RQ1: *Who are the key actors shaping leadership discourse on Twitter (X)?*

RQ2: *How is digital leadership discourse socially constructed and sustained through networked interactions within the Twitter (X) community?*

RQ3: *How are the principles of transformational leadership expressed and negotiated within this networked social learning community?*

By focusing on patterns of interaction rather than message transmission, this study examines how leadership meaning, influence, and legitimacy take shape within networked publics. As social media increasingly shapes how professional knowledge

circulates, situating TFL within digital discourse connects this inquiry to broader social science discussions of networked influence, collective sensemaking, and the social conditions under which authority is produced. The findings are relevant to scholars studying digital publics, networked influence, and how leadership recognition takes shape outside formal institutional structures. This study contributes to digital leadership research by conceptualizing leadership discourse on social media as a networked social process emerging within community clusters rather than diffusing uniformly across a platform.

2. Theoretical Framework

2.1. Transformational Leadership (TFL)

Transformational leadership (TFL) explains how influence is generated through shared purpose, motivation, and relational engagement rather than through formal authority alone (Burns 1978; Bass 1985; Bass and Riggio 2006). Leadership in this tradition is not treated as a fixed role individual trait, but as a social process through which actors shape commitment, interpret collective goals, and encourage change (Fairhurst and Grant 2010). This orientation positions leadership as something enacted through communication and recognition rather than simply possessed by individuals, which is the analytical stance the present study adopts.

TFL originates from Burns (1978), who described transformational leadership as a process in which leaders and followers raise one another to higher levels of motivation and moral purpose. Bass (1985) built on this by specifying the behavioral dimensions that made the theory more directly usable in empirical research. Bass and Riggio (2006, pp. 45–46) later refined these dimensions as individualized consideration, intellectual stimulation, inspirational motivation, and idealized influence. As a set, these dimensions describe how leaders support development, challenge assumptions, articulate vision, and gain legitimacy through ethical and symbolic modeling. Each dimension captures a distinct but related aspect of transformational leadership. *Individualized consideration* refers to recognizing followers' unique strengths and offering mentorship and developmental support. *Intellectual stimulation* challenges assumptions and encourages critical reflection and creative problem-solving. *Inspirational motivation* refers to articulating a compelling vision that energizes followers toward shared objectives. *Idealized influence* refers to the demonstration of trustworthiness, credibility, and ethical conduct through which leaders gain respect and legitimacy (Bass and Riggio 2006).

As leadership increasingly operates across distributed networks of interaction, its relational orientation extends beyond hierarchical coordination (Avolio et al. 2001) and treats communication as the primary medium through which influence is established and maintained. Because leadership in networked publics is constituted through communication and recognition rather than formal authority, the four TFL dimensions are useful not as behavioral measures but as analytical categories for identifying which leadership meanings are discursively invoked, contested, and recognized within the network.

2.2. Digital TFL in Networked Social Environments

The rapid emergence of new technologies, platforms, and disruptive business models has intensified questions about how leadership operates within digitally mediated publics (Boston Consulting Group 2023). Digital communication has substantially altered the context in which leadership is enacted and observed. Research on e-leadership shows that communication technologies change how leaders maintain presence and build trust across dispersed settings (Avolio et al. 2001). In these environments, digital media reshape the conditions under which influence becomes visible and socially recognized, rather than simply replicating offline managerial practice through a new channel.

Social media platforms have become consequential venues for knowledge sharing and leadership discourse through ongoing interaction (Yaqub and Alsabban 2023). While organizations and professional associations integrate digital engagement into their communication strategies, leadership discourse often remains institutionally bound and limited in public visibility. Platforms such as Twitter (X) allow users to endorse, amplify, and contest messages across overlapping audiences. As a result, influence is not determined solely by institutional position but also by network location, visibility, and patterns of recognition (Dubois and Gaffney 2014). Social media thus makes it possible to study leadership as a public and relational process rather than as an exclusively organizational one.

Digital TFL is negotiated through networked interaction rather than simple message transmission. Opinion leaders (i.e., users recognized for their visibility and credibility) and information brokers (i.e., users who connect otherwise segmented communities) play distinct relational roles in shaping leadership discourse (Kim and Chakraborty 2024). Their significance lies not only in the messages they produce, but also in their structural capacity to connect communities and frame issues in ways that others adopt or circulate (Dubois and Gaffney 2014). Social media is not merely a channel for leadership communication but a space in which leadership-related meanings are constructed through repeated interaction and networked endorsement.

This interpretive potential, however, requires caution. Platform interactions are shaped by algorithmic amplification, selective participation, and uneven distributions of attention. Online visibility cannot be treated as a direct measure of leadership effectiveness or social influence in a broader sense (Dubois and Gaffney 2014).

2.3. TFL Dimensions as Analytical Categories for Social Media Discourse

Because leadership in a networked public is constituted through communication and recognition rather than through formal authority (DeRue and Ashford 2017; Fairhurst and Grant 2010), the four dimensions of TFL are employed as analytical categories for reading leadership-related discourse rather than as a direct measurement instrument (Blumer 1956). They specify which leadership meanings (such as developmental support, critical engagement, shared vision, and symbolic legitimacy) are discursively invoked, contested, and recognized within the network, without claiming that all visible actors on the platform expressed transformational leadership in a complete or verifiable sense. Treating the dimensions as categories of meaning rather than as behaviors also clarifies the status of the analysis. They function as an a priori lens that the discourse may partially confirm or fail to support, not as properties assumed to be present in advance.

In this way, each dimension corresponds to a recognizable repertoire of leadership, meaning that may circulate in discourse rather than to directly observable behavior. *Idealized influence* is relevant because public communication depends on credibility and symbolic authority. In networked settings, these qualities may be reflected in repeated endorsement or the construction of an actor as a legitimate voice within a community. *Inspirational motivation* is pertinent because social media discourse frequently centers on shared purpose and future-oriented language. Messages that frame collective goals or project a compelling vision may be interpreted through this dimension. *Intellectual stimulation* is important in online settings where discourse involves contestation and the reinterpretation of established perspectives. Social media can function as a space in which assumptions are challenged, and competing understandings are made visible, though the platform context does not guarantee such engagement. Among the four dimensions, *individualized consideration* requires careful treatment in social media research. In the TFL tradition, it refers to attention to followers' development and circumstances through mentoring and tailored support (Bass and Riggio 2006), but in platform-based contexts such sustained developmental relationships are harder to observe. It should therefore be

interpreted as a limited and indirect signal rather than as direct evidence of developmental leadership.

2.4. Research Gap and Study Positioning

Much of the leadership literature addresses organizational or educational contexts without fully engaging networked publics, while social media research more often focuses on influence, engagement, or opinion leadership without grounding its analysis in TFL. The intersection of TFL and platform-based public discourse therefore remains underdeveloped in the literature.

The present study responds to this by bringing together transformational leadership theory and social network analysis to examine leadership discourse on Twitter (X). The study does not treat social media traces as direct evidence of leadership effectiveness or durable leader-follower relationships, but approaches leadership as a discursive and relational process that becomes visible through interaction, recognition, and networked communication. TFL supplies interpretive vocabulary through which patterns of discourse can be read, while the network perspective makes it possible to examine how such meanings are distributed across a digitally mediated public space.

3. Methods

3.1. Social Network Analysis (SNA)

Social network analysis (SNA) is a methodological approach for visualizing social entities, their relationships, and emergent cluster structures within complex social systems (Wasserman and Faust 2009). SNA operates through two core units: vertices and edges. Vertices (also referred to as actors, nodes, or agents) represent a wide range of social entities, including individuals, brands, affiliations, and even non-human elements such as web pages, keywords, events, or geolocations. Edges (also called links, ties, or connections) depict specific types of relationships, such as communication, collaboration, transactions, investments, friendship, or shared attributes, capturing the relational dynamics among entities (Wasserman and Faust 2009). In the Twitter context, edges also capture interactions such as tweets, retweets, replies, and mentions, highlighting real-time, directional connections among users and reflecting how information and influence flow through the network (Olivares-De la Fuente et al. 2025).

To analyze these Twitter networks, this study employed NodeXL Pro (Social Media Research Foundation, Belmont, CA, USA), an SNA software tool integrated with Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) that enables network computation, graph visualization, and content analysis. Using NodeXL Pro, the study computed key metrics and applied relevant algorithms to examine information diffusion and relational influence within the network (Hansen et al. 2020). Data were collected through the Twitter Application Programming Interface (API) and organized to address the study's three research questions.

For research question 1 (RQ1), key actors were identified using in-degree, out-degree, and betweenness centrality (BC) metrics, which locate nodes occupying high-connectivity and structurally bridging positions within the network. For RQ2, the structural conditions under which leadership discourse is constructed and sustained were examined through cluster analysis using the Clauset–Newman–Moore (CNM) algorithm and visualized with the Harel–Koren Fast Multiscale (HKFM) layout to map sub-community boundaries and inter-cluster relationships. For RQ3, leadership discourse was analyzed through semantic network analysis and “inductive thematic mapping” to identify keyword co-occurrence patterns and thematic clusters, which were then interpreted against the four TFL dimensions.

Each metric was selected for its correspondence to a specific research question rather than as a generic descriptor. Betweenness centrality operationalizes brokerage and bridging position, making it appropriate for RQ1's focus on actors who connect otherwise separated conversational clusters; modularity-based community detection (CNM) operationalizes the boundary structure of sub-communities, making it appropriate for RQ2's focus on how discourse is socially organized; and keyword co-occurrence structure operationalizes the semantic association among leadership concepts, making it appropriate for RQ3's focus on thematic alignment with TFL. NodeXL was used for network construction and visualization, while the substantive analytic claims for RQ3 rest on the supplementary exploratory factor analysis (EFA) of the semantic co-occurrence data, which adds a quantitative and reproducible layer beyond descriptive centrality and clustering metrics, and reduces the subjectivity of the interpretive mapping (See Section 3.3).

3.2. Data Collection: Detecting the Topic-Specific Twitter Network

Two institutional programs, the National Retail Federation Foundation Student Program (NRF) and the Harvard Business School Leadership Development Program (HBS), served as focal points for network exploration because both are recognized contexts for public discourse on leadership, mentorship, and professional development. To examine online communities engaged in these themes, data were collected over one year from April 2023 to April 2024, allowing the study to capture leadership-related discourse across different periods of professional, academic, and organizational activity on Twitter (X). Data were collected using NodeXL Pro through a keyword-based Boolean search strategy. The logical OR operator was used to broaden the query's scope across related yet distinct topic areas. The search query "Leadership Development OR Career Mentorship OR Retail OR HBS NRF" (hereafter LMR) was selected to operationalize digital leadership as a discourse spanning formal development programs, relational mentorship, and applied professional settings. "Leadership Development" and "Career Mentorship" capture the developmental and relational vocabulary central to transformational leadership. "Retail" anchors the discourse in an applied, workforce-facing professional sector, while "HBS" and "NRF" represent institutional contexts associated with leadership development, business education, and professional advancement. Combining these complementary terms was intended to generate a sufficiently large yet thematically relevant body of discourse rather than to maximize data volume for its own sake.

Importantly, the resulting dataset is not intended to represent a single bounded population or all digital leadership discourse on Twitter (X). Rather, the LMR query assembles a keyword-bounded discursive field in which leadership meanings are articulated, circulated, and negotiated across sectors. This approach fits the study's exploratory purpose of mapping visible actors, interaction structures, and semantic associations within a thematically defined networked public. At the same time, the inclusive keyword strategy necessarily introduces heterogeneity, as some actors may be only indirectly connected to leadership development or mentorship. Accordingly, the findings are interpreted as patterns of discourse visibility and relational positioning within the LMR network, rather than as representative evidence of leadership behavior, mentorship outcomes, or workforce skill transfer. The resulting LMR network included 1186 Twitter users (vertices) whose tweets contained at least one of the designated keywords or who were mentioned, replied to, retweeted, or quoted within those conversations. These interactions generated 1362 relational ties (edges) within the network (see Table 1 and Figure 1).

It should be emphasized that the LMR network constitutes a topic-specific discourse network rather than a representative sample of any defined population. Vertices were included based on keyword co-occurrence and conversational participation, not through probability sampling, and the network therefore captures one configuration of leadership-

related discourse circulating on the platform during the collection window. Accordingly, the heterogeneity of actors (e.g., political, medical, entrepreneurial, and institutional accounts) is treated not as a sampling limitation but as a substantive feature of the platform's cross-sectoral discourse structure, and findings are interpreted as characterizing this discourse network rather than as generalizable to leadership populations more broadly.

Table 1. Overall metrics in the LMR search network.

Graph Metric	Value
Graph Type	Directed
Vertices (The number of Twitter accounts)	1186
Total Edges (The number of connections with other Twitter accounts)	1362
Unique Edges	1011
Edges With Duplicates	351
Maximum Geodesic Distance (Diameter)	6
Average Geodesic Distance	1.677449
Graph Density	0.000409133
Modularity	0.612411

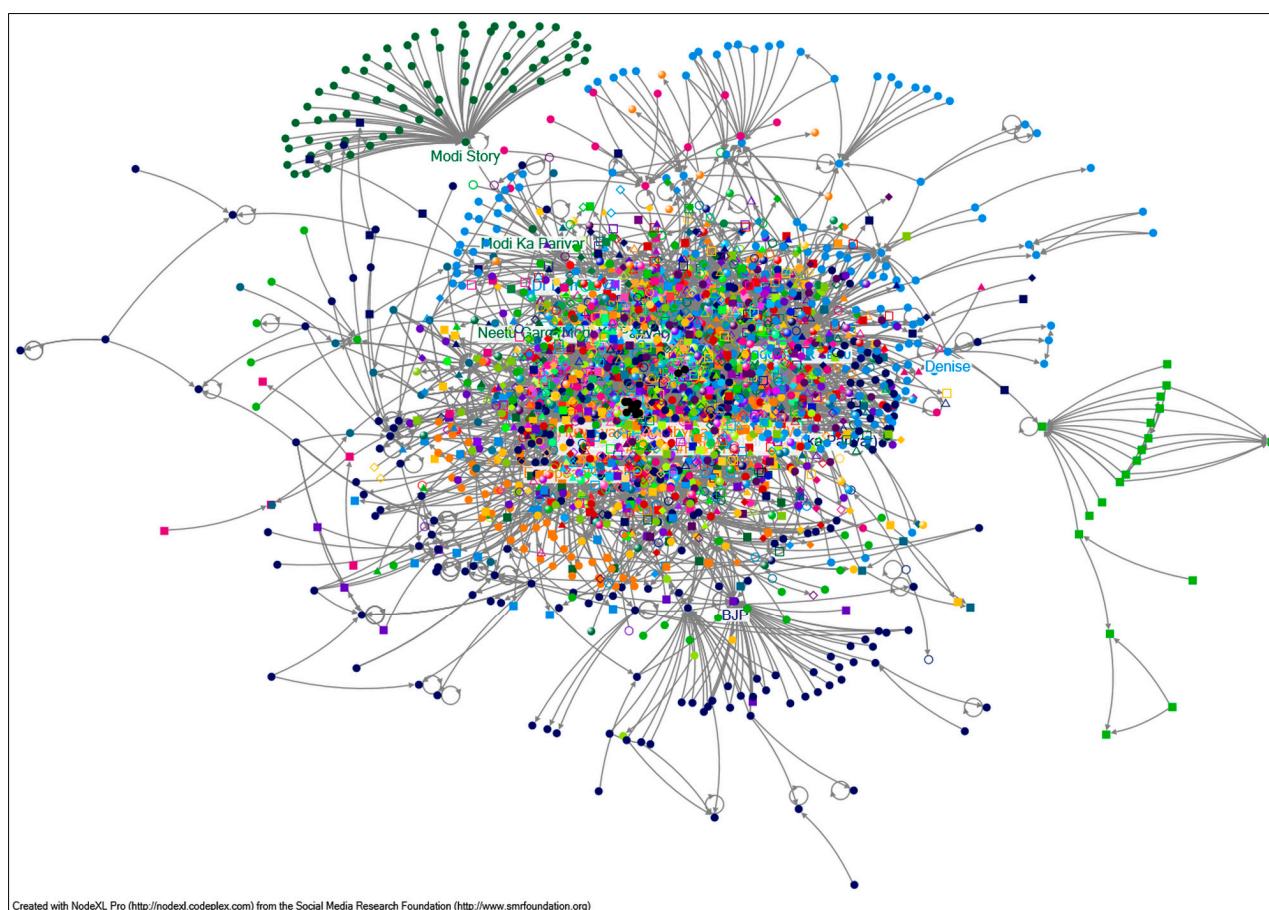


Figure 1. Initial mapping of the LMR search network.

3.3. Supplementary Exploratory Factor Analysis

To complement the inductive thematic mapping and address the potential subjectivity of that interpretive process, a supplementary exploratory factor analysis (EFA) was conducted on the LMR semantic co-occurrence data. A term-by-term co-occurrence matrix was constructed from cleaned word-pair edges derived from the NodeXL semantic network output. Raw co-occurrence counts were aggregated into an 18-term symmetrical

matrix after applying a minimum cumulative co-occurrence strength threshold of 30, which excluded semantically diffuse terms (e.g., platform artifacts, proper nouns, and non-conceptual connectors). Co-occurrence profiles were row-normalized, and Pearson correlations were computed across term profiles to generate the input correlation matrix.

Principal Axis Factoring (PAF) with Varimax rotation was applied, with communalities iterating to convergence. The number of factors was specified at three on theoretical grounds. The Kaiser criterion suggested four factors, but the fourth factor contained only two terms loading in isolation, offering no interpretive value beyond a three-factor solution. The three-factor model was therefore selected as more parsimonious and more consistent with the documented structure of TFL in digital leadership contexts (Eitan and Gazit 2025).

Factorability diagnostics indicated KMO = 0.483 and significant Bartlett's Test of Sphericity, $\chi^2(153) = 6035.93, p < 0.001$. The KMO value falls below the conventional threshold of 0.60, reflecting the inherently sparse and fragmented structure of Twitter co-occurrence data. This is consistent with the study's central finding that TFL discourse on Twitter is unevenly distributed across community clusters. Given this limitation, EFA results are interpreted as supplementary descriptive pattern evidence rather than confirmatory validation. An alternative 26-term model incorporating technology-domain vocabulary (e.g., Coruzant, AI, emerging technology, protege) was evaluated but rejected. The expanded model produced KMO = 0.121, attributable to the near-perfect internal co-occurrence coherence of the technology cluster and its weak integration with the broader leadership and mentorship vocabulary. This result is itself theoretically meaningful, confirming that technology-oriented discourse operates as a structurally isolated community rather than an integrated dimension of the broader leadership semantic network.

4. Results and Discussion

4.1. Digital Influencers in Digital Leadership Discourse (RQ1)

Betweenness centrality (BC) was used to identify key influencers within the LMR search network by measuring how frequently a user appears along the shortest communication paths, an indicator of their control over information flow and influence within the discourse (Hansen et al. 2020). A high BC value reflects a user's role as an information broker or opinion leader who connects otherwise disconnected clusters. After filtering and ranking by BC scores, Table 2 presents the top 27 influencers. Their relative impacts were evaluated using activity metrics (their numbers of followers, accounts followed, and tweets) and their cluster affiliations, with each representing distinct positions and roles in the network's dialogue dynamics.

Table 2. Top 27 Influencers in the LMR search network.

	Vertex ID (Group Number): Account Description	B/C	FER	FED	TW
1.	Rigathi (G1) Deputy President of the Republic of Kenya.	2391.000	682,713	117	3414
2.	mbuma_ke (G1) Nonchalant. rwanda world real diplomatic unique growth #mlimanews riggyg engagements #rigathionassignment	383.000	11,993	1893	35,918
3.	cbs_ke(G1) Digital Journalist Digital Media Strategist Opinion is Free But Facts are Sacred	192.000	129,828	32,116	188,080
4.	pooh_vel(G3) Structural & Interventional #Education Cardiologist; HRPCI #SHD; Opinions	180.000	11,562	966	23,071
5.	victorkjr32 (G1) God Fearing social Media Influencer/Creating and marketing Digital content	143.333	2059	228	88,351

6.	min_waterug (G6) Ministry is mandated to set national policies & standards, manage and regulate water & environmental resources in Uganda.	132.000	12,755	261	6976
7.	dolores_mckeen (G4) Newf wife momx3 proud @MUNalumni @MUNmed'92 @DeanMUN Med Professor #OBAnes RCPSC #Surveyor #Examiner #EDI MyOpinions NotAfraidToShareEm	132.000	2113	1990	7614
8.	Augranious (G1) Drive leaders generation youth cbs_ke, empower positive progress, mp nspire' forward, #govsimbaarati county, forward nurtured, generation, future programs, nurtured equipped, skills emphasis, youth knowledge, drive development, programs.	98.000	80	124	6728
9.	Kojiromoriwaka (G5) CEO @SiliconVV/Advisor CV/Venture Partner BE VCch@CVLabs/Advisor@ArkaVentureLabs Health/@Gifted-DaRapper @_BE_Health_tw/@FukuokaGrind Ventures	91.000	8452	3946	41,525
10.	m_samatar(G9) Supply chain and logistics specialist. Views on by Me, Myself and I	90.000	47	739	866
11.	puneetsinghal22(G7) #Dyspraxic CDO @NASA @Billionstrong1 Leading @GNYPWD DEI Practitioner Board @thegysrl Member @IUCN #WeAreBillionStrong, #a11y, #SDGs, #AXSChat	84.000	1145	4011	8866
12.	m_francis(G5) Chief Product Officer @ForbesTech Cncl member; @ElectronicCare; past: @AWS @Intel @AgeWave Harvard Pitt my tweets are my own	77.000	960	1239	8401
13.	Tycoonstoryco (G8) Largest Online Network for #Startups and #Entrepreneurs #shareyourstory #startuplife #entrepreneurship #small-business #finance, career growth, training, business ideas, leadership development, self improvement, mentorship, leadership qualities, team development, skill building, goal setting	72.000	1947	1839	9141
14.	trath2017 (G11) Travel enthusiast, chef at heart, a true Oriyaenachak woman, commsadda barriers madhurimab_1 mou chakravorty fulfill aroraamandeepk new bhavyachirps	56.000	61	152	161
15.	Modeldoc (G12) Cardiologist Professor/MasterPhysician mentorship sponsorship conflict negotiation @EmorMedicine @Emoryat-Grady @Unilbadan@JohnsHopkinsSPH @MSMEDU @VUMC_heart #TheFaceofCardiology	51.000	3002	2214	4233
16.	Ersozlusara (G10) Attending Cardiologist University Hospital Zurichch Multimodality Cardiac Imaging Research Heart Failure PCHF24-25 Rare Diseases SCMR SoMe 'community, glad leadership, vicferrarimd glad, part early, career scmr, leadership support, early spread, word scmr, supriyajain efforts	46.400	465	1203	283
17.	Tycoontejaswi (G8) shares the challenges of being an entrepreneur and offers a regularly updated resource on entrepreneurship. Women in leadership, gender equality, empowerment, career development, mentorship, and leadership professional development	46.000	203	555	817
18.	lucas_fondo (G2) AdvocacyandComms @kilifi_youth •RMNCAH Advocate •Researcher •MalariaYouth Corp •Youth Advocate @MalariaYouthKE •@rhnkorg •Defeat #HIV #TB #Malaria investin-women iwd2024 stopfemicideke	44.154	2256	975	13,775
19.	maxwell_karani4 (G2) 'training help ambaariu gvrkenya kecosce anindosharlyne genderkilifi implement yowpsud_opportunities	44.000	8	16	98
20.	online_hbs (G8) Wherever you are in your career, Harvard Business School Online offers a unique and highly engaging way to learn vital #business concepts. Leadership development hbs online climb elevate your career management training.	34.000	31,137	677	13,912

21.	doctor_paz (G13) @The_MRC Clinician Scientist Cons Cardiologist @ImperialNHLI @RBandH Cardiomyopathy and cardiac imaging @royalsociety @BritishCardioSo @RoySocMed	31.000	794	322	574
22.	10scollins (G20) Director of Student Activities CEO 365 Mentoring and Coaching, LLC Guest Speaker, Presenter and Podcast Panelist Teach AD Certification classes VSU Alumni	30.000	1183	948	1913
23.	Hphororo (G17) UN Resident Coordinator in Namibia. Women who have privilege facilitate programme unfpa_namibia best house wfpnamibia unaidsnamibia	30.000	1915	300	2035
24.	Hbsalumni (G5) Tweeting about Harvard Business School for the 90K alumni living in 161 countries around the world. Official HBS account	30.000	27,084	9922	164,863
25.	Harvard Alumni (G5) Official Harvard Alumni Association. HAA maintains and enhances a highly engaged, vibrant community of alumni and friends worldwide	30.000	100,326	9483	39,450
26.	Accintouch (G3) Official American College of Cardiology account. Join us to transform Find us: @JACCJournals cardiovascular care and improve heart health. @Cardiology' through mission philanthropic stages Dr. Blossom's #accpresident	26.000	147,399	2003	41,592
27.	Forbes (G14) Forbes' free daily newsletter for unmatched insights and exclusive reporting	26.000	19,970,219	4900	567,723

B/C: Betweenness Centrality; FER (# of Followers); FED (# of Followed); TW (# of Tweets).

Interestingly, Group 1 (G1) comprised high-BC political and media influencers. Among the 27 identified users, the top three functioned as information brokers due to their notably high BC scores. 'Rigathi' (Deputy President of Kenya) led 682,713 followers into the LMR network with a BC of 2391.000, followed by 'mbuma_ke,' (digital content creator) with a BC of 383.000 and 35,918 tweets, and 'cbs_ke,' (digital journalist and media strategist) with 188,080 followers and 32,116 followed, and a BC of 192.000. In addition, 'victorkjr32' (social media influencer) and 'Augranious' (youth leadership advocate) acted as opinion leaders, directly shaping the LMR dialogue. Although these political figures and social media influencers were not explicitly engaged with the LMR-specific themes, their positions as information brokers and opinion leaders amplified the visibility and reach of leadership-related discussions across the broader Twitter sphere.

Group 2 (G2) consisted primarily of youth and health advocates, including 'lucas_fondo' (youth empowerment activist, 2256 followers, 13,775 tweets) and 'maxwell_karani4' (leadership trainer promoting gender equality and youth opportunities). Despite a modest follower base, 'maxwell_karani4' exhibited a relatively high BC of 44.000, reflecting the influence of niche experts within specialized leadership communities.

Groups 3 (G3) and 10 (G10) were composed mainly of medical professionals and institutions. Influencers such as 'pooh_vel' (cardiologist) and 'Accintouch' (American College of Cardiology) illustrated how healthcare experts incorporate TFL-related themes into professional mentorship and education.

Group 5 (G5) featured institutional influencers in technology and business, including 'Kojiromoriwaka' (tech CEO), 'm_francis' (tech council representative), and alumni accounts such as 'hbsalumni' and 'harvardalumni', underscoring the role of elite institutions in linking academic and technological leadership networks. Group 8 (G8) included entrepreneurship and business-education influencers such as 'Tycoonstoryco' and 'online_hbs', representing platforms through which leadership and entrepreneurial discourse reach emerging professionals.

Groups 11 (G11) and 14 (G14) showcased lifestyle and media influencers, including ‘trath2017’ (lifestyle communicator) and major business outlet ‘Forbes’, demonstrating how non-academic actors contribute to shaping public discourse on leadership and mentorship.

These 27 actors occupied structurally significant positions within a cross-sectoral network of TFL communicators, including politicians, youth advocates, medical professionals, technology leaders, entrepreneurs, educators, and media organizations. Their positions within the LMR network show how leadership discourse crosses institutional and professional boundaries, with no single sector dominating its production or circulation. However, it is important to distinguish structural influence from leadership influence. A high BC score indicates that an actor occupies a bridging position in the flow of information and thus enjoys visibility and reach; it does not, in itself, establish that the actor exercises transformational leadership or is recognized as a leadership exemplar by other participants. Several top-ranked accounts (e.g., political and media figures) are structurally central yet only peripherally engaged with leadership development discourse. Network prominence is thus treated here as a measure of discursive position rather than as evidence of leadership effectiveness.

4.2. Social Process of Digital Leadership Discourse on Twitter (RQ2)

On Twitter, communication takes the form of networked social dialogue, with users interacting through replies, mentions, and retweets. These relational exchanges generate distinct topologies shaped by discourse themes and the positioning of influential actors (Kim and Chakraborty 2024). Smith et al. (2014) identified six common structural patterns in social media networks: *polarized crowd*, *tight crowd*, *brand clusters*, *community clusters*, *broadcast network*, and *support network*. Each topology reflects how relational positioning and interaction patterns shape the development of discourse within online communities (Himmelboim et al. 2014).

To identify the structural pattern of the LMR network, cluster analysis was conducted using the Clauset–Newman–Moore (CNM) algorithm combined with the Harel–Koren Fast Multiscale (HKFM) layout. Using the Group-in-a-Box (GIB) layout option, Figure 2 clearly illustrates how influencers connect with their audiences within theme-based subgroups, yielding dense interactions within groups and comparatively weaker connections between groups. The GIB map further demonstrates that leadership discourse develops through multiple localized communities rather than through a single centralized network. Of the 182 detected clusters, 31 were visualized after excluding isolated groups with minimal engagement (i.e., groups consisting of a few users who viewed content but did not interact with others). The resulting topology resembles a *community cluster* structure, with multiple interconnected groups defined by localized influence and thematic focus. Seven dominant groups formed around individual thought leaders, advocacy coalitions, or specialized domains such as healthcare, technology, and education, while smaller clusters functioned as sites of mixed dialogue and peripheral interaction.

For example, Group 1 clustered around political and media brokers (e.g., *Rigathi_cbs_ke*, *mbuma_ke*), engaging audiences in leadership and political discourse. Group 2 highlighted youth advocates and community development leaders such as *lucas-fondo* and *maxwell_karani4*. Group 3 included medical professionals and institutions (e.g., *pooh_vel*, *Ersozlusara*, *Accintouch*), embedding TFL principles into healthcare mentorship and professional practice. Group 5 centered on TFL-aligned institutions and tech-oriented leaders, including *Kojiromoriwaka*, *m_francis*, and alumni accounts such as *harvardalumni* and *hbsalumni*. Group 8 featured entrepreneurship influencers like *Tycoonstoryco*, while Groups 11 and 14 represented lifestyle, communication, and business-media voices.

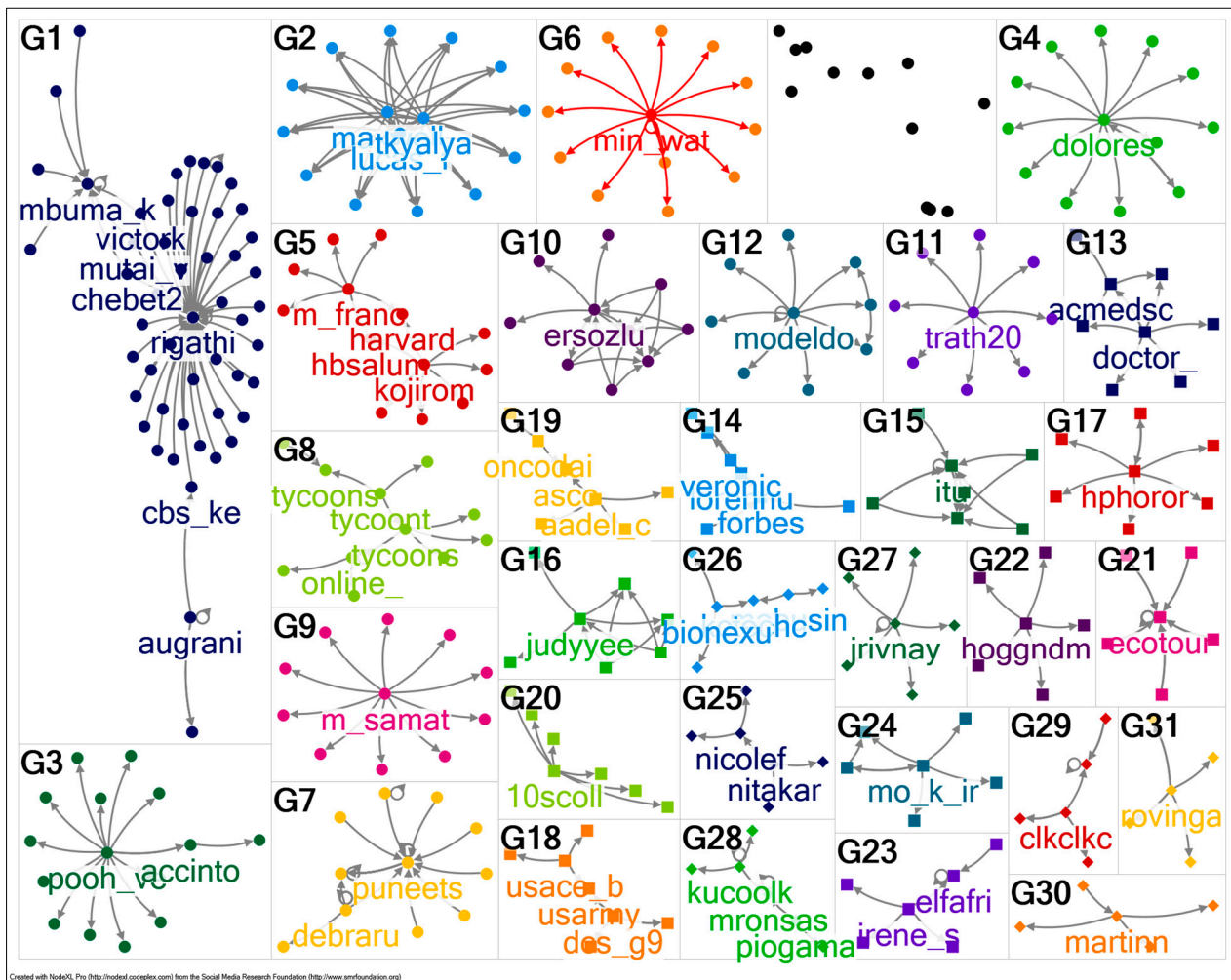


Figure 2. Community clusters in the LMR search network.

At least seven groups contained opinion leaders and information brokers who played essential roles in facilitating cross-cluster interactions and relational connectivity. The topology of this community cluster revealed a persistent skill-transfer gap, as fragmentation across inter-group networks limited opportunities for sustained engagement and shared interpretation. As a result, leadership-related discussions often remained situated within specific communities, with only selective recognition beyond cluster boundaries. Notably, the HBS cluster (G5) demonstrated an effort to address this fragmentation by leveraging its alumni network to foster connection, mentorship, and shared meaning around technology and entrepreneurship through TFL-oriented initiatives.

The cluster map shows digital leadership as a networked social process rather than a property of centralized authority. Leadership discourse develops through recurring interactions among digital influencers and their communities, not through top-down diffusion or linear pathways. Digital influencers, including educators, industry experts, community advocates, and thought leaders, position themselves and gain recognition within these networked publics through sustained engagement. While fragmentation across clusters points to the limits of Twitter as a platform for sustaining cross-sector leadership discourse, the dense interaction within individual communities suggests that platform-based TFL discourse develops primarily through localized social learning processes rather than through network-wide integration.

4.3. Discursive Alignment with Core TFL Principles (RQ3)

Semantic network analysis maps how leadership-related keywords co-occur and cluster within the LMR community, revealing the thematic structure of discourse across the dataset. Word pairs were identified based on frequency and salience metrics, producing a semantic network of 1283 vertices (keywords) and 2285 edges (co-occurrence relationships) (see Table 3).

Table 3. Overall metrics in the LMR semantic network.

Graph Metrics	Value
Graph Type	Undirected
Vertices (The number of keywords)	1283
Total Edges (The number of connections with other words)	2285
Unique Edges	2141
Edges With Duplicates	144
Maximum Geodesic Distance (Diameter)	24
Average Geodesic Distance	4.555555
Graph Density	0.002686031
Modularity	0.567783

A cluster analysis for the semantic network was conducted and visualized using the Clauset–Newman–Moore (CNM) algorithm and the Harel–Koren Fast Multiscale (HKFM) layout (see Figure 3). Semantic clusters were labeled (e.g., G1, G2) and color-coded to represent thematic groupings, with spatial proximity indicating conceptual closeness and topical alignment.

Inter-cluster edges revealed cross-theme linkages that illustrate how leadership nodes become connected through shared discourse. For example, the keyword ‘mentorship’ created strong red-line ties across multiple groups, underscoring its bridging role in linking otherwise separate thematic conversations. Within G1, ‘mentorship’ was strongly associated with *development, career, women, program, youth, and opportunities*, highlighting its integrative function across the network. Meanwhile, the emphasis of G5 on *#technology* and related tags (*ai, #emergingtech, #protegy*), associated with *Coruzant*, reflects a distinct focus on digital leadership within technology-oriented communities. Clusters such as G1 and G2 functioned as discourse hubs where leadership themes were consistently produced through the structural activity of opinion leaders and information brokers within the network.

Following exploratory cluster analysis, an inductive thematic mapping approach was used to identify recurring semantic patterns and group them into qualitative patterns into higher-level conceptual categories. These categories were then interpreted against TFL’s four dimensions, drawing on established qualitative thematic analysis procedures (Braun and Clarke 2006; Miles et al. 2014).

The 50 most salient keywords were identified based on frequency and centrality metrics and analyzed for correspondence with the four dimensions of transformational leadership. ‘Leadership’ was the most salient topic (BC = 296,348.961; count = 924 in G2), with its betweenness centrality score indicating a bridging position across discourse clusters (see Table 4).

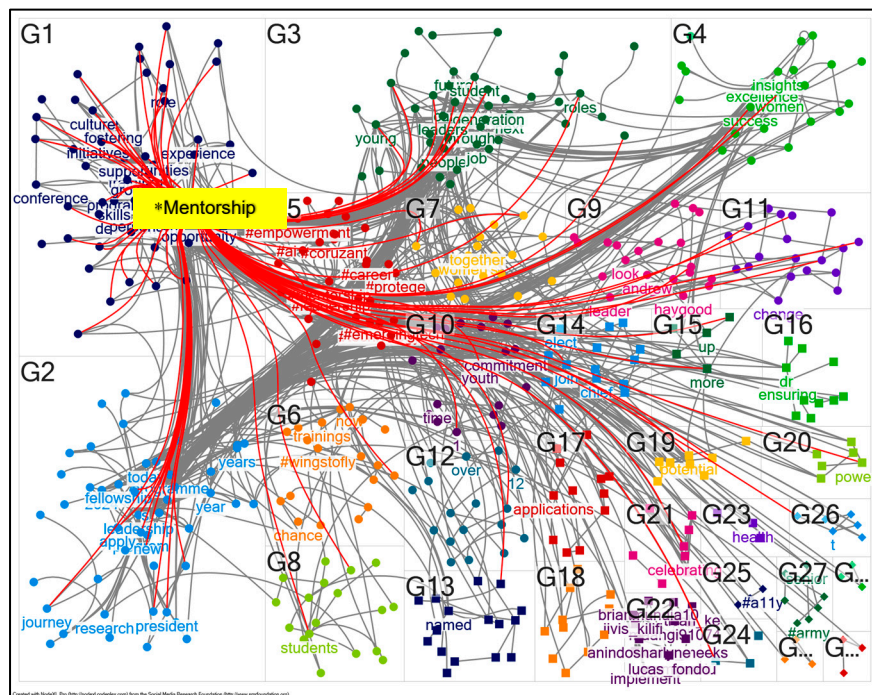


Figure 3. Thematic clusters in the LMR semantic network. Note: * The keyword ‘mentorships’ created strong ties (red lines) that bridged dialogue.

Table 4. The 50 most salient keyword metrics in the LMR semantic network.

	Vertex	Betweenness Centrality	Closeness Centrality	Word Count	Vertex Group
1.	leadership	296,348.961	0.376	924	2
2.	mentorship	187,685.655	0.360	873	1
3.	development	133,400.176	0.348	692	1
4.	career	101,293.651	0.332	375	3
5.	women	55,490.508	0.320	184	4
6.	amp	37,614.673	0.318	212	1
7.	#mentorship	35,623.465	0.294	184	5
8.	join	28,648.364	0.310	72	14
9.	#leadership	26,596.579	0.265	168	5
10.	program	26,439.395	0.310	165	2
11.	leaders	25,715.416	0.281	132	3
12.	president	22,760.761	0.287	20	2
13.	young	19,185.103	0.306	72	3
14.	opportunities	18,873.749	0.312	133	1
15.	apply	18,446.653	0.287	63	2
16.	programs	18,434.240	0.310	123	1
17.	youth	17,510.761	0.299	110	10
18.	skills	16,527.500	0.314	113	1
19.	implement	15,940.233	0.272	17	22
20.	trainings	14,709.391	0.258	12	6
21.	future	14,186.311	0.284	101	3
22.	growth	13,614.841	0.313	103	1
23.	named	13,604.928	0.226	12	13
24.	students	13,537.288	0.269	54	8
25.	student	12,728.297	0.287	30	3
26.	#wingstofly	12,283.298	0.205	14	6
27.	#Coruzant	12,233.896	0.285	109	5

28.	maangi91074	12,170.000	0.148	3	22
29.	research	11,611.282	0.277	25	2
30.	leader	11,117.201	0.248	22	9
31.	lucas_fondo	10,962.000	0.129	2	22
32.	success	10,819.015	0.297	49	4
33.	elect	10,756.636	0.222	2	14
34.	women's	10,482.122	0.280	31	7
35.	next	10,439.666	0.275	45	3
36.	training	10,334.092	0.304	126	1
37.	chief	10,087.721	0.182	17	14
38.	andrew	9941.436	0.198	8	9
39.	#protege	9752.000	0.208	55	5
40.	brianmundia10	9752.000	0.114	3	22
41.	fostering	9293.157	0.296	47	1
42.	senior	8594.626	0.240	16	27
43.	#emergingtech	8540.000	0.171	55	5
44.	anindosharlyne	8540.000	0.102	3	22
45.	experience	8439.901	0.300	45	1
46.	potential	8431.399	0.288	49	19
47.	support	8326.633	0.307	99	1
48.	business	7518.366	0.292	44	1
49.	job	7409.446	0.267	33	3
50.	ensuring	7383.354	0.251	18	16

The LMR semantic network indicates that leadership discourse engaged unevenly with the core dimensions of TFL. Mentorship and individual development practices strongly reflected *Individualized Consideration*, while *Intellectual Stimulation* appeared frequently but was oriented more toward incremental reflection than toward disruptive innovation. *Inspirational Motivation* emerged as an aspirational theme but remained limited in emotional depth and sustained engagement, whereas *Idealized Influence* was largely associated with a small number of highly visible actors, suggesting constrained opportunities for broader recognition of leadership exemplars.

To complement this inductive thematic mapping and reduce potential interpretive subjectivity, a supplementary exploratory factor analysis (EFA) was conducted (see Section 3.3 for full methodological detail). The three-factor solution explained 62.4% of rotated variance [$KMO = 0.483$; Bartlett's $\chi^2(153) = 6035.93$, $p < 0.001$] and revealed a partial rather than comprehensive semantic alignment with the four canonical TFL dimensions (see Table 5).

Factor 1 (Platform-mediated leadership discourse, 30.1%) was the dominant factor, clustering 'leadership (0.968), software (0.988), career (0.826), program (0.829), opportunity (0.806), professional (0.808), and training (0.592).' This factor reflects the co-occurrence of leadership discourse with career infrastructure vocabulary (i.e., programs, opportunities, professional development) and aligns most closely with the *Inspirational Motivation* dimension of TFL, specifically discourse of aspiration, opportunity access, and professional mobilization. The strong loading of software alongside leadership reflects how technology-adjacent vocabulary saturates the same discursive space as leadership on Twitter, consistent with the platform's cross-sectoral reach documented in RQ1.

Factor 2 (Mentorship and inclusive development, 21.0%) provided the strongest and most theoretically coherent TFL alignment, loading on 'development (0.988), young (0.973), mentorship (0.849), skill (0.618), and women (0.381).' This factor directly corresponds to *Individualized Consideration*, which is concerned with recognizing individual

needs, providing mentorship, and supporting developmental growth. The presence of women and young indicates that this discourse is directionally oriented toward underrepresented and emerging professionals, with implications for the skill-transfer gap argument. Mentorship-oriented leadership discourse in Twitter is not uniformly distributed but is specifically targeted toward groups whose workforce readiness has most frequently been identified as underdeveloped (Deming 2017; Succi and Canovi 2020).

Factor 3 (Innovation and future orientation, 11.3%) captured future (1.000) and innovation (0.935), partially consistent with *Intellectual Stimulation*, which emphasizes challenge, creativity, and forward-looking thinking. The two-term structure limits interpretive depth, and the marginal Heywood case for future (loading = 1.000) is consistent with the well-documented tendency for improper solutions to arise when a factor is defined by very few indicators (Cooperman and Waller 2022). Nevertheless, the directional pattern confirms that aspirational and innovation-oriented vocabulary occupies a distinct discursive space from mentorship and career-opportunity discourse.

Notably, *Idealized Influence* did not emerge as a coherent factor. Terms most associated with this dimension (i.e., leader and generation) showed communalities below 0.15 ($h^2 = 0.129$ and 0.075 , respectively), indicating that leadership-exemplar discourse is semantically diffused across the network rather than concentrated around recognizable figures. This absence is theoretically meaningful in that leadership visibility on Twitter is distributed across many actors and communities rather than consolidated around a small number of idealized exemplars, consistent with the decentralized community cluster topology identified in RQ2. The failure of *Idealized Influence* to consolidate as a semantic factor thus corroborates the structure finding that cross-cluster recognition of individual leadership figures is limited on the Twitter platform.

Table 5. Exploratory semantic factor structure and alignment with TFL dimensions.

Factor	Key Terms (Loading ≥ 0.30)	% of Variance	TFL Dimension	Interpretive Strength
Factor 1: Platform-Mediated Leadership Discourse	leadership (0.968), software (0.988), career (0.826), program (0.829), opportunity (0.806), professional (0.808), training (0.592), skill (0.538)	30.1%	Inspirational Motivation	Moderate—leadership visibility and career-opportunity discourse; technology vocabulary co-saturates this space.
Factor 2: Mentorship and Inclusive Development	development (0.988), young (0.973), mentorship (0.849), skill (0.618), women (0.381)	21.0%	Individualized Consideration	Strongest—most consistent with TFL theory; oriented toward emerging and underrepresented professionals
Factor 3: Innovation and Future Orientation	future (1.000), innovation (0.935)	11.3%	Intellectual Stimulation	Weak—two-term structure limits inference; directionally consistent
Idealized Influence	Not extracted due to communalities below 0.15: leader ($h^2 = 0.129$), generation ($h^2 = 0.075$)	—	Not supported	Absent—exemplar discourse is semantically diffuse rather than consolidated.

Note: EFA conducted on an 18-term co-occurrence profile matrix derived from the LMR semantic network. Principal Axis Factoring with Varimax rotation; three factors specified on theoretical and parsimony grounds (Kaiser criterion suggested four; the fourth factor contained two isolated terms). KMO = 0.483; Bartlett's $\chi^2(153) = 6035.93$, $p < 0.001$; total rotated variance = 62.4%; PAF converged in 30 iterations. The marginal Heywood case for future (loading = 1.000) is interpreted with caution. Terms with communality $h^2 < 0.15$ (growth, leader, tech, generation) did not load meaningfully on any factor and are excluded from interpretation. Factor labels are researcher-assigned and descriptive, not inferential. A 26-term alternative model incorporating technology-center vocabulary (KMO = 0.121) was evaluated and rejected (see Section 3.3).

Taken together, these findings indicate that transformational leadership within the Twitter (X) community shows partial semantic alignment with the four canonical TFL dimensions. Consistent with the exploratory and low-factorability nature of the analysis, these results are read as indicative patterns rather than as robust validation of the TFL dimensions. The strongest indicative support is for *Individualized Consideration*; *Inspirational Motivation* is reflected in the dominant career and opportunity discourse of Factor 1; *Intellectual Stimulation* appears weak in the innovation/future cluster; and *Idealized Influence* is absent as a coherent factor. These patterns reflect how platform interaction structures shape the visibility and recognition of leadership practices, dense within communities but fragmented across them, reinforcing the interpretation of digital leadership as a networked social process (Fairhurst and Grant 2010) that is sustained locally but unevenly integrated across the broader platform.

5. Conclusions

This study positions digital leadership on social media as a networked social process that emerges within community clusters rather than through centralized authority. Combining social network and semantic analyses of Twitter (X) discourse, it shows how leadership visibility and influence develop through recurring interaction within platform-based communities. The analysis identified 27 highly visible actors across diverse sectors (politics, youth advocacy, healthcare, technology, entrepreneurship, education, and media) who shaped leadership discourse through sustained positional engagement rather than formal authority.

Although these clusters were fragmented and only loosely tied to formal leadership-education initiatives, the key actors performed a relational bridging function, linking otherwise separate conversational spaces and sustaining a participatory discourse network. Leadership discourse was not concentrated in a single authority structure but developed across 31 interconnected community clusters spanning socio-political actors, institutional participants, grassroots youth advocates, and localized professional conversations. This pattern reinforces the view of digital leadership as a networked social process in which visibility and recognition are produced through interaction rather than granted by institutional position. While this decentralization limited sustained cross-sector integration, it also opens opportunities to connect retail- and business-oriented leadership conversations with the broader discourse already circulating on these platforms.

The supplementary EFA provides additional pattern-level evidence of the same unevenness. Semantic coherence was strong for *Individualized Consideration* (the mentorship, development, and inclusion discourse of Factor 2), while *Idealized Influence* did not form a coherent factor. This absence may signal more than network fragmentation. Idealized influence assumes a stable leader-follower relationship in which a recognized figure embodies shared values and is repeatedly treated as an exemplar. Decentralized, multi-community platforms rarely meet this condition: visibility is dispersed, authority is provisional and audience-specific, and recognition seldom settles on durable exemplars. The pattern thus suggests that a core assumption of TFL theory, the centrality of a single, idealized leader, may not carry over to networked digital settings, where leadership meaning is produced collectively rather than vested in identifiable individuals. Together, the network fragmentation observed in RQ2 and the semantic diffusion of leadership-exemplar terms in the EFA are not separate limitations but converging signs of the same dynamic: the way the platform is structured determines which forms of TFL can become established in the discourse. Idealized Influence is not among them, because the platform does not provide the stable, recognized-leader conditions that this dimension requires.

Practically, these patterns suggest, rather than establish, that addressing persistent skill-transfer gaps may benefit from attention to how TFL-related discourse is expressed

through mentorship, innovation, and resilience in digital communities, alongside more inclusive leadership models (Nietzel 2025). Because the study examines discourse rather than learning or behavioral outcomes, these implications are offered as directions consistent with the observed patterns, not as validated prescriptions. Theoretically, the findings extend TFL by demonstrating its value for interpreting leadership-related discourse, mentorship, and influence within social-learning communities mediated by social media (Eitan and Gazit 2025), where Twitter networks act as informal yet consequential infrastructures for professional discourse and the negotiation of leadership legitimacy (Oliveras-De la Fuente et al. 2025). The findings also bear on how institutions prepare individuals for platform-driven professional ecosystems such as LinkedIn, particularly the extent to which digital literacy, social media strategy, and influence-building are treated as core rather than supplementary competencies. Institutions might strengthen these capacities by engaging alumni through structured mentorship, project-based learning, and leadership coaching that connect academic preparation with professional practice (Bataineh et al. 2025). To reduce fragmentation across communities, TFL initiatives may prioritize cross-sector interaction through public forums and mentorship circles that foster recognition, shared purpose, and inclusive participation rather than unidirectional knowledge transfer (Daher-Armache et al. 2025). Emphasizing emotional intelligence, resilience, and diverse representation remains especially important in professional environments undergoing rapid technological and organizational change (Boston Consulting Group 2023; Bush 2025).

Several limitations should also be considered when interpreting these findings. The LMR dataset reflects a single keyword-based query collected within a defined window, capturing one configuration of leadership discourse rather than a stable or generalizable pattern. Betweenness centrality identifies bridging positions but reflects structural location within the communication graph rather than the content or reach of messages. More fundamentally, platform data are shaped by algorithmic curation, visibility dynamics, bot activity, performative engagement, and uneven participation. Observed ties such as retweets, mentions, and keyword co-occurrences should not be read as transparent indicators of leadership relationships since structurally identical interactions may reflect very different social processes. These constraints are integrated into the interpretation rather than merely noted: the low EFA factorability (KMO = 0.483) and the absence of a coherent *Idealized Influence* factor are interpreted as properties of a sparse, fragmented, platform-shaped environment, not as direct evidence about individual leadership behavior. Accordingly, the EFA is reported as exploratory and descriptive, and its factor structure should not be taken as a statistical validation of the four-dimensional TFL model. Finally, the study examines only Twitter, whose open, reply-oriented structure differs from platforms such as LinkedIn, YouTube, or closed professional communities. Future research could extend this work through longitudinal network analysis, closer examination of post content, and cross-platform comparisons.

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References

- Avolio, Bruce J., Surinder Kahai, and George E. Dodge. 2001. E-leadership: Implications for theory, research, and practice. *The Leadership Quarterly* 11: 615–68. [https://doi.org/10.1016/S1048-9843\(00\)00062-X](https://doi.org/10.1016/S1048-9843(00)00062-X).
- Bass, Bernard M. 1985. *Leadership and Performance Beyond Expectations*. New York: Free Press.
- Bass, Bernard M., and Bruce J. Avolio. 1990. Developing transformational leadership: 1992 and beyond. *Journal of European Industrial Training* 14: 21–27. <https://doi.org/10.1108/03090599010135122>.
- Bass, Bernard M., and Ronald E. Riggio. 2006. *Transformational Leadership*, 2nd ed. Mahwah: Lawrence Erlbaum Associates. <https://doi.org/10.4324/9781410617095>.
- Bataineh, Abdallah Q., Mohammad Alhur, Dhia Qasim, and Ahmed Shuhaiber. 2025. The role of emotional intelligence in enhancing organizational resilience: Examining the moderating impact of transformational leadership. *Problems and Perspectives in Management* 23: 79–94. [https://doi.org/10.21511/ppm.23\(3\).2025.07](https://doi.org/10.21511/ppm.23(3).2025.07).
- Blumer, Herbert. 1956. Sociological analysis and the “variable.” *American Sociological Review* 21: 683–90. <https://doi.org/10.2307/2088418>.
- Boston Consulting Group. 2023. *Amid Uncertainty: AI Gives Retailers a Path to Resilience*. Brighton: World Retail Congress. Available online: <https://www.bcg.com/publications/2023/improving-resilience-with-the-use-of-ai-in-retail> (accessed on 5 January 2026).
- Braun, Virginia, and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology* 3: 77–101. <https://doi.org/10.1191/1478088706qp063oa>.
- Burns, James MacGregor. 1978. *Leadership*. New York: Harper and Row.
- Bush, John A. 2025. Positive leadership and diversity, equity, and inclusion (DEI) initiatives: An integrative framework. *International Journal for Multidisciplinary Research* 7: 1–7. <https://doi.org/10.36948/ijfmr.2025.v07i02.39079>.
- Cooperman, Allison W., and Niels G. Waller. 2022. Heywood you go away! Examining causes, effects, and treatments for Heywood cases in exploratory factor analysis. *Psychological Methods* 27: 156–76. <https://doi.org/10.1037/met0000384>.
- Daher-Armache, Gaby, Joseph Armache, and Hala N. Ismail. 2025. Leadership development in U.S. higher education: Strategies for lifelong learning and upskilling. *Journal of Innovation & Knowledge* 10: 100754. <https://doi.org/10.1016/j.jik.2025.100754>.
- Deming, David J. 2017. The growing importance of social skills in the labor market. *The Quarterly Journal of Economics* 132: 1593–640. <https://doi.org/10.1093/qje/qjx022>.
- DeRue, Scott D., and Susan J. Ashford. 2017. Who will lead and who will follow? A social process of leadership identity construction in organizations. *Academy of Management Review* 35: 627–47. <https://doi.org/10.5465/amr.35.4.zok627>.
- Dubois, Elizabeth, and Devin Gaffney. 2014. The multiple facets of influence: Identifying political influentials and opinion leaders on Twitter. *American Behavioral Scientist* 58: 1260–77. <https://doi.org/10.1177/0002764214527088>.
- Ehlers, Ulf Daniel. 2020. Future skills and the future of higher education. In *Proceedings of the 2019 ICDE World Conference on Online Learning*. Edited by Mark Brown, Mairead Nic Giolla Mhichíl, Elaine Beirne and Eamon Costello. Dublin: Dublin City University, pp. 1–10. <https://doi.org/10.5281/zenodo.3804014>.
- Eitan, Tom, and Tal Gazit. 2025. Explaining transformational leadership in the digital age: The example of Facebook group leaders. *Technology in Society* 78: 102637. <https://doi.org/10.1016/j.techsoc.2024.102637>.
- Fairhurst, Gail, and David Grant. 2010. The social construction of leadership: A sailing guide. *Management Communication Quarterly* 24: 171–210. <https://doi.org/10.1177/0893318909359697>.
- Hall, Brian, Eric Lamarre, Rodney Levin, Jason T. Lorenz, and Paul Simon. 2024. Rewired and Running Ahead: Digital and AI Leaders Are Leaving the Rest Behind. *McKinsey Digital*, January 12. Available online: <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/rewired-and-running-ahead-digital-and-ai-leaders-are-leaving-the-rest-behind> (accessed on 5 January 2026).
- Hansen, Derek, Ben Shneiderman, Marc A. Smith, and Itai Himelboim. 2020. *Analyzing Social Media Networks with NodeXL: Insights from a Connected World*, 2nd ed. Cambridge, MA: Morgan Kaufmann.

- Himelboim, Itai, Guy Golan, Byeong-Yeon Moon, and Ryan Suto. 2014. A social networks approach to public relations on Twitter: Social mediators and mediated public relations. *Journal of Public Relations Research* 26: 359–79. <https://doi.org/10.1080/1062726X.2014.908724>.
- Jackson, Denise. 2010. An international profile of industry-relevant competencies and skill gaps in modern graduates. *International Journal of Management Education* 8: 29–58. <https://doi.org/10.3794/ijme.83.288>.
- Kim, Hyun-Mi, and Subhajyoti Chakraborty. 2024. Exploring the diffusion of digital fashion and influencers' social roles in the metaverse: An analysis of twitter hashtag networks. *Internet Research* 34: 107–28. <https://doi.org/10.1108/INTR-09-2022-0727>.
- Korejan, Mohammad Mahdi, and Hossein Shahbazi. 2016. An analysis of the transformational leadership theory. *Journal of Fundamental and Applied Sciences* 8: 452–61. <https://doi.org/10.4314/jfas.v8i3s.192>.
- Miles, Matthew B., A. Michael Huberman, and Johnny Saldaña. 2014. *Qualitative Data Analysis: A Methods Sourcebook*, 3rd ed. Thousand Oaks: Sage.
- Moldoveanu, Mihnea, and Das Narayandas. 2019. The future of leadership development. *Harvard Business Review* 97: 40–48.
- Nietzel, Michael. 2025. New Report: As Skills Gap Grows, Job Market for College Grads at 5-Year Low. *Forbes*, September 10. Available online: <https://www.forbes.com/sites/michaelt Nietzel/2025/09/10/new-report-as-skills-gap-grows-job-market-for-college-grads-at-5-year-low> (accessed on 5 January 2026).
- Olivares-De la Fuente, Pablo, Enrique Jiménez-García, and Óscar García-López. 2025. Twitter and YouTube as digital tools in higher education: A systematic review. *Frontiers in Education* 10: 1625803. <https://doi.org/10.3389/feduc.2025.1625803>.
- Skelly, Luke, and Nick Handrinos. 2023. 2023 Retail Industry Outlook: Embrace the Changing Consumer to Bolster Growth in Inflationary Times. *Deloitte*. Available online: <https://tinyurl.com/3m5fh7cp> (accessed on 5 January 2026).
- Smith, Marc, Lee Rainie, Ben Shneiderman, and Itai Himelboim. 2014. *Mapping Twitter Topic Networks: From Polarized Crowds to Community Clusters*. Wilmette: Pew Research Center. Available online: <https://www.pewresearch.org/internet/2014/02/20/mapping-twitter-topic-networks-from-polarized-crowds-to-community-clusters/> (accessed on 5 January 2026).
- Sons, Steve. 2016. Facilitating employee socialization through mentoring relationships. *Career Development International* 21: 554–70. <https://doi.org/10.1108/CDI-02-2016-0014>.
- Succi, Chiara, and Monica Canovi. 2020. Soft skills to enhance graduate employability: Comparing students' and employers' perceptions. *Studies in Higher Education* 45: 1834–47. <https://doi.org/10.1080/03075079.2019.1585420>.
- van Laar, Ester, Alexander J. van Deursen, Jan A. Van Dijk, and Jos De Haan. 2017. The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior* 72: 577–88. <https://doi.org/10.1016/j.chb.2017.03.010>.
- Wasserman, Stanley, and Katherine Faust. 2009. *Social Network Analysis: Methods and Applications*. Cambridge, UK: Cambridge University Press.
- Willems, Kim, Annelien Smolders, Malaika Brengman, Kris Luyten, and Jürgen Schonin. 2017. The path-to-purchase is paved with digital opportunities: An inventory of shopper-oriented retail technologies. *Technological Forecasting and Social Change* 124: 228–42. <https://doi.org/10.1016/j.techfore.2016.10.066>.
- Yaqub, Muhammad Z., and Abdoullah Alsabban. 2023. Knowledge sharing through social media platforms in the silicon age. *Sustainability* 15: 6765. <https://doi.org/10.3390/su15086765>.

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