http://dx.doi.org/10.18623/rvd.v23.

AI BIBLIOMETRIX 5.0 FOR CULTURAL FACTORS, ORGANISATIONAL, AND LEADERSHIP ON DIGITAL TRANSFORMATION AND EDUCATIONAL EFFICIENCY

AI BIBLIOMETRIX 5.0 PARA FATORES CULTURAIS, ORGANIZACIONAIS E DE LIDERANÇA NA TRANSFORMAÇÃO DIGITAL E EFICIÊNCIA EDUCACIONAL

Article received on: 11/4/2025
Article accepted on: 2/6/2026

Nguyen Phuong Nam*
* University of Labour and Social Affairs (Campus II) – Vietnam
namnp@ldxh.edu.vn

Bui Huy Khoi**
**Industrial University of Ho Chi Minh City, Vietnam
Orcid: https://orcid.org/0000-0002-4976-7435
buihuykhoi@iuh.edu.vn

The authors declare that there is no conflict of interest

Abstract
This study conducts a bibliometric analysis to examine the interconnected influences of cultural factors, organisational dynamics, and leadership capabilities on digital transformation and educational efficiency, drawing on a dataset generated with AI Bibliometrix 5.0 to map the field's intellectual landscape. The results show consistent growth in scientific production from 2016 to 2025, reflecting an increasing worldwide interest in digital transformation across multiple educational scenarios, with significant scientific output originating mainly from the USA, the UK, Australia, Indonesia, and China. Network co-occurrence and word-cloud map analyses demonstrate that research topics are increasingly converging on digital innovation, organisational readiness, leadership competencies, and cultural flexibility, emphasising how these factors together may determine successful transformative outcomes. Analysis of trend topics also reveals that digitalisation processes in education are highly influenced by institutional culture, the governance model, and leadership approach, which, in turn, impact the level of technology adoption and the institution's operational effectiveness. The thematic map and the factorial analysis evidence significant shifts from basic research on digital adoption toward more mature themes focused on organisational efficiency, strategic alignment, and performance enhancement. The bibliometric results confirm that cultural openness, organisational agility, and transformative leadership are interrelated factors that substantially contribute to the positive outcomes of the digital transformation and the

Resumo
Este estudo realiza uma análise bibliométrica para examinar as influências interligadas de fatores culturais, dinâmicas organizacionais e capacidades de liderança na transformação digital e na eficiência educacional, com base em um conjunto de dados gerado com o AI Bibliometrix 5.0 para mapear o panorama intelectual da área. Os resultados mostram um crescimento consistente na produção científica de 2016 a 2025, refletindo um interesse mundial crescente na transformação digital em vários cenários educacionais, com uma produção científica significativa originária principalmente dos EUA, Reino Unido, Austrália, Indonésia e China. Análises de coocorrência de rede e mapa de nuvem de palavras demonstram que os tópicos de pesquisa estão cada vez mais convergindo para inovação digital, prontidão organizacional, competências de liderança e flexibilidade cultural, enfatizando como esses fatores juntos podem determinar resultados transformadores bem-sucedidos. A análise dos tópicos de tendência também revela que os processos de digitalização na educação são altamente influenciados pela cultura institucional, pelo modelo de governança e pela abordagem de liderança, que, por sua vez, afetam o nível de adoção da tecnologia e a eficácia operacional da instituição. O mapa temático e a análise fatorial evidenciam mudanças significativas da pesquisa básica sobre adoção digital para temas mais maduros, focados na eficiência organizacional, alinhamento estratégico e melhoria de desempenho. Os resultados bibliométricos

potential to improve educational effectiveness. The paper makes a contribution through a systematic, data-based synthesis of research patterns and thematic trends, thereby paving the way for further empirical research and policy development in digitally supported education.

Keywords: Digital Transformation. Cultural Factors. Organisational Dynamics. Leadership. Educational Efficiency.

confirmam que a abertura cultural, a agilidade organizacional e a liderança transformadora são fatores inter-relacionados que contribuem substancialmente para os resultados positivos da transformação digital e o potencial de melhorar a eficácia educacional. O artigo contribui por meio de uma síntese sistemática e baseada em dados de padrões de pesquisa e tendências temáticas, abrindo caminho para novas pesquisas empíricas e desenvolvimento de políticas na educação apoiada digitalmente.

Palavras-chave: Transformação digital. fatores culturais. dinâmica organizacional. liderança. eficiência educacional.

1 INTRODUCTION

Digitisation has now become a strategic necessity for educational institutions, driven to raise the efficiency of education delivery itself, which means more flexible teaching styles, enhanced student experience, and more efficient operations through digitised processes and data-centric management. However, current studies reveal that the success of transformation is not largely dependent on the availability of technology, but on cultural alignment, organisational preparedness, and leadership capability, which affect the depth of implementation and its sustainability. In higher education, digital transformation is consistently presented as a comprehensive overhaul of institutional functions, pedagogies, and human development rather than a simple integration of tools, suggesting that efficiency gains are influenced by institutional ecosystems and preparedness. Consistent with this shift, bibliometric scholarship posits that Education 4.0 pathways reinforce "curriculum innovation practices" and digital literacy as critical enablers, understood as indicative of a shift from technology adoption to capability-oriented transformation (Sharma et al., 2025). From the perspective of developing the field, there are also other bibliometric "Core Information" measures, which signal that the research area is growing at a rapid pace and becoming conceptually diverse: the whole collection ranges from 2015 to 2026 and entails 414 documents from 317 sources, displaying an annual growth rate of 9.93%, indicating a more mature but still consolidating knowledge base. Therefore, applying a bibliometric method is timely to consolidate this evolving field by visualising the formation of themes, uncovering

influential patterns, and illuminating the theorisation of how culture–organisation–leadership configurations translate into educational efficiency.

On this ground, the cultural element is always theorised as the "soft infrastructure" that conditions reception, trust, and the daily performance of digital practices and experiences, shaping whether transformation trickles down to routine work (educational work) or not (Nottingham & Nottingham, 2025). Contributions on sustainable institutional cultures posit that digitally enabled change is more sustainable and capacity-enhancing when aligned with value systems that venerate responsibility, continuity, and long-term betterment over ephemeral digitisation (Genga & Babalola, 2025). In addition, cultural intelligence is emphasised as more important than ever for higher education leaders in multicultural, post-pandemic settings, as remote work and digitalisation require building legitimacy, engagement, and culturally responsive coordination (Du Plessis et al., 2025). However, culture is not enough: organisational theory tells us that efficiency gains arise when organisations mobilise organisational readiness, integrated governance, and strategic implementation capacity (Alvarez Toro-Moreno, 2025). Evidence-based research from higher education settings reveals ongoing institutional obstacles to translating digital projects into routine process and performance enhancements, including accessibility and affordability, task–technology fit, and psychologically embedded practices (Goarty & Gupta, 2025). System-based evidence also shows that organisational factors largely determine the effective utilisation of multifaceted performance outcomes in smart campus projects, highlighting the importance of institutional readiness in shaping efficiency and sustainability. (Blakong et al., 2025). Furthermore, workflows in both conceptual and policy-related work in digital universities suggest that success in transformation requires balancing leadership capacity, providing a trustworthy infrastructure, developing innovative teaching, and engaging in continuous qualification development—all aspects encapsulated in organisational capability for efficiency (Zhukabayeva et al., 2025). Collectively, these studies provide strong support for the argument that cultural openness and legitimacy foster empowerment, that organisational capability enables implementation, and that it is the interaction of these that determines whether digital transformation leads to quantifiable improvements in educational efficiency (Genga & Babalola, 2025; Goarty & Gupta, 2025).

Throughout the data, leadership is the major integrator that aligns cultural readiness with organisational resources and governance, and maintains momentum for transformation in the face of uncertainty (Kalra et al., 2025). Leadership Distilled, through a series of related but diverging constructs, digital leadership, distributed leadership, trust-based leadership, and human-centred leadership, foregrounds leaders' involvement in capacity building, communication, and the ethical consideration of technology-intensive change (Akbari et al., 2025; Laufer et al., 2025). There is evidence in higher education that digital leadership has a positive impact on teachers' ICT competence, and that this effect is partially mediated by organisational commitment, suggesting that leadership influences effectiveness by facilitating the human capacity and motivational congruence needed for quality implementation (Liao & Ismail, 2025). From the perspective of the strategic framework, human-centred design-integrated leadership development is articulated as a viable approach to mitigating resistance, fragmentation, and misalignment, without which these factors dilute the velocity of return on digital investments (Khajoueinejad et al., 2025). Outside of education-only contexts, research on education and training organisations found that organisational digital capability facilitates innovation through cognitive flexibility, and that this nexus is enhanced by empowering leadership, highlighting the importance of leadership in translating digital capability into performance outcomes (Fan & Yang, 2026). Notably, the literature also chronicles enduring barriers, funding limitations, resistance to change, and gaps in skills that need leadership-led- led investment in training, governance, and change management if gains in efficiency are to be safeguarded and transformation sustained (Pandey et al., 2026; Goarty & Gupta, 2025). Hence, this is the current human-based study, intended to strengthen the field by illustrating how cultural issues, organisational determinants, and leadership mechanisms co-evolved in the literature, and by analysing leading thematic trajectories and outstanding issues in explaining how digital transformation generates educational efficiency (Sharma et al., 2025; Yanti et al., 2025).

2 METHODOLOGY

This article applies a bibliometric research design to provide a systematic synthesis and mapping of the scholarly terrain on cultural aspects, organisational

conditions, and leadership regarding digitalisation and educational effectiveness. Bibliometric tools are becoming increasingly important in rapidly growing fields that span interdisciplinary areas such as education, management, and digital technologies, where narrative reviews may be less reliable and prone to selective interpretation (Sharma et al., 2025). The features of this dataset (414 documents published from 2015 to 2026 across 317 sources, with an average annual growth rate of 9.93%) validate this as a growing research domain, calling for a systematic mapping of cluster-based thematic patterns and conceptual linkages to capture structural research patterns in this domain (Nam 2026.csv). Recent bibliometric papers on digitalisation and education also argue for the usefulness of co-word mapping, keyword co-occurrence, and theme evolution approaches to detect clusters related to digital literacy, Education 4.0, innovative behaviour, and leadership-led transformation dynamics (Yanti et al., 2025; Blakong et al., 2025).

The bibliometric procedure in this paper consisted of four staged processes: (1) defining the boundaries of the dataset, (2) pre-processing, (3) analysing the performance of the clusters, and (4) science mapping. Dataset delineation initially focused on studies of digital transformation in education and neighbouring organisational systems, including research on cultural factors (e.g., digital culture, cultural intelligence, and inclusivity) (Du Plessis et al., 2025; Yanti et al., 2025). Related to this, organisational terms were searched for alongside readiness, governance, competence gaps, and barriers, in line with findings indicating that organisational barriers pose substantial obstacles to digital transformation (Goarty & Gupta, 2025). Constructs of leadership were also included, including digital leadership, empowering leadership, and human-centred leadership, in line with research indicating that leadership influences capability development, commitment, and adoption behaviours (Liao & Ismail, 2025; Khajoueinejad et al., 2025).

Next, we performed data cleaning to avoid the fragmentation of author names, keywords, and source titles. This step was necessary because naming variations (e.g., “digital leadership” vs. “leadership,” “ICT competence” vs. “digital competence”) may affect keyword co-occurrence and thematic clustering (Sharma et al., 2025). Third, a performance analysis of publications, active authors, and source journals was conducted to assess publication patterns and journal prominence, in line with bibliometric best practices to recognise (mature) knowledge domains and patterns of research

concentration in a given field (Yanti et al., 2025). Finally, we applied science-mapping methods (co-word structuring, thematic mapping, and cluster interpretation) to analyse how culture, organisation, and leadership relate to digital transformation solutions in this literature. Cultural processes were found in studies on digital culture change and cultural intelligence (Du Plessis et al., 2025); organisational processes were demonstrated through models of readiness and barriers to change (Goarty & Gupta, 2025; Zhukabayeva et al., 2025); and leadership processes were consistent with concepts of digital leadership capability, empowering leadership, and human-centred models (Fan & Yang, 2026; Khajoueinejad et al., 2025). These mapping outcomes reflect empirical pathways across the dataset, such as leadership positively predicting ICT competence via organisational commitment (Liao & Ismail, 2025).

Performance profiling and science mapping facilitate the presentation of a replicable evidence-based narrative on how cultural, organisational and leadership factors operate as antecedents and mechanisms in the digital transformation and educational efficiency literature. This dual procedure resonates with Q1 methodological requirements for analytical transparency, theoretical breadth, and conceptual clarification through the network-based structure and cross-cluster interpretation (Sharma et al., 2025; Yanti et al., 2025). Moreover, focusing on 2025–2026 literature reinforces the immediacy of interpretation, since the most recent research identifies organisational obstacles (Goarty & Gupta, 2025), cultural intelligence in leadership (Du Plessis et al., 2025), digital leadership impacts (Liao & Ismail, 2025), and burgeoning system-level frameworks for digital universities (Zhukabayeva et al., 2025). As such, this study, using a bibliometric technique, provides an integrated, data-derived understanding of the contributions of cultural, organisational, and leadership constructs in shaping educational efficiency in a digital transformation context.

3 PRISMA

In a PRISMA-style logic, the bibliometric dataset was processed through a stepwise selection to improve transparency and replicability. Records were then scanned from the full bibliographic export for 2015-2026 (414 documents, 317 sources), revealing the current trend of expansion in research on digital transformation in education. In the

screening phase, duplicate or fragmented records (e.g., different spellings of authors' names and keywords) were homogenised to avoid biasing co-word and theme analyses. Then a title/abstract eligibility screening was performed to select those articles which explicitly focused on at least one dimension of the triad of interest culture (e.g., digital culture change; cultural intelligence), organisation (e.g., readiness, governance, barriers), and leadership (e.g., digital leadership, empowering leadership, human-centred leadership) within the scope of digital transformation and education-related performance or efficacy indicators. Finally, the resultant set was tested to make sure that central current strands were apparent within the dataset, e.g. digital culture and cultural intelligence in higher education leadership; organisational barriers and readiness conditions; and leadership strategies that foster capacity and commitment (such as leadership → organisational commitment → ICT competence), trusted to be thematically relevant.

Table 1

Data Extraction Schema

Extraction unit	Field extracted	Operational definition	Primary bibliometric use
Document metadata	Authors; Year; Title; Source title; Document type	Identifies publication outputs and classifies evidence (e.g., article, review, book chapter) for descriptive profiling.	Performance analysis (productivity; source dispersion)
Impact/visibility	Cited by (citations)	Used to contextualise influential documents descriptively (not interpreted as causal impact).	Performance analysis (impact profiling)
Traceability	DOI; EID/Link	Enables verification, record-level traceability, and supports de-duplication/auditability.	Data cleaning + auditability
Conceptual content	Abstract	Supports eligibility screening and qualitative interpretation of clusters/themes.	Eligibility screening + interpretation
Author keywords	Author Keywords (DE)	Captures author-intended topical framing for co-word and thematic analyses.	Co-word analysis; thematic evolution
Index terms	Index Keywords / Keywords Plus (ID)	Provides database-assigned terms to broaden conceptual coverage and support robustness checks.	Co-word analysis; robustness checks
Contextual metadata	Affiliations; Countries (derived from affiliations)	Profiles geographic contributions and institutional contexts; supports country-level output and collaboration views.	Country productivity + collaboration (descriptive)
Collaboration	Co-authors per doc; International co-authorship %	Summarises co-authorship intensity and internationalisation patterns.	Performance analysis (collaboration)

Thematic coding (analytic)	Culture / Organisation / Leadership tags (derived)	Derived tags created from keyword/abstract signals to categorise records into culture, organisation, and leadership lenses for interpretation.	Thematic clustering + interpretation

Source: Scopus

3.1 Sample size

Figure 1

Main Information

Source: AI Bibliometrix 5.0.

Figure 1 reveals a growing, complex, tightly linked network of research connecting cultural, organisational, and leadership aspects with digital transformation and educational efficacy, based on a corpus spanning 2015–2026. The dataset comprises 414 documents from 317 sources (journals, books, and similar outlets), reflecting both a disciplinary spread and an expanding publishing ecosystem for research on digitally enabled education. Growing signs of thriving suggest a surge of scholarly interest, with an Annual Growth Rate of 9.93%, indicating that the culture–organisation–leadership triad is gaining recognition as core to understanding why digital initiatives translate (or fail to translate) into efficiency gains. The corpus is quite recent (mean document age: 2.79 years), suggesting that theoretical integration and evidence consolidation are evolving and that conceptual debates about cultural readiness, organisational agility, and leadership capability remain highly relevant. The impact, while moderate (8.167 citations per document), is significant, consistent with a forming core literature that serves as a

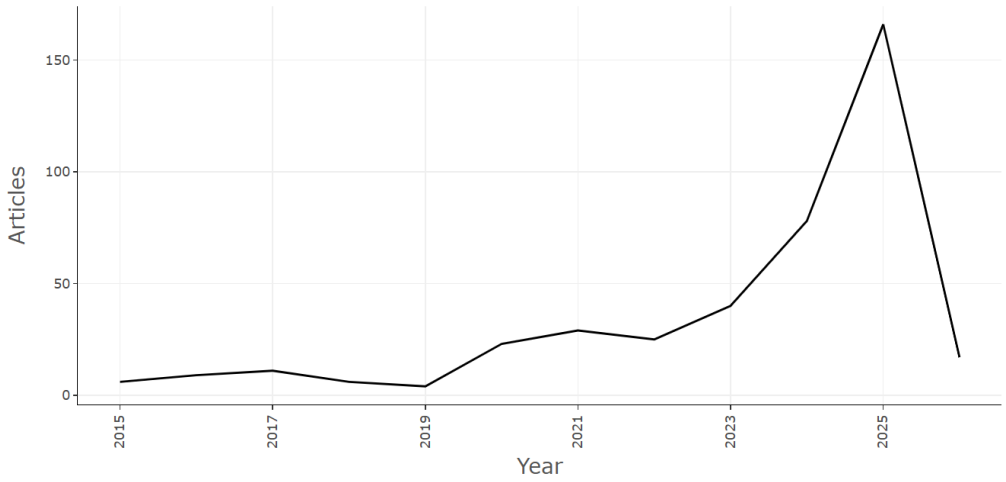
pivot for further studies on performance, productivity, and quality outcomes in education. Substantial content richness is observed (2,247 Keywords Plus and 1,391 Author Keywords), indicating thematic variety and a more detailed framing of problems related to culture, governance, capability development, and leadership practices in transformation projects. Authorship analysis reveals high collaboration: 1,593 authors, none of the documents single-authored, and an average of 7.06 co-authors per document. These findings indicate the field's interdisciplinarity and the methodological difficulty of associating "soft" determinants with efficiency outcomes. Cross-border knowledge exchange is further substantiated (25.12% international co-authorships), consistent with the inherently comparative and contextual nature of culture in digital transformation pathways. Publication types are mainly articles (220) and conference papers (87), along with book chapters (56) and reviews (24), showing both frontier exploration and early-stage synthesis; however, the reported References = 0 may reflect an export/metadata limitation and should be verified prior to undertaking reference-based analyses (Aria & Cuccurullo, 2017).

4 RESULTS

4.1 Annual scientific production

Figure 2

Publications by year, 2016–2025



Source: AI Bibliometrix 5.0

Figure 2 shows a clear pattern of maturity in the literature on the joint influence of culture, institutional context, and leadership on the digitalisation of educational institutions. The number of publications is still relatively small during the years 2015–2019 (6, 9, 11, 6, and 4 articles, respectively), marking a period of early conceptualisation and the first empirical investigation of digitally facilitated change in educational contexts. There is a sharp inflexion in 2020 with 23 articles and further consolidation in 2021–2023 (29, 25, and 40 articles respectively), which suggests that the field starts to systematise explanations that go beyond technology adoption by presenting culture as enabling constraint, organisational structures as implementation infrastructure and leadership as the coordinating mechanism that aligns strategy, people and digital capability. The growth is even more salient in 2024 (78 articles) and culminate in 2025 (166 articles), signaling a trend-phase in which more scholars raise questions about how culturally ingrained norms (e.g., openness to innovation), organizational readiness (e.g., agility, resourcing, governance), and leadership skills (e.g., transformational and digital leadership) mediate digital efforts into tangible efficiency outputs such as process-optimization, service quality, and learning performance. The smaller number for 2026 (17 articles) is most likely due to the indexing of an incomplete year rather than a declining trend and, as such, should be interpreted with caution in comparisons over time. Taken as a whole, the sharp post-2020 growth trend clearly points to an intensifying research agenda, with culture–organisation–leadership interactions ever more firmly established as the key route by which digital transformation generates sustainable improvements in educational efficiency.

4.2 Countries' scientific production

Figure 3

Trend Topics

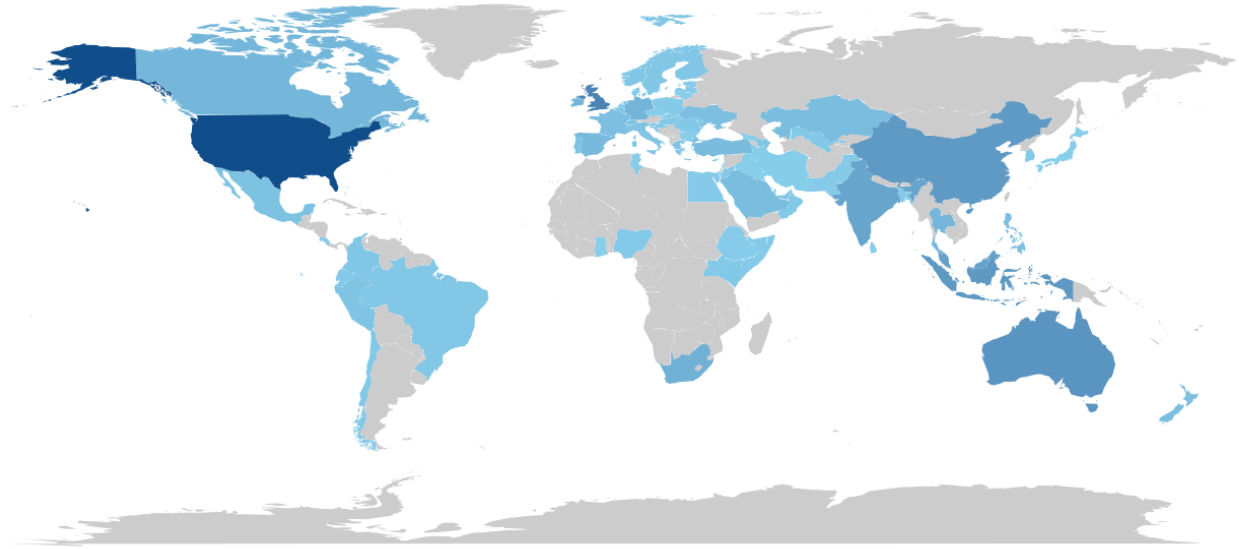


Table 2

Countries' Scientific Production

Country	Freq	Country	Freq
USA	183	MALAYSIA	61
UK	104	INDIA	56
AUSTRALIA	80	SOUTH AFRICA	40
INDONESIA	73	GERMANY	36
CHINA	71	IRELAND	33

Source: AI Bibliometrix 5.0

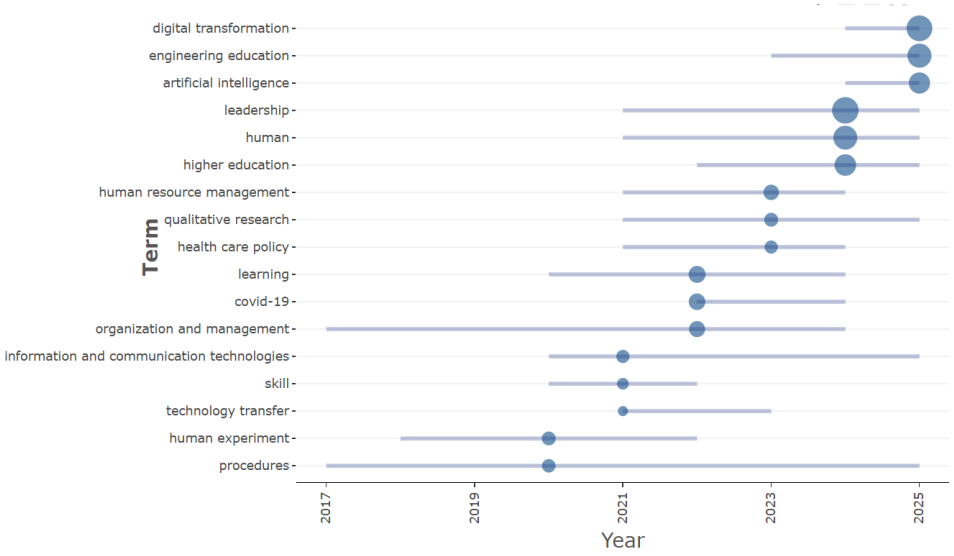
The countries' profiles in scientific production reveal a national specialisation in relevant, policy-applicable knowledge on how cultural elements, organisational structure, and leadership influence digitalisation and educational performance, with research leadership concentrated in a handful of systems at the high end of a long tail of emerging contributors. The USA leads the field (183 publications), followed by the UK (104) and Australia (80); these form a core Anglo-Saxon hub where electronically mediated educational reform is often theorised in terms of organisational capacity, governance, and the efficacy of leadership. A robust second tier for Indonesia (73), China (71), Malaysia

(61), and India (56) replicates the emerging hybridity of Asia-centric scholarship, echoing contexts of intersecting large-scale digitisation initiatives and culturally embedded social norms (e.g., collectivism, hierarchy, uncertainty tolerance) in institutional arrangements that simultaneously obstruct and demand organisational flexibility and adaptive leadership to achieve scalable efficiency gains. With additional stepped contributions from South Africa (40), Germany (36), and Ireland (33) strengthening the imprint, the direction of the research agenda is quite clear: it is not tethered to a particular development path; rather, it reflects the way good leadership practices, organisational readiness, and cultures that are receptive to change co-create the quality of implementation and subsequently performance outcomes. Together, the distribution reflects a field that may be growing more comparative in its geographic orientation: core high-output countries are quite likely to set dominant conceptual and measurement frames within which rapidly emerging contributors bring increased coverage of empirical contexts, thereby greatly increasing the number of case studies through which to better understand how culture shapes organisational transformation and how leadership facilitates the translation of digital investments into educational efficiency in Table 2 and Figure 3.

4.3 Trend topics

Figure 4

Trend Topics



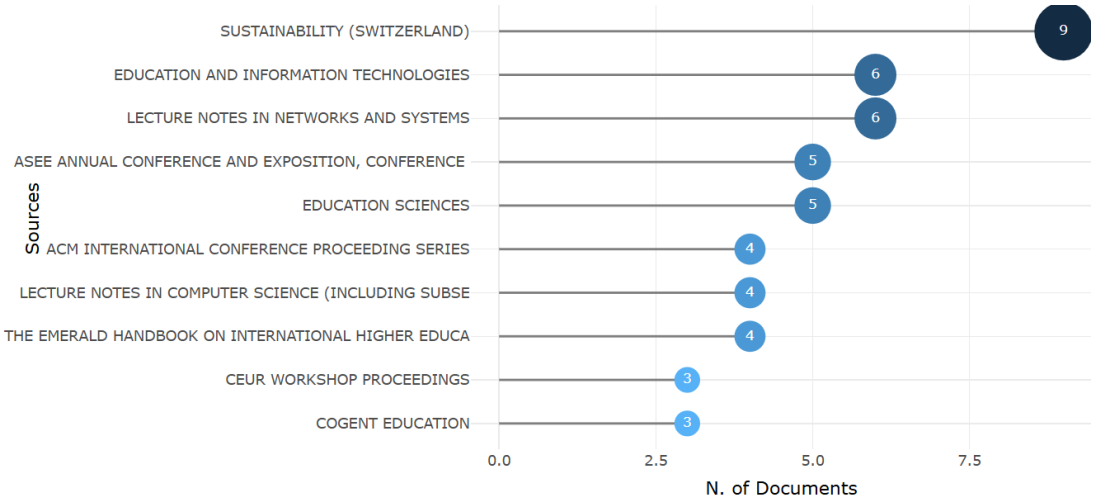
Source: AI Bibliometrix 5.0

Trend-topic analysis, as visualised through the time-encoded bubble plot, indicates a clear thematic progression in the literature connecting cultural factors, organisational dynamics, and leadership to digital transformation and educational efficiency. Initial streams of signals focus more on operational and procedural streams (e.g., procedures and human experiments) and slowly transition toward capability-building concerns (e.g., technology transfer and skill), suggesting an Initial focus on technological deployment and competence building prior to a broader institutional transformation that becomes salient. Moving later in time, the focus in the agenda comes to be defined in terms of socio-organisational framing, with information and communication technologies as well as organisation and management as the core themes continuing as main topics, representing a continuous concern with governance mechanisms, institutional (re)alignment and organisational process redesign deemed necessary for turning digital investments into efficiency gains. A mid-period surge of COVID-19 and learning underscores this shock-driven acceleration of digital adoption, as seemingly stimulated research focuses on system resilience and scalable digital delivery models. In the more recent phase, more abstract constructs leadership, higher education, human resource management, and qualitative research become prominent, indicating a sophistication of the field toward understanding "why" and "how" transformation is successful: leadership is conceptualized as the coordination mechanism that harmonizes organizational preparedness with culturally embedded norms (e.g., openness to innovation, trust, and change orientation), HRM and qualitative research denote further interrogation of people-centred barriers and enablers of implementation. The emergence and reinforcement of artificial intelligence alongside digital transformation in recent years indicate a new mode of transformation from digitisation to intelligent transformation, in which cultural flexibility, organisational agility, and digitally proficient leadership are increasingly seen as the critical path for advanced technologies to translate into sustainable gains in educational effectiveness (Figure 4).

4.4 Most relevant sources

Figure 5

Most Relevant Sources



Source: AI Bibliometrix 5.0

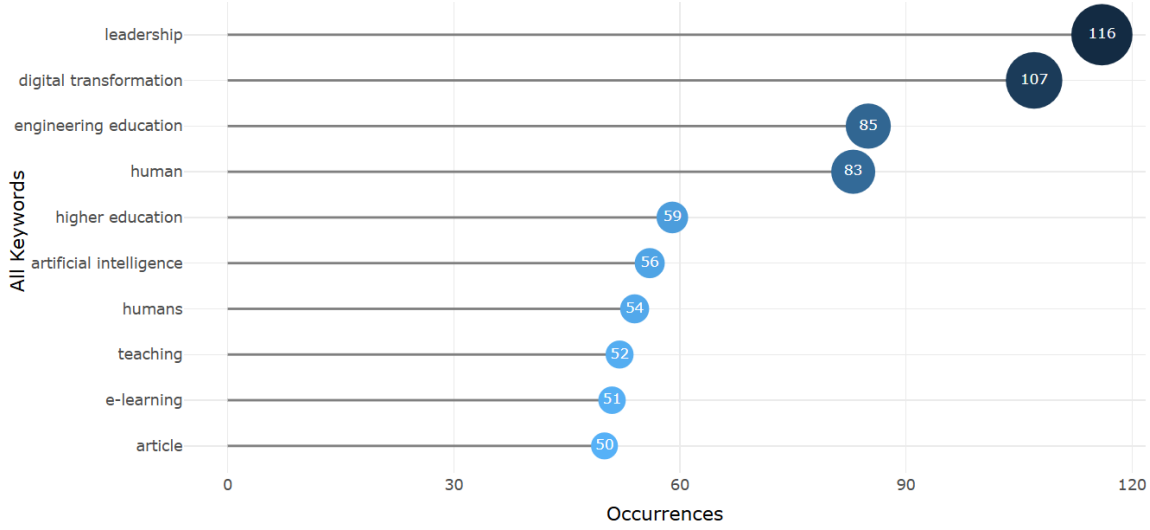
The Most Relevant Sources pattern indicates that scholarship on cultural factors, organisational conditions, and leadership in relation to digital transformation and educational efficiency is anchored in a deliberately cross-disciplinary publication ecology spanning sustainability-oriented outlets, education-technology journals, and computer-science/engineering conference proceedings. The top publisher, Sustainability (Switzerland) (9 documents), with a significant margin from the second, hints at a digital transformation in education that is gradually being viewed through a systems perspective that links organisational governance, cultural adaptability and leadership capability to wider performance and sustainability expectations, such as resilience and long-term institutional value generation. The prevalence of Education and Information Technologies (6) and Lecture Notes in Networks and Systems (6) points to a solid foundation of methodology and technology underpinning the persistent concern in the infrastructures, digital platforms and socio-technical mechanisms of implementation to support the enhancement of efficiency in both educational delivery and administration. The visibility of ASEE Annual Conference and Exposition (5) and Education Sciences (5) once again suggests a strand of applied, practice-oriented research in which leadership strategies, capacity building for organisational change and culturally rooted pedagogical

routines are investigated in the context of both professional and tertiary education. A secondary tier of sources, ACM International Conference Proceedings Series (4), Lecture Notes in Computer Science (4), and CEUR Workshop Proceedings (3) illustrates the field's rapid-cycle innovation venue, which includes early-stage discussions of emergent digital tools (such as data-driven and AI-enabled methods) alongside barriers to adoption, change management, and capability development. And, an integrative scholarly outlet like The Emerald Handbook on International Higher Education (4) and a broad education journal like Cogent Education (3) highlight the comparative, contextual sensitivity of the agenda: cultural difference and leadership paradigms are not background conditions, rather they are treatable as explanatory mechanisms of first order that shape whether organisational preparedness converges with digital initiatives in order to realise sustained enhancements in educational efficiency (Figure 5).

4.5 Keyword data visualisation

Figure 6

Most Frequent Words



Source: AI Bibliometrix 5.0

The Most Frequent Words profile provides a concise bibliometric signal of the field's conceptual "centre of gravity" and clearly positions leadership and digital transformation as the dominant organising lenses through which educational efficiency is

examined. Among these two most common terms (counts in brackets), “leadership” (116) and “digital transformation” (107) show that the literature is increasingly discussing transformation outcomes to be more dependent on leadership agency than on technology adoption alone. “engineering education” (85), “higher education” (59), “teaching” (52), and “e-learning” (51) are also strongly co-present, indicating that a great bulk of the empirical focus lies in higher/technical education settings, where the pressures for efficiency (scale, quality assurance, resource optimization) are most intense, and can be tested and verified through digitally-mediated delivery and management systems. The high prominence of “artificial intelligence” (56) and related terms (e.g. “machine learning”) indicates a move beyond digitisation towards intelligent transformation, suggesting that cultural readiness (trust, openness to innovation, ethics) and organisational capability (data governance, infrastructure, skills) are increasingly pivotal factors determining whether AI-enabled undertakings lead to increased efficiency or generate novel risks. “decision making” (37), “organization and management” (20), “human resource management” (17), and “professional development” (18) also strongly reflect that organizational mechanisms – here technical ones such as decision making, resource dependency relationships, as well as broader issues of professional development – play a significant role in how and why digital technologies transform organizational life, and that considerations of strategic alignments, capability development, and workforce redesign are the preferred explanatory framing through which efficiency dividends are now reproduced in digital change. Cultural and value-defined aspects manifest through “organisational culture”, “digital culture”, “ethical technology” (14), “sustainability” (13), and “digital divide” (9), insinuating that norms, equity, and ethics are seen as boundary conditions that confine adoption quality and performance outcomes. Finally, the pattern “covid-19” (22) captures the shock-induced acceleration of digital transformation research, reinforcing a current agenda that centres on exploring how leadership and organisational readiness within cultural environments facilitate the translation of rapid digitalisation into sustained educational efficiency (Figure 6).

Figure 7

WordCloud

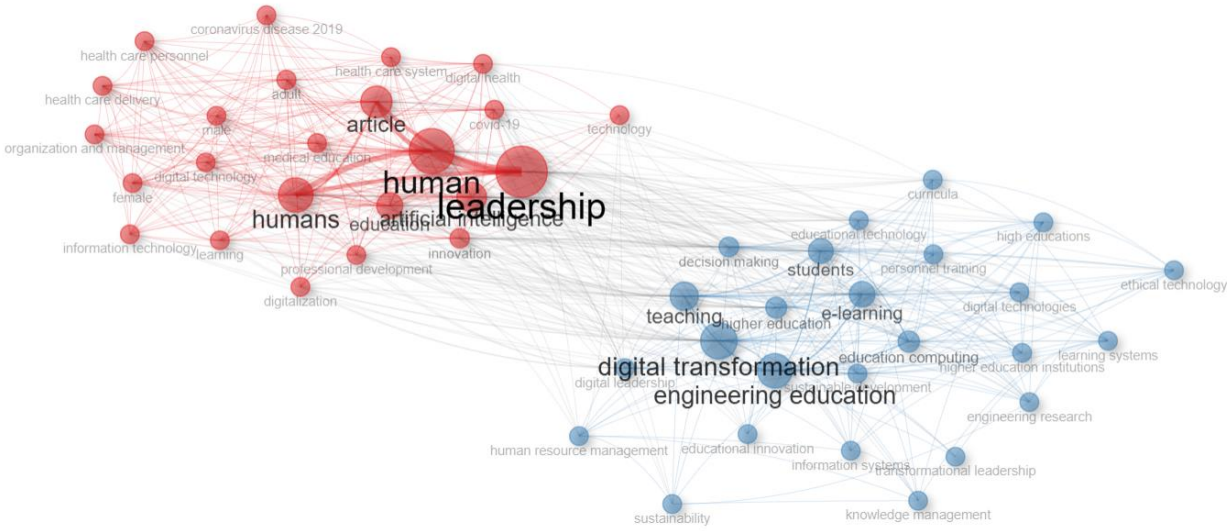
Source: AI Bibliometrix 5.0

The word cloud visually compresses the field of intellectual attention into a well-bracketed triad of digital transformation, leadership, and the education system, suggesting that efficiency in education is mainly theorised as a socio-technical, rather than merely a technical, end. The most/fewest prominent words (such as “leadership” and “digital transformation”) illustrate that the research focus is on leadership agency as the means to legitimise, coordinate, and sustain digital initiatives within and across institutions. The visibility of engineering education, higher education, teaching, and e-learning reflects a view that the empirical heartland of the literature relevant to these two articles was found in higher or technical education, where pressures for efficiency were enacted through digitally mediated delivery, assessment, and administration. In addition, the prominence of “artificial intelligence” and similar digital-technology keywords points to a continuing thematic transition from digitisation to intelligent transformation, with a growing reliance on data-driven infrastructures for decision-making and the potential to integrate AI in an ethical and viable manner to realise efficiency improvements. Organisational influences are apparent in the bisociation of managerial terminology , such as decision making, organisation and management, human resource management, and professional development, suggesting that organisational readiness (governance, skills systems,

resourcing, and change management routines) is conceptualised as the operational substrate that enables leadership vision to be realised in producible effectiveness results. These cultural and normative aspects are represented by implication but nevertheless thematised in the language of values and limits of acceptable behaviour through such gift-related concepts as “organisational culture”, “digital culture”, “ethical technology”, “sustainability”, and “digital divide” indicating that the values of openness, trust, equity and ethics are what help frame the quality and inclusiveness of the impacts of transformation. Finally, “COVID-19” underscores the shock-induced acceleration of digital change, and the persistence of leadership and organisational discourses suggests an established understanding of sustainable educational effectiveness as contingent upon culturally congruent leadership that facilitates organisational development through engagement with digital innovation (Figure 7).

Figure 8

Co-occurrence Network



Source: AI Bibliometrix 5.0

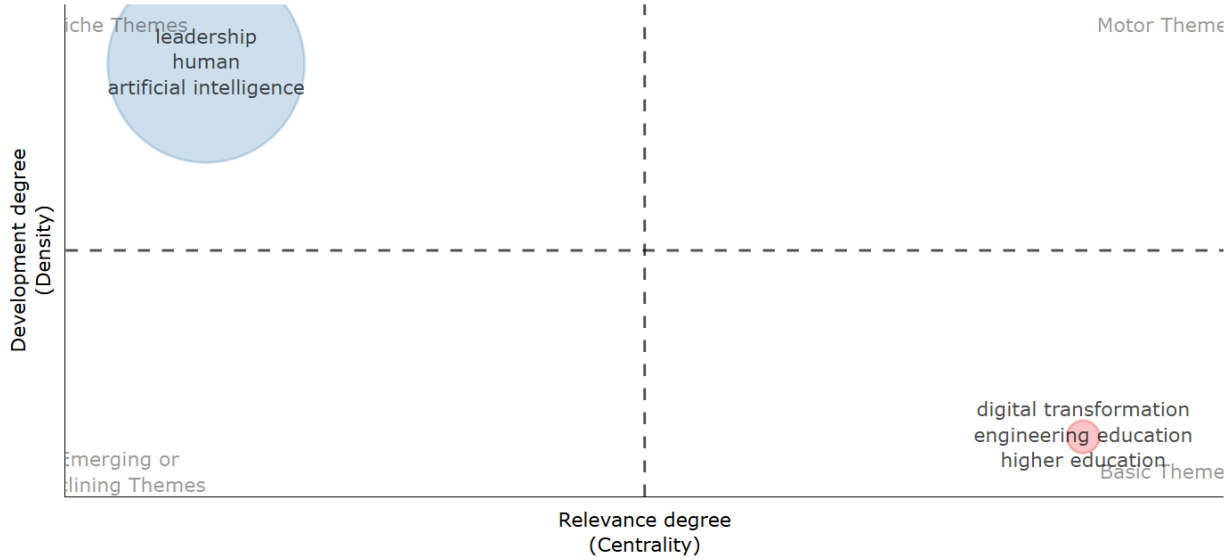
Figure 8 illustrates the co-word network reveals a two-cluster intellectual structure in which leadership and digital transformation operate as dominant bridging concepts that connect cultural–organisational determinants to educational efficiency outcomes. Cluster 1 is centred on “leadership”, which exhibits the highest structural brokerage (betweenness = 131.558) and centrality (closeness = 0.019; PageRank = 0.067), suggesting that

leadership serves as the main integrative mechanism for coordinating disparate topics within the knowledge base. In this cluster, “artificial intelligence” also has a strong intermediary power (betweenness = 70.238; closeness = 0.019), which can be read from the field an evolving view of efficiency enhancement as depending on leaders’ ability to lead in an era of AI-enabled change, to build trust, and to bridge ethical norms and institutional practice, an implicit cultural route. The prominence of “human/humans” (e.g., PageRank = 0.059 for “human”) reflects a human-focused perspective and reiterates that digital transformation in education is seen as a sociotechnical change influenced by behaviours, values and preparedness more than by physical infrastructure. Cluster 2 is structured around “digital transformation” (betweenness = 105.291; closeness = 0.019; PageRank = 0.044) and is highly integrated with application domain such as “engineering education” (betweenness = 40.613), “teaching” (31.098), “e-learning” (19.115), “students” (19.139), and “decision making” (18.021), showing that efficiency is defined within the frameworks of digitally driven pedagogies, learning platforms, and management decision making. 6 Already at this point in time, with the inclusion of “organisation and management”, “human resource management” and “professional development” (although with less brokerage), organisation capability building can be interpreted as the enabling base that renders leadership purpose into scalable transformation and measurable efficiency gains. The network as a whole agrees with the inference that educational efficiency is most consistently manifested when culturally attuned leadership orchestrates the organisation's readiness (both internal and external) to assimilate digital technologies (now escalating to AI-enabled) in teaching/learning as well as in governing and performing routine tasks.

4.6 Theme map

Figure 9

Thematic Map



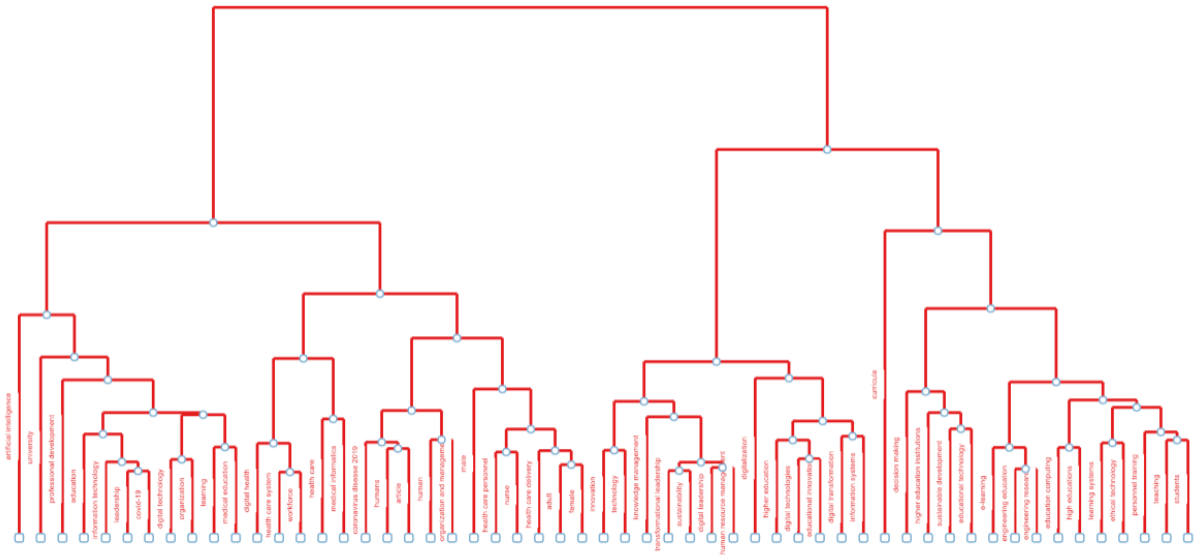
Source: AI Bibliometrix 5.0

Based on Figure 9, the thematic map indicates a field structured around a clear division between high-centrality foundational themes and high-density specialised themes, offering a coherent bibliometric explanation of how cultural, organisational, and leadership drivers shape digital transformation and educational efficiency. In the basic theme (high centrality and low density) the cluster named digital transformation, higher education and engineering education constitutes the conceptual core of the field, signalling that the majority of the research bases its claims on the mainstream educational contexts in which transformation is assessed by means of incremental teaching, learning, and administrative performance enhancements. This renders a more "collective restaging" of the signals from the broader corpus 'digital transformation' and higher-education related terms, both persist prominently amongst the keyword landscape , distilling them as reference points for the cumulative construction of knowledge. In contrast, a niche-theme cluster (more dense, less central) clusters around leadership, human, and artificial intelligence, indicating a somewhat niche yet mature stream exploring people-centred and AI-enabled change through leadership agency, ethics, trust,

and behavioural readiness – aspects highly related to cultural alignment and change acceptance. This is exemplified by leadership and artificial intelligence, which emerged as high-bridging terms with very high centrality in the co-word network, establishing them as umbrella terms connecting diverse topics, even when considered as specialised themes. Significantly, the discernible lack of "motor themes" would indicate that integrative, highly central and highly developed theoretical constructs are yet to be can be developed for suggesting a worthwhile research pursuit while future research can further contribute to the field by tracing explicitly the interplay between culture (norms, openness, trust) and organisation resources (governance, HR development, decision routines) with leadership to turn digital transformation into sustained educational efficiency gains.

Figure 10

Factorial Analysis



Source: AI Bibliometrix 5.0

The factorial co-word analysis (words x cluster) provides a geometric representation of how the literature conceptualises the balancing relationship among cultural dimensions, organisational context, and leadership in the sense-making of digital transformation and learning effectiveness, by mapping the most frequent words onto two latent dimensions (Dim1–Dim2). A distinctly strong education–technology–application

grouping emerges clearly towards the positive end of Dim2 with such words as curricula (Dim2 = 2.56), education computing(1.98), students(1.70), learning systems (1.65), teaching(1.62), and e-learning(1.31) grouped tightly indicating that digital efficiency is perhaps most often operationalized in terms of digitally mediated pedagogy, curriculum redesign and platform facilitated learning-workflows. Along this same developmental axis, engineering education (1.19) and engineering research (1.15) reaffirm that a good deal of the field's discursive concern with measurable performance is situated within higher/technical education, where notions of scalable delivery and competency-based redesign are particularly prominent. In contrast, the terms on the negative side of Dim1 are related to terms about humans rather than machines, and about governance more than organization: human (Dim1 = −1.74), humans (−2.12), leadership (−1.04), organization & management (−1.85), and information technology (−1. 04) implying a line of interpretation that views transformation as a process of socio-cultural and organizational change influenced by norms, behaviours, and the coordination of managers and not simply a change process dictated by tools. "Artificial intelligence" (Dim2 = 0.59; Dim1 = −0.62) was located between the human/leadership and education–implementation groupings, highlighting its bridging role: AI is presented as a technological (instructional/operational) enabler and as a cultural–ethical challenge that leaders must manage to establish trust, lead adoption, and manage risk. Meanwhile, digital transformation (0.32; 0.15) and university (0.34; −0.18) are located in the middle of the conceptual space, indicating that these have links which bridge organisational readiness (e.g. knowledge management: 0.59; −0.37) and leadership types (e.g. transformational leadership: 0.38; −0.57; digital leadership: 0.28; −0.53) with discussions of educational performance. The two factors, in general, indicate that educational governance is most consistently theorised when (a) within the context of implementation/learning-system design and (b) within the context of people–culture–organisation governance, with leadership as the mediating agency that brings together cultural acceptance and organisational capability to facilitate educational transformation results (Figure 10).

5 DISCUSSION

The AI Bibliometrix results suggest that research on culture, organisation, and

leadership in digital transformation has experienced a strong upward trend, with a growing number of outputs since 2020 and a predicted peak in 2025. Such a surge is in line with the field progressing beyond technology-adoption storylines towards explanations that focus on socio-technical alignment, particularly with respect to how leadership, organisational readiness, and culturally grounded acceptance influence whether digital initiatives in education systems produce observable efficiency gains. To be clear, the smaller 2026 tally should be viewed as the effect of annualised indexing, not as indicative of a meaningful decrease.

The first interpretive contribution of the bibliometric patterns is the unambiguous centrality of leadership and digital transformation in the conceptual nucleus. “Leadership” and “digital transformation” are notably the most common patterns , and the co-word network indicates that leadership is the greatest broker among transversing topics. This is in line with recent studies demonstrating that digital leadership affects transformation outcomes along human-capability pathways, for instance, enhancing ICT capability through organisational commitment (Liao & Ismail, 2025). Accordingly, the bibliometric map substantiates prior assertions that leadership is not simply a contextual factor but a strategy, capacity-building, and implementation-fidelity moderating mechanism.

Parallel to this insight is the observation that organisational conditions matter for the functioning of the efficiency locus. The trending topics shift to “organisation and management,” “human resource management,” and “decision making,” revealing that the field increasingly views efficiency as resulting from governance, resource reallocation, and the development of platform capabilities through platform acquisition. This pathway is consistent with qualitative work demonstrating that confusion about mission and purpose, cost barriers, and taker resistance are among the most persistent barriers to change in higher education (Goarty & Gupta, 2025). Systems-level research on smart campuses similarly alerts us to the importance of organisational readiness in predicting performance outcomes and thus complements the bibliometric emphasis on organisational readiness as a necessary condition for educational efficiency (Blakong et al., 2025).

Third, the network representation reveals that culture is operationalised (though indirectly) through trust, ethics, inclusion, and cultural intelligence, among other factors.

The patterns of words include the following related terms: ‘organisational culture,’ ‘digital culture,’ ‘ethical technology,’ and ‘digital divide,’ among others, as defining cultural conditions, insofar as these boundary conditions relate to the quality and equity of adopters. This supports claims that cultural intelligence is an increasing need for leadership, authentic voice, and voice relevance in digitally enabled, post-pandemic HE spaces (Du Plessis et al., 2025). It also aligns with the literature that conceptualises sustainable digital culture as a double bind of transformational endurance, indicating that efficiency gains are more likely to be sustained when cultural norms support continuous refinement and judicious adoption (Genga & Babalola, 2025).

One futuristic signal playing out is that artificial intelligence is a bridging function. AI is a high-betweenness topic in the co-word network, located in the middle of the factorial space, linking two human/leadership clusters in the education-implementation space. This pattern is aligned with the recent results that digital organisational capability could facilitate innovation through cognitive flexibility and that empowering leadership positively moderates the effect of organisational digital capability on innovation through cognitive flexibility, indicating the more an organisation is engaged with “intelligent transformation”, the more it needs culturally congruent governance and leader competence (Fan & Yang, 2026). Complementary strategic logic for “digital universities” similarly proposes that the path to transformation is predicated on attuning infrastructure, pedagogy, leadership and ongoing capability development resonates with the bibliometric transition toward integrated system-level elucidations of efficiency (Khajoueinejad et al., 2025; Zhukabayeva et al., 2025).

In conclusion, the bibliometric analysis indicates a developing – yet incomplete – integrative agenda. The thematic map reveals that the core themes of digital transformation and higher education are located in the right-hand quadrants, while tertiary clusters highlight leadership–human–AI. This structure underpins recent bibliometric calls for integrating multi-theoretical perspectives (e.g., Education 4.0, digital literacy, leadership mechanisms) as clear explanatory models not only for adoption but also for efficiency outcomes (Sharma et al., 2025; Yanti et al., 2025). From a methodological perspective, the exported main information of the dataset implies a metadata artefact in the dataset that may hinder reference-based mapping if not addressed, emphasising the significance of meticulous preprocessing and open reporting in bibliometric research.

6 CONCLUSION

This bibliometric analysis, developed with AI Bibliometrix, contributes to organising and making sense of an exploding research topic that connects cultural aspects, organisational environments, and leadership with digitalisation and educational success. Throughout the mapped literature, there is a very strong signal: the discourse surrounding digital transformation in education is no longer about how to manage technology as if it were a neutral tool, but is increasingly about how to manage the sociotechnical process of change, where cultural openness, trust and ethical orientation towards the other constitute the grounds for acceptance and sustainability; organisational readiness, governance and capacity-building are the grounds for execution quality; and leadership is the means by which strategy, people and resources are aligned over time. The thematic development indicates a clear advancing from earlier approaches to issues of adoption and tools towards more rigorous concerns with performance optimisation, strategic coherence, and identifiable returns in teaching, learning and administration, whilst the most contemporary theme signals a move away from digitisation towards intelligent transformation with AI-related issues complicating the need for human-centred governance and culturally sensitive leadership. The complete cognitive map between (94%) is formed by three intersecting dimensions (C1, C2, and C3) whose thematic satellites reveal that educational efficiency is most stably linked to combined mechanisms of culturally embedded willingness to change, organisational capability to routinise novel activities, and leadership competency to manage collaboration, professional growth, and accountability. By presenting a clear-cut quantitative overview of patterns, clusters, and trajectories, this study provides an evidence-based platform for scholars to develop integrative research models and for decision-makers to develop transformative strategies, transcending hardware and software toward sustainable organisational learning and educational value creation.

6.1 Limitations

This helps to solidify and crystallise an ever-growing research area analysing the interplay between cultural factors, organisational environments, and leadership, using the

constructs of digital transformation and educational efficiency, through a bibliometric review facilitated by AI Bibliometrix. The strongest signal across the mapped literature is that digital transformation in education is not articulated anymore as a technology provisioning problem but as a socio-technical change in which cultural openness, trust and ethical orientation influence acceptance and continuity; organisational readiness and governance, and capability formation play a role on the quality of implementation; and leadership is the integrative function for aligning people, strategy and resources across time. The thematic development appears to show a clear maturation from early adoption and tools discussions towards more significant issues surrounding performance management, strategic alignment, and measurable effectiveness improvements for teaching, learning, and administration, with the latest theme suggesting a shift away from digitisation toward intelligent transformation as AI-related topics stress the importance of human-centred governance and culturally sensitive leadership. The dominant intellectual structure portrays educational efficiency as most robustly related to the combination of three levers: culturally informed readiness for change; institutional capacity to embed new practices; and leadership capacity to lead, at the institutional level, a system of collaboration, professional development, and accountability. By revealing a clear quantitative view of patterns, clusters and trajectories, this paper serves two critical functions: one, as a foundation upon which scholars may develop integrative models that may advance understanding about how to design system transformation; and two, as a guide for policymakers for how to design transformation beyond hardware and software to include the learning of the organization and the delivery of educational value.

6.2 Future directions for Vietnam

A future research agenda with implications for Vietnam on cultural factors, organisational dynamics, and leadership in digital transformation for educational effectiveness should decisively move from descriptive studies of “technology adoption” towards explanatory, measurement-based, and policy-relevant models that take account of Vietnam’s institutional context and cultural logics. First, future research should operationalize educational efficiency beyond general assertions by integrating multi-level indicators of process efficiency (cycle time, bureaucratic load, service turnaround),

learning efficiency (time-to-competency, assessment validity, learning analytics-based progression), and resource efficiency (cost per credit, use of digital infrastructure, faculty workload redistribution) and examine how these outcomes differ by type of institution (public vs. private; research intensive vs. teaching intensive; urban vs. rural; vocational colleges vs. universities), thus allowing the evidence base to be more nation-specific and less utopian. Second, specifically Vietnamese cultural mechanisms need more crisp theorisation: "culture" should not be a tag in the background, research should theorise culturally-patterned behaviours that reasonably condition fidelity to transformation, for example in terms of relational trust, face-saving communications, deference to hierarchy, collective accountability and risk aversion; and that theorise countervailing cultural capabilities that might speed its pace such as strong communal norms, respect for learning, or pragmatic problem-solving; mixed-methods designs that bring ethnographic understanding to bear on large-scale survey modelling can identify when cultural cohesion serves as a propulsion for disciplined implementation and when it morphs into an anvil of compliance-distorted adoption. Third, Vietnamese organisational readiness should be broken down into a series of actionable capacity bundles—levels of data governance maturity, interoperability and platform strategy, procurement flexibility, cybersecurity protocols, staff upskilling mechanisms and change- management capabilities— and future research might investigate which bundles are the strongest predictors of efficiency gains, under what (budgetary, talent, policy volatility) constraints, and lagged by how long, as early-stage digitisation could initially raise the workload before efficiencies emerge. Fourth, leadership inquiry should move beyond listing 'transformational' qualities to testing mechanisms such as how leaders create legitimacy for data-driven decision making, how distributed leadership practices manifest in hierarchical contexts, how middle managers enact strategy-as-routine, and how leaders navigate the ethical and equity tension implicit in AI-enabled education (fairness in automated assessment, transparency of analytics, privacy, and growing the digital divide). Fifth, in light of the increasing role of AI in driving changes in education systems, "intelligent transformation" as a particular stage should be analysed in the future research, framed as a question regarding how Vietnamese higher education institutions develop a human-centred governance model that enables AI to complement rather than supplant professional judgement, and how cultural acceptance, organisational safeguards and

leadership accountability coalesce in shaping trust and ongoing adoption. Sixth, stronger causal inference is also required: longitudinal panels (or perhaps quasi-experiments around policy pilots and implementation science approaches) can tease out symbolic from substantive capacity building, and comparative research across ASEAN can locate Vietnam's pathway within the regional concert without undermining local particularity. In summary, towards the end, the future direction in should be an integrative Vietnam context wise framework that connects cultural openness and trust, organisational agility and capability development, leadership orchestration into a coherent path model, with actionable diagnostics (e.g. readiness indices, leadership competency rubrics, culture–tech alignment instruments) that institutions and policy makers can apply to help them determine in what order they should undertake investments, sequence reforms, and track whether digital transformation is truly resulting in tangible gains in educational efficiency, or is just contributing to greater digital activity.

FUNDING DECLARATION

This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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Authors' Contribution

Bui Huy Khoi and Nguyen Phuong Nam drafted the primary manuscript text, while Bui Huy Khoi developed the Methods and Data mining, and Nguyen Phuong Nam wrote the others. All authors contributed to the review and approval of the final manuscript.

Data availability

All datasets relevant to this study's findings are fully available within the article.

How to cite this article (APA)

Nam, N. P., & Khoi, B. H. (2026). AI BIBLIOMETRIX 5.0 FOR CULTURAL FACTORS, ORGANISATIONAL, AND LEADERSHIP ON DIGITAL TRANSFORMATION AND EDUCATIONAL EFFICIENCY. Veredas Do Direito, 23, e234888. https://doi.org/10.18623/rvd.v23.4888