

When Technology Becomes Too Complex: Techno-Complexity and Lecturer Productivity in Higher Education

Yulefnita¹, Ahmad Hidayat Sutawijaya³, Siti Mariam³, Agung Edi Rustanto⁴

^{1,2,3,4}Doctoral Program in Management Science, Faculty of Economics and Business, Universitas Esa Unggul

Abstract

The rapid digitalization of higher education has transformed how lecturers teach, communicate, and conduct research, creating new challenges that demand constant adaptation. Among the dimensions of technostress, techno-complexity has been identified as a key factor influencing faculty performance. This study systematically reviews empirical evidence on the impact of techno-complexity on lecturer performance in higher education. Following the PRISMA 2020 protocol, ProQuest and Google Scholar databases were searched for studies published between 2020 and 2025. After screening 158 articles, 11 quantitative studies met the inclusion criteria. The analysis focused on research design and context, variables and instruments, the relationship between techno-complexity and academic performance, and identified research gaps. Most studies indicate that techno-complexity negatively affects teaching, research, and academic productivity through cognitive overload and adaptation fatigue. Inconsistent findings across countries and institutions underscore the importance of contextual and moderating factors such as digital competence, work engagement, and organizational support. Techno-complexity exerts a significant influence on faculty performance, highlighting the need for strengthened digital training and institutional support to mitigate its adverse effects and enhance productivity in the era of digital transformation. Future research should explore moderating and mediating variables, adopt longitudinal and mixed-method designs, investigate cross-cultural differences, and examine the dynamic processes of technological adaptation to provide a more comprehensive understanding of how techno-complexity affects the multifaceted roles of academic staff.

Keyword: Faculty Performance, Higher Education, Techno-Complexity, Technostress

1. Introduction

The rapid advancement of digital technologies has reshaped the landscape of higher education, influencing how lecturers teach, communicate, and conduct research. While these innovations have enabled more flexible and efficient academic practices, they have also introduced new challenges that demand continuous adaptation to complex and evolving technological systems. Among the various dimensions of technostress, techno-complexity has emerged as a critical factor influencing how faculty members perform their academic roles (Wang & Yao, 2025). This dimension captures situations in which educators are required to acquire new knowledge and skills to keep up with the increasing complexity and constant evolution of information and communication technologies (ICTs). As technology changes rapidly, lecturers often find themselves struggling to stay competent in using new digital platforms, thereby experiencing stress that can hinder their teaching performance and productivity (Boyer-Davis & Berry, 2022; Christian et al., 2020).

Techno-complexity arises from the intricate and frequently updated nature of ICTs, which compel academics to continually refresh their skills and adapt to new systems (Boyer-Davis & Berry, 2022). This ongoing demand for digital proficiency often leads to cognitive overload and emotional strain, especially for lecturers who are expected to integrate multiple digital tools into teaching, research, and community service. Within the broader framework of technostress, techno-complexity stands alongside other stress creators such as techno-overload, techno-insecurity, and techno-uncertainty (Decataldo & Fiore, 2022). However, research increasingly shows that techno-complexity may exert a particularly strong and unique influence on performance outcomes compared to other dimensions, as it directly affects how educators manage, deliver, and innovate in their teaching roles (Christian et al., 2020).

Scholars have emphasized that understanding techno-complexity is vital because it not only affects individual well-being but also the overall effectiveness of academic institutions. Unlike workload stress caused by the quantity of tasks, techno-complexity introduces qualitative challenges that stem from how work is performed—specifically, from the evolving digital methods and platforms that require new forms of literacy and engagement (Christian et al., 2020). Therefore, it becomes essential to investigate how techno-complexity contributes to changes in work behavior, task performance, and academic productivity in higher education.

Despite growing interest, findings on techno-complexity remain inconsistent. Some studies have reported that it negatively affects teaching performance and work engagement, while others have found no significant relationship or even potential long-term positive effects when educators successfully adapt to complex systems (Ismail et al., 2022; Christian et al., 2020). Research has also explored demographic differences, revealing that female lecturers may experience higher levels of techno-complexity than male counterparts, though these findings are not universally supported (Boyer-Davis & Berry, 2022; Decataldo & Fiore, 2022). Such discrepancies suggest that the impact of techno-complexity may depend on contextual factors such as institutional support, individual digital competence, and the degree of technological change within universities.

These conflicting results indicate significant gaps in the existing literature. While prior studies have investigated various dimensions of technostress, there has been limited synthesis focusing specifically on techno-complexity and its relationship with faculty productivity. Moreover, empirical findings on moderating variables, measurement instruments, and contextual influences remain fragmented (Boyer-Davis & Berry, 2022; Decataldo & Fiore, 2022). To address these limitations, this systematic literature review seeks to consolidate and clarify current knowledge on techno-complexity as it relates to lecturer performance in higher education. The study also aims to explore whether the challenges posed by techno-complexity may, over time, promote continuous learning and technological adaptability, potentially leading to improved academic outcomes.

This review addresses four main research questions: (RQ1) What are the common research designs, contexts, and populations used in studies investigating techno-complexity among academic staff and educators? (RQ2) What other variables have been found to correlate with or influence techno-complexity, and what measurement instruments and indicators have been employed to assess techno-complexity and performance outcomes across the reviewed studies? (RQ3) How does techno-complexity influence teaching performance and academic

productivity in higher education settings? (RQ4) What research gaps, practical implications, and future research directions have been identified in the existing literature?

2. Literature Review

2.1 Theory of Techno-complexity

Techno-complexity is defined as the perceived difficulty in learning and managing increasingly sophisticated digital technologies at work (Tarafdar et al., 2007). It arises when employees, including lecturers, struggle to adapt to new systems or digital platforms, leading to cognitive strain and reduced efficiency (Ragu-Nathan et al., 2008; Khan et al., 2022). Within the Job Demands-Resources framework, techno-complexity can act as a stressor that decreases performance when demands exceed available resources, yet it may also stimulate innovation and skill development when supported by adequate training and institutional support (Bakker & Demerouti, 2017; Muslimin et al., 2023).

2.2 Theory of Lecturer Productivity

Lecturer productivity refers to the effectiveness of lecturers in fulfilling their academic roles in teaching, research, and service (Blackburn & Lawrence, 1995). Grounded in Human Capital Theory, productivity depends on how well knowledge and skills are utilized to generate academic outcomes (Becker, 1993). In the digital era, technology plays a dual role—enhancing productivity through efficiency and collaboration while potentially hindering it through increased complexity and workload (Winarno et al., 2021; Amalia et al., 2023).

3. Material and Method

3.1 Search Strategy

This systematic literature review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. The literature search was performed using ProQuest and Google Scholar databases between August and September 2025. The search strategy employed the following Boolean keyword combination:

“techno complexity” OR “techno-complexity” OR “digital complexity”

AND (“faculty” OR “lecturer” OR “academic staff” OR “university teacher” OR “dosen”)

AND (“job performance” OR “academic performance” OR “kinerja” OR “Tridharma”).

All retrieved articles were exported and organized for further screening and analysis..

3.2 Article Selection Criteria

The selection of studies followed specific inclusion and exclusion criteria to ensure relevance, methodological rigor, and alignment with the research objectives. Inclusion criteria encompassed full-text journal articles employing quantitative research designs, with study populations consisting of faculty members, university lecturers, or academic staff in higher education institutions such as universities, polytechnics, or institutes. Eligible studies were required to examine techno-complexity as a primary variable or predictor and its relationship with job or academic performance. Only articles written in English or Indonesian were included. Conversely, exclusion criteria eliminated conference proceedings, theses or dissertations, qualitative studies, and research involving participants other than lecturers (e.g., students or administrative staff). Articles that did not explicitly address techno-complexity as one of the main study variables were also excluded from the review.

3.3 Bibliometric and Analytical Tools

To complement the systematic review, a bibliometric analysis was conducted using VOSviewer and Datawrapper to visualize publication trends, country distributions, and

keyword co-occurrences. These tools were employed to map the global research landscape and reveal thematic connections surrounding techno-complexity in higher education.

3.4 Data Extraction and Synthesis

Data from the included studies were systematically extracted into a Microsoft Excel spreadsheet, including information on author(s), year, country, sample characteristics, study design, measurement instruments, variables, and major findings. A narrative synthesis was conducted to summarize methodological patterns, relationships among variables, and conceptual insights across the reviewed studies.

3.5 Article Quality Assessment

The methodological quality of the included studies was systematically evaluated through a collaborative assessment process. The evaluation considered several key criteria, including the clarity of variable definitions, reliability and validity of measurement instruments, and the appropriateness of statistical analyses. Only studies that met the minimum standards of methodological rigor were retained for synthesis.

4. Result

The results of this systematic literature review are presented through a combination of bibliometric and systematic analyses. A bibliometric analysis using VOSviewer was conducted to explore publication trends, keyword relationships, and thematic clusters among the 158 articles initially retrieved from ProQuest (n = 46) and Google Scholar (n = 112) databases. This analysis provides a comprehensive overview of how technocomplexity is positioned within the broader context of technostress and higher education research. Subsequently, a systematic screening process adhering to the PRISMA 2020 guidelines identified 11 empirical studies that met the inclusion criteria. These selected studies were further analyzed to synthesize methodological characteristics, research settings, and temporal as well as geographical distributions.

4.1 Bibliometric Analysis

4.1.1 Global Distribution of Authors' Affiliations

Figure 1 illustrates the global distribution of institutional affiliations contributing to research on technostress and techno-complexity.



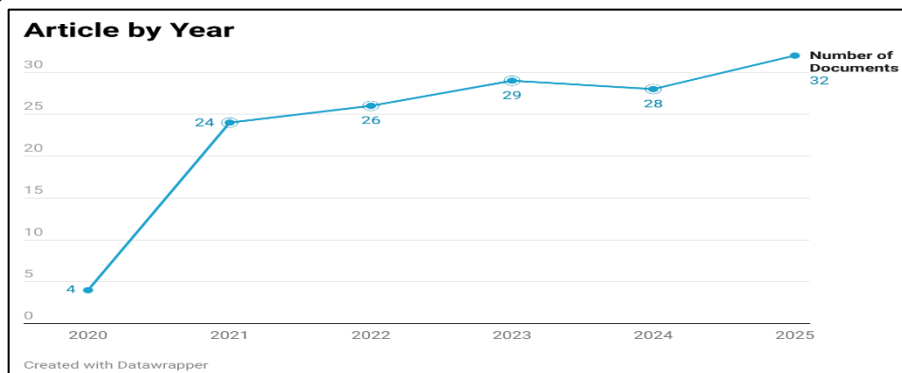
Source: Output Datawrapper Software

Figure 1. Global Distribution of Author’s Affiliations

The visualization demonstrates that studies on these topics have been conducted across multiple continents, with notable concentrations in Asia, Europe, and North America. European countries—particularly those in Western and Central Europe—represent major contributors, reflecting their advanced digital transformation and longstanding interest in workplace technology adaptation. In Asia, countries such as Indonesia, Malaysia, and China show increasing engagement, highlighting growing academic attention toward the psychological and organizational effects of digitalization in emerging economies. Although contributions from Africa and the Middle East remain limited, their presence indicates the expanding global relevance of technostress as a modern occupational phenomenon. Overall, this spatial distribution underscores the international significance of digital strain and complexity within technology-driven work environments.

4.1.2 Annual Publication Trends

Figure 2 presents the annual trend in publications addressing technostress and techno-complexity from 2020 to 2025.



Source: Output Datawrapper Software

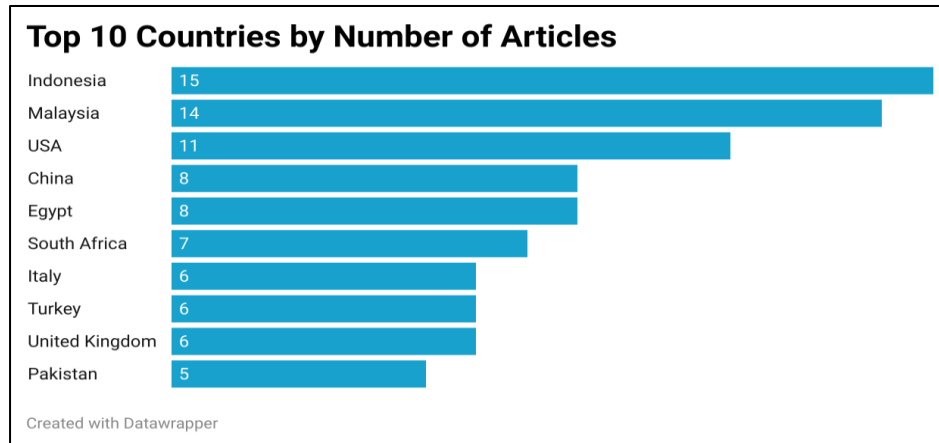
Figure 2. Article by Year

The data reveal a clear upward trajectory, beginning with only four publications in 2020 and rising sharply to 24 in 2021. This surge likely reflects the accelerated digital transformation

triggered by the COVID-19 pandemic, which intensified concerns regarding employees' psychological and behavioral adaptation to technology. The number of studies continued to grow steadily through 2022 and 2023, peaking at 32 in 2025, with only a slight decline observed in 2024. The overall pattern indicates a sustained scholarly interest, suggesting that technostress and techno-complexity have evolved from niche concerns into mainstream research themes within organizational behavior, information systems, and human resource management.

4.1.3 Top Contributing Countries

Figure 3 identifies the top ten countries contributing to research on technostress and techno-complexity.



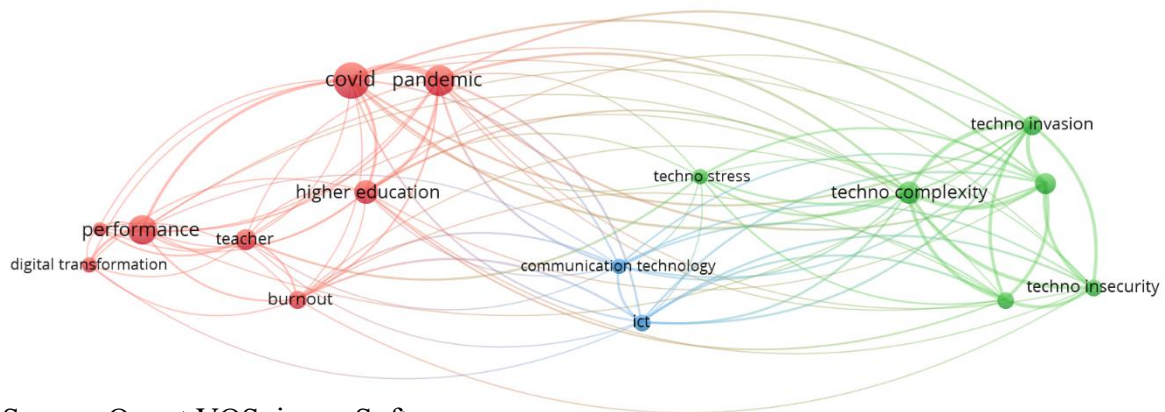
Source: Output Datawrapper Software

Figure 3. Top 10 Countries by Number of Articles

Indonesia ranks first with 15 publications, followed by Malaysia (14) and the United States (11). Other significant contributors include China and Egypt (8 each), South Africa (7), Italy (6), Turkey (6), the United Kingdom (6), and Pakistan (5). The leading positions of Indonesia and Malaysia highlight the increasing academic productivity and regional interest in exploring digital challenges in higher education and organizational contexts. Meanwhile, contributions from Western countries demonstrate that technological strain and complexity are globally relevant issues, affecting institutions with varying levels of digital maturity. The diversity in geographical representation reinforces the importance of adopting cross-cultural perspectives to better understand and manage technostress phenomena worldwide.

4.1.4 Co-occurrence Keywords

The bibliometric visualization generated through VOSviewer revealed several major research themes associated with techno-complexity in higher education. The co-occurrence network shows that the central term technostress is closely connected to related constructs such as techno-overload, techno-insecurity, techno-uncertainty, and techno-complexity, reflecting their interdependent nature.



Source: Ouput VOSviewer Software

Figure 4. Co-occurrence Framework and Representation of Key Items

Additionally, digital transformation and work engagement emerge as significant secondary themes, indicating that techno-complexity is frequently examined within the broader context of organizational and psychological constructs. The clustering of keywords such as performance and teacher also highlights the strong educational orientation of this research domain. Collectively, these associations suggest that techno-complexity has evolved from being a purely technological issue into a multifaceted construct encompassing aspects of digital adaptation, job demands, and academic productivity.

4.1.5 Top 10 Keywords by Authors

Table 2 presents the ten most frequent author-assigned keywords and their total link strength as identified in the VOSviewer output.

Table 1. Keywords by Authors

Rank	Keywords	Total Link Strength
1	Work engagement	2,58
2	Digital Transformation	2,37
3	Techno-invasion	1,71
4	Techno-overload	1,64
5	Technostress	1,61
6	Techno-uncertainty	1,46
7	Techno-insecurity	1,38
8	Techno-complexity	1,13
9	Performance	0,92
10	Teacher	0,87

Source: Ouput VOSviewer Software

The Table 2 data show that work engagement and digital transformation are the most dominant themes, suggesting a strong research focus on how educators respond to digital change in academic settings. Although techno-complexity exhibits a lower link strength (1.13) relative to other stressors, its inclusion among the top ten keywords indicates its emerging significance as a determinant of academic performance and engagement.

4.2 Systematic Analysis

4.2.1 PRISMA 2020 Flow Summary

The PRISMA 2020 flow diagram outlines the screening and selection process of the reviewed literature. Out of 158 initially retrieved studies, 11 met the inclusion criteria and were incorporated into the final synthesis. These studies collectively provide quantitative evidence on the relationships between techno-complexity and academic performance across diverse higher education contexts.

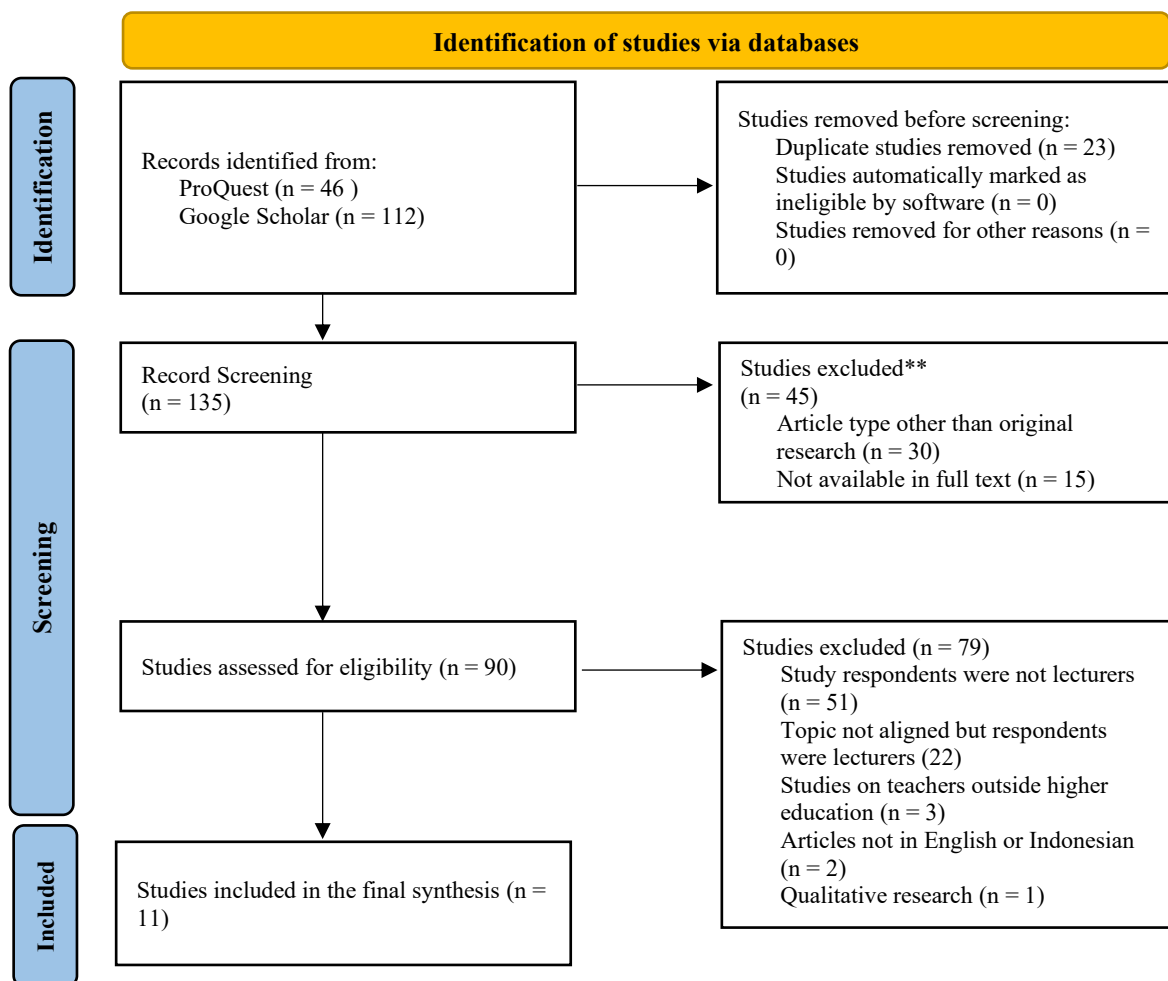


Figure 5. PRISMA 2020 Flow Chart

4.2.2 Literature Findings

Table 1 provides an overview of the eleven studies analyzed in this review, illustrating the progressive growth and methodological advancement of techno-complexity research in higher education from 2021 to 2025.

Table 2. Literature Findings

No	Author	Country	Study Design	Sample	Variables Examined	Performance Indicator	Techno-Complexity Instrument	Key Findings
1	Khan et al. (2022)	Pakistan	Quantitative design using survey methods	3,786 university teachers across nine divisions of Punjab	Technostress (Techno-complexity) as antecedent → Work Behaviour (Task Performance, Contextual Performance, Counterproductive Work Behaviour) as outcome	Task performance (teaching and research); contextual performance (community service)	5-item Techno-complexity instrument developed by Ragu-Nathan et al. (2008)	Techno-complexity shows a negative correlation with task, contextual, and counterproductive work behaviours.
2	Muslimin et al. (2023)	Indonesia	Quantitative correlational study	Six EFL lecturers (P1–P6) actively teaching at six different universities	Digital Literacy Competence (antecedent) → Technostress (Techno-complexity) → Teaching Performance (outcome)	Teaching performance	Technostress questionnaire adapted from Tarafdar et al. (2019)	Techno-complexity negatively affects EFL lecturers' teaching performance.
3	Maipita et al. (2023)	Indonesia	Quantitative design using survey methods	419 pre-service teachers in economics and business education	Technostress (Techno-complexity) as antecedent → Teaching Performance (outcome)	Teaching performance	5-item Techno-complexity instrument developed by Ragu-Nathan et al. (2008)	Techno-complexity does not significantly affect teacher performance in fully online learning contexts.
4	Winarno et al. (2021)	Indonesia	Quantitative design using survey methods	400 private university lecturers in West Java and Banten	Computer-Related Technostress (CRT) as moderating variable between Job Resources–Demand (JD-R) and both Work Engagement (WE) and Job Performance (JP)	The Tridharma of higher education (teaching, research, and community service)	Instrument for Computer-Related Technostress includes Techno-complexity as one of its dimensions	Techno-complexity, as a facet of CRT, negatively affects work engagement and job performance.
5	Amalia et al. (2023)	Indonesia	Quantitative design using survey methods	123 university lecturers	Technostress (Techno-complexity) as antecedent → Lecturer Performance (outcome)	The Tridharma of higher education (teaching, research, and community service)	Questionnaire adapted from Tarafdar et al. (2010)	Techno-complexity does not significantly affect lecturer performance.

6	El-Saka et al. (2024)	Egypt	Cross-sectional design using survey methods	2,138 medical faculty members from Mansoura University	Technostress (Techno-complexity) as antecedent → Lecturer Productivity (outcome)	Teaching and learning productivity	Techno-complexity subscale from the Technostress instrument by Ragu-Nathan et al. (2008)	Techno-complexity shows a significant negative correlation with productivity.
7	Ismail et al. (2022)	Malaysia	Descriptive cross-sectional quantitative design	159 educators from private colleges and universities in Johor Bahru	Technostress (Techno-complexity) as antecedent → Educator Performance (outcome)	Teaching performance	Instrument measures perceived ICT complexity and the need for continuous skill upgrading	Techno-complexity shows a moderate negative relationship with educator performance.
8	Ismail et al. (2023)	Egypt	Cross-sectional survey study	332 academic staff from the Faculty of Medicine, Zagazig University	Technostress (Techno-complexity) as antecedent → Staff Productivity (outcome)	Teaching, research, and administrative tasks	Techno-complexity measured by 4 items from Tarafdar et al. (2010)	Significant negative correlation between techno-complexity and productivity.
9	Mahmoud et al. (2025)	Egypt	Cross-sectional survey study	403 university staff members from Zagazig University	Technostress (Techno-complexity) as antecedent → Staff Productivity (outcome)	Research, thesis/dissertation, and accessing online resources	Techno-complexity measured as one of the technostress creators using a 5-point Likert scale	Significant negative correlation between techno-complexity and productivity.
10	Christian et al. (2020)	Indonesia	Quantitative design using survey methods	228 lecturers from private universities in Jakarta	Technostress (Techno-complexity) as antecedent → Teaching Performance (outcome)	Teaching performance	Questionnaire using a 5-point Likert scale	Teaching performance is influenced by techno-complexity.
11	Amin et al. (2024)	Jordan	Quantitative design using structured online survey	500 educators from public and private schools	Technostress (Techno-complexity) as antecedent → Gender Factor as moderator → Remote Working Productivity (outcome)	Online teaching	Technostress Scale developed by Tarafdar et al. (2007)	Techno-complexity negatively impacts remote teaching productivity.

5. Discussion

The eleven empirical studies included in this systematic review. The overall analysis indicates a clear upward trajectory in research addressing techno-complexity between 2021 and 2025, reflecting a growing scholarly interest in the intersection of digital transformation and technostress within higher education. Earlier investigations were often limited in scope and analytical depth, whereas more recent studies exhibit improved methodological sophistication, stronger statistical validation, and a greater focus on exploring the causal dynamics between technology-related stressors and various aspects of academic performance (Christian et al., 2020; Khan et al., 2022; Winarno et al., 2021).

This evolution in research attention underscores that techno-complexity—defined as the perceived difficulty in learning, mastering, and managing increasingly sophisticated digital systems—has emerged as a core dimension within the broader technostress framework (Tarafdar et al., 2007; Ragu-Nathan et al., 2008). As universities undergo deeper digital integration, the perceived burden of technological complexity has shown measurable effects on teaching quality, work engagement, and overall academic productivity. To address the objectives of this review, the discussion is organized around four research questions (RQ1–RQ4), each examining different aspects of techno-complexity in higher education—from research designs and contextual settings to measurement approaches, performance implications, and future research directions.

5.1. (RQ1) Research Designs, Settings, and Populations

The reviewed studies collectively reveal that techno-complexity research remains concentrated in developing and digitally emerging higher education systems, notably in Indonesia (five studies), Egypt (three studies), Pakistan, Malaysia, and Jordan (one study each). This geographic distribution highlights how universities in transition toward digital maturity offer fertile ground for exploring how technological complexity affects teaching effectiveness and academic productivity (Amalia et al., 2023; El-Saka et al., 2024; Mahmoud et al., 2025).

All studies were conducted within higher education settings—including public and private universities, polytechnics, and specialized faculties such as medicine and business—where digital transformation has become a central institutional agenda (Christian et al., 2020; Winarno et al., 2021). Most research populations comprise lecturers and academic staff who juggle teaching, research, and administrative tasks while adapting to complex and evolving digital platforms.

This institutional focus reinforces the recognition that techno-complexity is not merely a personal challenge but an organizational phenomenon influencing academic culture and productivity. The synthesis also suggests that techno-complexity has evolved into a salient construct over the past five years, symbolizing a shift from digital adaptation to digital dependency in universities. Accordingly, higher education institutions now perceive techno-complexity not only as a stress factor but also as a potential determinant of innovation and adaptability in the digital era (Ismail et al., 2022; Khan et al., 2022).

5.2. (RQ2) Correlating Variables, Measurement Instruments, and Indicators

Across the reviewed literature, techno-complexity is consistently conceptualized as stress arising from the perceived difficulty of mastering new digital technologies (Tarafdar et al., 2010; Ragu-Nathan et al., 2008). It is typically examined alongside other technostress

creators—such as techno-overload, techno-insecurity, and techno-uncertainty—that collectively shape the digital work environment (Khan et al., 2022; Ismail et al., 2023). While techno-overload refers to excessive digital demands, techno-insecurity reflects fear of job loss due to automation, and techno-uncertainty arises from continuous technological updates (Amin et al., 2024; Mahmoud et al., 2025), techno-complexity focuses on the cognitive, skill-based, and psychological burdens of digital adaptation.

Measurement approaches largely rely on validated instruments developed by Tarafdar et al. (2007, 2010) and Ragu-Nathan et al. (2008), later adapted across various contexts (Ismail et al., 2022; El-Saka et al., 2024). These tools assess the perceived effort required to learn new systems, doubts regarding their utility, and the mental strain associated with adapting to technological change. Indicators frequently include difficulty in operating digital systems, perceived inadequacy in digital competence, and time burden for adaptation (Amalia et al., 2023; Maipita et al., 2023). Most studies employed Likert-scale instruments, allowing comparability and cross-validation of findings.

Dependent variables typically relate to teaching performance, academic productivity, and work engagement (Christian et al., 2020; Winarno et al., 2021; Ismail et al., 2023), with some studies extending to institutional innovation and research outcomes (El-Saka et al., 2024; Mahmoud et al., 2025). These findings suggest that techno-complexity is a multidimensional construct that influences both individual well-being and organizational effectiveness.

5.3. (RQ3) Influence on Teaching Performance and Academic Productivity

Evidence from the reviewed studies shows that techno-complexity exerts both direct and indirect effects on teaching performance and academic productivity. Most findings indicate negative correlations, suggesting that greater digital complexity tends to increase cognitive strain and reduce efficiency among academic staff (Ismail et al., 2022; Muslimin et al., 2023; El-Saka et al., 2024). Lecturers often report difficulties in balancing digital teaching demands with research and administrative duties, leading to fatigue, frustration, and declining teaching quality (Mahmoud et al., 2025; Amalia et al., 2023).

Nonetheless, several studies identify a dual-effect mechanism, wherein techno-complexity can serve as a challenge stressor that fosters professional growth under supportive organizational conditions. When educators possess strong digital literacy and receive adequate institutional support, complex technological environments can stimulate creativity, innovation, and engagement (Muslimin et al., 2023; Amin et al., 2024). This interpretation aligns with the challenge–hindrance stressor framework, suggesting that the impact of techno-complexity depends on contextual moderators such as work engagement, self-efficacy, and organizational climate (Winarno et al., 2021; Ismail et al., 2022).

Hence, while unmanaged complexity may hinder performance, structured digital training, peer mentoring, and responsive IT support can transform complexity into a driver of competence and innovation.

5.4. RQ4. Research Gaps, Practical and Theoretical Implications, and Future Research Directions

Despite the expanding evidence base, several research gaps persist. The findings remain inconsistent across cultural and institutional contexts, with reported relationships between techno-complexity and performance ranging from negative to positive, or even nonsignificant (Khan et al., 2022; Amalia et al., 2023; Ismail et al., 2023). Moreover, potential moderators

and mediators—such as digital self-efficacy, work engagement, and institutional support—have not been thoroughly examined (Winarno et al., 2021; Muslimin et al., 2023). Methodologically, most studies employ cross-sectional designs, limiting causal inference; thus, longitudinal, experimental, and mixed-method studies are recommended for future inquiry (Mahmoud et al., 2025; El-Saka et al., 2024).

From a practical standpoint, universities should prioritize capacity-building programs, including ongoing digital literacy training, technical mentoring, and adaptive technology integration (Ismail et al., 2022; Winarno et al., 2021). Simplifying digital systems and promoting user-centered design could reduce perceived complexity, sustain productivity, and prevent burnout (Muslimin et al., 2023; Amin et al., 2024).

Theoretically, this synthesis strengthens the position of techno-complexity as a dual-nature construct—both a potential stressor and an enabler of innovation—within the technostress literature. Future research should integrate this duality into comprehensive models that consider individual, organizational, and cultural factors shaping the digital experience in academia (Mahmoud et al., 2025; El-Saka et al., 2024). Expanding meta-analytic and longitudinal bibliometric approaches will further illuminate how techno-complexity evolves as universities progress toward digital maturity

6. Conclusion, Implication, and Recommendation

The findings of this systematic review conclude that techno-complexity has emerged as a pivotal construct within the broader technostress framework, exerting both detrimental and potentially facilitative effects on teaching performance and academic productivity in higher education. While most studies report that increasing technological complexity heightens cognitive strain and reduces efficiency, others highlight its potential to stimulate innovation and engagement when supported by adequate digital literacy and institutional resources. These insights imply that universities must not only mitigate the negative impact of techno-complexity through continuous training, simplified systems, and technical support but also harness its positive potential to drive digital competence and pedagogical innovation. Accordingly, future research should adopt longitudinal and cross-cultural approaches to better understand contextual moderators—such as digital self-efficacy, work engagement, and organizational climate—that determine whether techno-complexity acts as a hindrance or a challenge in the evolving digital ecosystem of higher education.

7. Acknowledge

The authors gratefully acknowledge the support and constructive feedback from their institutions and colleagues, which greatly contributed to the completion of this study.

8. References

- Amalia, W. R., Rimayanti, & Syahdan, S. A. (2023). Technostress dan Pengaruhnya terhadap Kinerja Dosen Perguruan Tinggi di Indonesia. *Balance: Jurnal Riset Akuntansi Dan Bisnis*, 6(1), 34–45. <https://jurnal.uniraya.ac.id/index.php/balance/article/view/706>
- Amin, E. B., Al-Dmour, R., Al-Dmour, H., & Al-Dmour, A. (2024). Technostress Impact on Educator Productivity: Gender Differences in Jordan's Higher Education. *Electronic Journal of E-Learning*, 22(8), 60–75. <https://doi.org/10.34190/ejel.22.8.3608>
- Azira, N., Aslinda, N., Seman, A., Nazir, M., & Adi, M. (2022). The Impact of Technostress on Malaysia Educator's Performance in the Age of Covid-19. *Research in Management of Technology and Business*, 3(1), 988–1002. <https://doi.org/10.30880/rmtb.2022.03.01.068>

- Bakker, A. B., & Demerouti, E. (2017). Job demands–resources theory: Taking stock and looking forward. *Journal of Occupational Health Psychology, 22*(3), 273–285. <https://doi.org/10.1037/ocp0000056>
- Becker, G. S. (1993). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education (3rd ed.)*. University of Chicago Press. <https://doi.org/10.7208/chicago/9780226041223.001.0001>
- Blackburn, R. T., & Lawrence, J. H. (1995). *Faculty at work: Motivation, expectation, satisfaction*. Johns Hopkins University Press.
- Boyer-Davis, S., & Berry, K. (2022). Technostress Creators in Higher Education During the Covid-19 Pandemic: A Comparison of Faculty Perceptions and Experiences. *Journal of Higher Education Theory and Practice, 22*(10), 1–16. <https://doi.org/10.33423/jhetp.v22i10.5383>
- Christian, M., Indriyarti, E. R., & Wibowo, S. (2021). Investigating Technostress as Moderating Information Quality and E-Learning Effectiveness on Students in Jakarta During the Covid- 19 Pandemic. *Ilkogretim Online -Elementary Education Online, Year, 20*(4), 46–52. <https://doi.org/10.17051/ilkonline.2021.04.07>
- Decataldo, A., & Fiore, B. (2022). Digital-Insecurity and Overload: the Role of Technostress in Lecturers’ Work-Family Balance. Introduction to the Special Section. *Italian Journal of Sociology of Education, 14*(3), 75–102. <https://doi.org/10.14658/pupj-ijse-2022-3-4>
- El-Saka, S. F., Elmetwaly, M. M., Elsherbeny, E. E., El-Khawaga, G. O., & El-Helaly, M. (2024). Technostress Among University Medical Staff Members; A Cross-Sectional Study. *Egyptian Journal of Occupational Medicine, 48*(3), 45–60. <https://doi.org/10.21608/ejom.2024.276646.1331>
- Ismail, A. A., Abdelhamid, E. H., Khalil, G. M., & Abdelsalam, N. M. (2023). Effect of Technostress and Work Stress on the Productivity of Staff Members of The Faculty of Medicine. *The Egyptian Journal of Hospital Medicine, 90*(1), 1801–1808. <https://doi.org/10.21608/ejhm.2023.284330>
- Ismail, N. A., Abu Seman, N. A., & Mohd Adi, M. N. (2022). The Impact of Technostress on Malaysia Educator’s Performance in the Age of Covid-19. *Research in Management of Technology and Business, 3*(1), 988–1002. <https://doi.org/10.30880/rmtb.2022.03.01.068>
- Khan, A. A., Shahzad, S., & Gull, H. (2022). Effect of Techno-Stress on the Work Behavior of University Teachers. *Global Educational Studies Review, VII*(II), 427–439. [https://doi.org/10.31703/gesr.2022\(vii-ii\).40](https://doi.org/10.31703/gesr.2022(vii-ii).40)
- Maipita, I., Dongoran, F. R., Syah, D. H., & Sagala, G. H. (2023). TPACK, Organizational Support, and Technostress in Explaining Teacher Performance During Fully Online Learning. *Journal of Information Technology Education, 22*, 041–070. <https://doi.org/10.28945/5069>
- Mohamed, E., El-Sattar, A., Mahmoud, N., Eman, Abd El-Sattar, M., Fathy, M., & Zaitoun, A. (2025). Technostress and its Effect on Work Productivity among Academic Staff Members at Zagazig University. *Egyptian Journal of Community Medicine, 43*(1), 46–73.
- Muslimin, A. I., Mukminatien, N., & Ivone, F. M. (2023). TPACK-SAMR digital literacy competence, technostress, and teaching performance: Correlational study among EFL lecturers. *Contemporary Educational Technology, 15*(2), ep409. <https://doi.org/10.30935/cedtech/12921>
- Ragu-Nathan, T. S., Tarafdar, M., Ragu-Nathan, B. S., & Tu, Q. (2008). The Consequences of Technostress for End Users in Organizations: Conceptual Development and Empirical Validation. *Information Systems Research, 19*(4), 417–433. <https://doi.org/10.1287/isre.1070.0165>
- Tarafdar, M., Tu, Q., Ragu-Nathan, B. S., & Ragu-Nathan, T. S. (2007). The Impact of Technostress on Role Stress and Productivity. *Journal of Management Information Systems, 24*(1), 301–328.

- Tarafdar, M., Tu, Q., & Ragu-Nathan, T. S. (2010). Impact of Technostress on End-User Satisfaction and Performance. *Journal of Management Information Systems*, 27(3), 303–334. <https://doi.org/10.2753/mis0742-1222270311>
- Wang, Q., & Yao, N. (2025). Understanding the impact of technology usage at work on academics' psychological well-being: a perspective of technostress. *BMC Psychology*, 13(1). <https://doi.org/10.1186/s40359-025-02461-1>
- Winarno, A., Kahpi, H., Salam, A., & Hermana, D. (2021). The Effect of Job Resources Demand on Job Performance Through Work Engagement, which is moderated by Computer-Related Technostress. *Proceedings of the Second Asia Pacific International Conference on Industrial Engineering and Operations Management Surakarta, Indonesia*, 1175–1185.